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From the Chairs

On behalf of the Conference Committee, please join us for the 86th Association for Information Science and Technology (ASIS&T) Annual Meeting.

We are excited that the ASIS&T Annual Meeting will return to Europe, hosted in London, one of the world’s most vibrant capital cities. We look forward to many stimulating paper presentations, workshops, and panels with lively discussions and pleasurable social occasions.

This year’s theme for our Annual Meeting is ‘Making a difference: Translating Information Research into Practice, Policy, and Action’. Information is one of the most powerful tools for achieving social justice. It plays a pivotal role in tackling crisis situations, creating robust democratic processes, over-coming social and economic disadvantage, and increasing our global assets of education, knowledge, and culture. Challenges to social justice often come first in the form of challenges to information: censorship, fake news, hollowing out of information services, and denial of access to information. Promoting the power of information to develop human happiness, equality, and wellbeing means tackling these problems and finding ways to release the transformational power of information research.

To achieve positive change, we need to consider what processes are effective in developing new ways of working with information, appreciate the challenges of translating excellent research into excellent practice and policy, and understand how to evaluate the difference we have made to the lives of others. As the premier international conference in the field, the ASIS&T Annual Meeting is a forum to assist in addressing these issues as we continue to push forward the positive contributions of information and technology. This includes the introduction of a new category of contribution for this year’s conference, that of research in practice papers to present examples of how research has been translated into practical outcomes.

We have three keynote speakers for our Annual Meeting. Sharing the opening plenary session, we have Alison Phipps and Tawona Sitholé from the University of Glasgow in Scotland. Their keynote is entitled, Librarians as Lifelines: In Praise of Critical Information Care.

Our closing plenary keynote speaker, Stuart Hamilton is Head of the Libraries Development for the Local Government Management Agency in Ireland. His keynote is entitled, If You Don’t Get It the First Time, Back Up and Try It Again (Party): How Information Research Must Be Harnessed to Improve Library Advocacy.

We are most grateful to our conference leadership team for all their insight, dedication, and hard work. Thanks to paper chairs Vivien Petras and Rebecca Reynolds, poster chairs June Abbas and Dana McKay, panels & alternative events co-chairs Alison Hicks and Alex Poole, and doctoral colloquium co-chairs Pnina Fichman and Howard Rosenbaum, we have a stimulating and inspiring programme.

We look forward to an important and exciting conference in London. We hope to see you there!
Many thanks to the 476 reviewers who completed 1,848 reviews of paper, panel, alternative event, poster, and doctoral colloquio submissions. We’d like to especially acknowledge our outstanding reviewers (marked with an *) who have been selected for a best reviewer award for papers, panels, alternative events, and posters.
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Melanie Feinberg
Ina Fourie
Tim Gorichanaz
Hans-Christoph Hobohm
Haruna Hussein
Isto Huvila
Aylin Imeri
Yong Ju Jung
Vanessa Kitzie
Lai Ma
Shuyuan Metcalfe
Anthony Million
Amy VanScoy
Lin Wang

This year we added a meta-review process for evaluation of long and short papers consisting of the following scholars. We warmly thank our meta-reviewers for their dedicated service to the peer review system.

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Bradley Bishop
Melanie Feinberg
Ina Fourie
Tim Gorichanaz
Hans-Christoph Hobohm
Haruna Hussein
Isto Huvila
Aylin Imeri
Yong Ju Jung
Vanessa Kitzie
Lai Ma
Shuyuan Metcalfe
Anthony Million
Amy VanScoy
Lin Wang
Charting the Australian COVID-19 Information Flow: Implications for Information Policy

Afzal, Waseem  
School of Information & Communication Studies, Charles Sturt University, Australia | wafzal@csu.edu.au

Du, Jia Tina  
UniSA STEM, University of South Australia, Adelaide, Australia | tina.du@unisa.edu.au

Haider, Ammar  
FAST School of Computing, National University of Computer and Emerging Sciences, Lahore, Pakistan | ammar.haider@nu.edu.pk

An, Lu  
School of Information Management, Wuhan University, China | anlu2009@whu.edu.cn

Khoir, Safirotu  
Graduate School of Library and Information Management, Universitas Gadjah Mada, Indonesia | safirotu@ugm.ac.id

Batool, Syeda Hina  
University of the Punjab, Pakistan | hina.im@pu.edu.pk

ABSTRACT
The outbreak of COVID-19 posed one of the most serious threats to humanity in recent times. The rapid transmission of this virus across the globe and presence of various information imperfections (e.g., absence of information, confusing information, misinformation) made the craft of developing an effective information policy during this pandemic extremely difficult. This study has analyzed the COVID-19 information environment of Australia with an aim to understand the important features of the information flow which, in part, helped Australia to achieve one of the lowest COVID-19 test positivity rates. The findings of this study carry important implications for the design of future information policy imperatives aiming to deal with pandemics, natural catastrophes, and human-made disasters.

KEYWORDS
COVID-19; information flow; information policy.

BACKGROUND PERSPECTIVES
COVID-19 has left a far-reaching impact on people across the globe. There is no facet of our life that this virus has not left an impact on. We noticed that contrary to the past pandemics such as Spanish flu and more recently SARS, COVID-19 spread very rapidly to almost every country in the world but more importantly caused millions of people (WHO Coronavirus (COVID-19) Dashboard, n.d.) losing their lives due to this virus.

Information policy, according to Braman, (2011, p. 3), can bring society-wide constitutive effects through information creation, processing, flows, access and use. Jaeger (2007) argued that information policy can have an immense impact on the roles of information in society. Facilitated by the ubiquitous online ICTs and global interconnectivity, the role of information policy during COVID-19 pandemic became central in developing a nation’s response to this virus, in fighting misinformation and disinformation, announcing lockdowns, and in alleviating concerns about the vaccination.

The nexus between mass media, information policy, government agencies, and the Internet presents an information environment that informs every aspect of our lives. Information environment, according to Lievrouw (2000, p. 156) is created by different sources of information at the most general level which becomes highly important to individuals when they get to know the available information and find it relevant to their needs. According to Lievrouw, various institutions, including government, cultural, and business organizations, produce information, which is then shaped by media.

Media captures information about different events and then disseminates it to people. Media also play an important role in regulating and shaping information flow which arguably has been taken to a new level by social media (e.g., Aral, 2020, p. 58). In any information environment, there can be several distinct flows of information pertaining to different events. For example, information in media about weather forecasts or stock markets presents distinct flow of information. Flows of information can change public opinions, inform policy imperatives, help in relief efforts, and can raise awareness about the risks posed by a crisis. The potential impact of any information flow is shaped by factors such as frequency, volume, intensity, and speed of an information flow. In addition to the preceding factors, quality of information underpinning an information flow is also an important ingredient.

It is evident from a copious body of research that aspects such as frequency (e.g., Chatterjee, 1999), speed (e.g., Aral, 2020), volume (e.g., Knippenberg et al., 2015), intensity, and quality of information are the real substrate of any information flow. Depending on the imbalance in and/or absence of the properties of information underlying any information flow, there can be varied information imperfections that emerge and become part of an information environment. Incomplete information, misinformation, disinformation, absence of information are some of the imperfections that can arise in any information environment and can seriously impact individuals, organizations, and
even governments. These imperfections can cause what is termed as ‘information failures’ which can become a source of political debacles, adverse healthcare events, and mismanagement of natural disasters.

COVID-19 presented such a situation where massive flows of information about different aspects of this pandemic were in circulation through various media outlets, government health departments, and international organizations. However, not all of this information was helpful in making sense of this crisis and often this information led to bewilderment. There were several reports of different information imperfections (e.g., misinformation, disinformation, lack of information, too much information) in COVID-19 information flows and the result was that the efforts aiming to understand, manage and control the numerous immediate and long-term effects of this crisis were far from being comprehensive. There have been efforts to study public response to coronavirus in social media (e.g., Thelwal, 2021), issues of misinformation (e.g., Wang et al. 2021; Zhou et al. 2021) and information avoidance (e.g., Link, 2021) during this pandemic. However, our understanding of the ways in which COVID-19 information flows evolved as this pandemic progressed is sketchy. We also don’t have clear idea about the nature of changes in disseminated information as this pandemic unfolded. The answers to the preceding questions can be quite helpful in informing information policy frameworks concerned with avoiding and managing a pandemic and/or a catastrophe.

The purpose of this research is to investigate the COVID-19 information flow in a bounded context of time and place (1) to identify and explicate the factors that underpinned and shaped the information flow and (b) to draw lessons that could inform future information policy imperatives aiming to deal with pandemics, natural catastrophes, and human-made disasters.

RESEARCH METHODOLOGY
Conceptual Framework
The conceptual framework was weaved by keeping in mind the research objectives of this study. The notions of frequency, volume, speed, intensity, quality, and information environment were used to develop a conceptual lens to look at the COVID-19 information flow. To identify the sources of COVID-19 information flow, the work of Lievrouw (2000) was used to choose relevant public media news outlet and official source of information on COVID-19. The qualitative and quantitative properties of information—based on the works of Knight and Burn (2002), Savolainen (2011), and Keller and Staelin (1987)—informed our review of the news items as well as of the information disseminated by the government agency. The work of Turner and Pidgeon (1987) guided us in terms of finding instances of information failures in COVID-19 information flow.

Research Context
For this study, we decided to review the COVID information flow in Australia. There were few reasons for this choice: (1) Australia was successful—especially in the very early phases of COVID—to keep the rate of infections very low, (2) had an effective information communication during the outbreak of this virus (Hyland-Wood et al., 2021), and (3) also recorded one of the lowest per capita fatalities from COVID-19 (ourworldindata.org as cited in Bromfield & McConnell, 2021, p. 519). All of the preceding reasons allude to a highly plausible assertion that the nature of information flow during COVID-19 in Australia may have contributed in limiting the negative impacts of this virus and hence worth examining to find some lessons for future information policy imperatives concerning managing a catastrophe.

Analytical Framework
Owing to huge amounts of information about COVID-19 and the underlying aim to understand the information flow progression in the very early phase of this virus, it was important to keep the scope of this research limited to a certain time frame as well as to news outlets with vast coverage and high import. Limiting the time frame also provided us with the ability to carefully analyze the different features of COVID-19 information flow. Therefore, a time frame encompassing the first mention of COVID-19 in media till the announcement of first lockdown in Australia was chosen. One mass media news outlet ABC [Australian Broadcasting Corporation] with vast coverage was chosen. ABC news was selected because it is considered to be the top news source in terms of the volume of visits to its website (Top news sites, 2021) as well as the most trusted source of information and current affairs in Australia (Trusted news and information, 2020). For official source of information, the Australian Government Department of Health (henceforth Dept. of Health) was selected.

Content analysis was used to review the news items from the ABC news as well as the information disseminated by the Dept. of Health. The analysis focused on gaining understanding of the overall scope of information provided and to identify the main theme of each news item. Initial review of news items enabled us to ascertain the aspects of COVID-19 that were covered which then guided the development of categories (Table 1). We reviewed together the domain of each category and then undertook the first round of content analysis. After the first round of coding, we met to review the classification of news items and press releases. Minor differences were observed which were resolved through discussion and elaboration on the rational used for classifying a particular news item or a press
release in a category. These discussions ensured consistency and uniformity in coding. A debriefing session was also held at the end of coding to review the complete categorization.

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Description of a Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Outbreak &amp; Spread</td>
<td>Spread of virus, number of fatalities, number of identified cases, outbreaks.</td>
</tr>
<tr>
<td>2</td>
<td>Economy</td>
<td>Impact of covid on trade, industry, stocks, and overall business activities; govt efforts to revive economy and efforts aiming to give financial support to people.</td>
</tr>
<tr>
<td>3</td>
<td>Educational</td>
<td>Information aiming to educate people about virus and about measures of protection against it.</td>
</tr>
<tr>
<td>4</td>
<td>Misinformation/Disinformation</td>
<td>Information reported by media as misinformation and/or disinformation and misinformation and/or disinformation created by media through its news.</td>
</tr>
<tr>
<td>5</td>
<td>Events</td>
<td>Information about any kind of events (e.g., sports, music, film, rallies, religious) cancelled or effected by covid.</td>
</tr>
<tr>
<td>6</td>
<td>Politics</td>
<td>Information that casted doubt about a national or a foreign govt’s ability to deal with covid and info that used the virus to depict a turbulent domestic political environment.</td>
</tr>
<tr>
<td>7</td>
<td>Racism</td>
<td>Instances involving discriminatory behavior against people of Chinese descent.</td>
</tr>
<tr>
<td>8</td>
<td>Travel</td>
<td>This included information about efforts to evacuate passengers from cruise ships or other places as well as advice on travel.</td>
</tr>
<tr>
<td>9</td>
<td>Management</td>
<td>It included information about quarantine, control measure efforts, response measures.</td>
</tr>
<tr>
<td>10</td>
<td>Resilience</td>
<td>Information regarding motivation, psychological resilience, well-being.</td>
</tr>
<tr>
<td>11</td>
<td>Research</td>
<td>The research updates and progress about the virus, e.g., vaccine, genome sequencing.</td>
</tr>
<tr>
<td>12</td>
<td>Health workers</td>
<td>This category referred to the information that describes the work of health professionals.</td>
</tr>
</tbody>
</table>

Table 1. Categories and their description

In addition to the identification of main theme of each news item, it was also important to look at the frequency of news items, to map the timing of news in order to develop a better understanding of (1) when information flow about COVID-19 started, (2) when the magnitude of COVID-19 information flow started to become regular and larger, (3) why some information flows about certain aspects of this pandemic started, (4) why their magnitude...
became larger or smaller as this pandemic started to unfold, and (5) what were some of the most prevalent themes in the COVID-19 information flow. For this purpose, we mapped the (a) dates on which COVID-19 information flow started, (b) time frame during which COVID-19 information flow started to become large, (c) time frame during which volume of information reached its peak, (d) the time-lag between the first mention of COVID and the first lockdown. It was hoped that the mapping of all of the preceding elements would help us to pin down the anatomy of COVID-19 information flow.

The web archive of the ABC news (https://www.abc.net.au/news/archive/) was searched using a combination of different search terms (Table 2) and a total of 346 news items about COVID-19 were identified (Table 2). These news items appeared between 4th January, 2020 and 22nd March, 2020. Each news item was content analysed to identify its main theme as well as to ascertain the aspects of COVID covered. This review resulted in the classification of news into 12 categories (Table 2). As for the government source, the web archive of the Dept. of Health (https://www.health.gov.au/) was searched and a total of 32 news releases were found which were classified into 8 categories (Table 2).

<table>
<thead>
<tr>
<th>No. of news</th>
<th>ABC News</th>
<th>Department of Health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>346</td>
<td>32</td>
</tr>
<tr>
<td>Search Terms</td>
<td>“COVID 19” AND “Australia” AND “lockdown”</td>
<td>“COVID 19” AND “impact”</td>
</tr>
<tr>
<td></td>
<td>“Australia” AND “lockdown”</td>
<td>“COVID 19” AND “education”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“COVID 19” AND “threat”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“COVID 19” AND “trade”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“COVID 19” AND “tourism”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“COVID 19” AND “Lockdown crises”</td>
</tr>
<tr>
<td>Categorization of information</td>
<td>12 categories</td>
<td>8 categories</td>
</tr>
<tr>
<td>Category Distribution</td>
<td>Educational 68 (19.65%)</td>
<td>Management 17 (53.13%)</td>
</tr>
<tr>
<td></td>
<td>Economy 68 (19.65%)</td>
<td>Educational 5 (15.63%)</td>
</tr>
<tr>
<td></td>
<td>Management 67 (19.36%)</td>
<td>Travel 4 (12.50%)</td>
</tr>
<tr>
<td></td>
<td>Outbreak &amp; Spread 48 (13.87%)</td>
<td>Outbreak 2 (6.25%)</td>
</tr>
<tr>
<td></td>
<td>Events 37 (10.69%)</td>
<td>Racism 1 (3.13%)</td>
</tr>
<tr>
<td></td>
<td>Travel 26 (7.51%)</td>
<td>Research 1 (3.13%)</td>
</tr>
<tr>
<td></td>
<td>Politics 19 (5.49%)</td>
<td>Events 1 (3.13%)</td>
</tr>
<tr>
<td></td>
<td>Resilience 4 (1.16%)</td>
<td>Economy 1 (3.13%)</td>
</tr>
<tr>
<td></td>
<td>Misinformation/Disinformation (1.16%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Research 3 (0.87%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Racism 1 (0.29%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health workers 1 (0.29%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Information sources, search terms and categorization of news items

**AUSTRALIAN COVID-19 INFORMATION FLOW**

During the first three months of COVID-19, ABC news disseminated information quite frequently about the following aspects of this pandemic: educational 68(19.65%), economy 68(19.65%), management 67(19.36%), outbreak and spread 48(13.87%), and events 37(10.69%). Less frequent but still regularly occurring news included about travel 26(7.51%) and politics 19(5.49%). Least frequent categories included racism 1(0.29%), health workers 1(0.29%), research 3(0.87%), and resilience 4(1.16%). The news releases by the Dept. of Health focused very heavily on management 12(38%) of and education 10(31.25%) about COVID-19. There were few official releases about other aspects of COVID such as travel, economy, and events.

It took almost a month for information concerning COVID-19 to be regularly disseminated through the news. For instance, the first mention of COVID-19 in ABC news was on 4th January 2020. However, it was not until 30th January that COVID-19 started to gain regular attention in ABC. Though news appeared before 30th January as well but there were often in-between breaks of 2, 3, 5 and even more days before one would see anything about this pandemic. A somewhat similar observation was made for COVID-19 information flow coming from the Dept. of Health. The first news release identified was on 25th January, 2020 with a very regular flow of information not starting till 12th March 2020. There were news releases in-between but with intervals ranging from 2 to 7 days.
In news, since 30th January, information flow concerning this virus became distinct and regular – that is, one would see every day some news item about COVID-19. As the virus started to spread globally, so the COVID-19 information flow started to become not only frequent but also greater in its volume. So, for example, in the month of January there were 18 news items about COVID-19 whereas this number grew to 53 in February and quadrupled to 275 in March—the month in which first lockdown was announced in Australia. It was also interesting to analyze the surge in volume of information in the three weeks of March. Specifically, a very significant upward trend in the volume of information was noticed beginning the first week of March 2020 and reaching its climax in the last three days—preceeding the first lockdown—of week 3 (Figure 1).

![Figure 1. Daily totals of news items](image)

A similar surge in volume of information was also observed in the Dept. of Health data. In the days leading to first lockdown, information about ‘management’ and ‘education about this virus’ doubled in volume. It can be reasoned that information flow about COVID started to change in its nature (i.e. kinds of topics covered), frequency and quantity in public media in response to many influences including daily press conferences by government officials, information coming from international sources as well as from WHO raising alarm about this impending crisis.

It was also important to find whether the nature of COVID-19 information flow changed over the time in terms of aspects covered in the news items. It was found that five aspects of this pandemic predominated the information flow starting from the first mention of the virus till the first lockdown. These aspects included: outbreak and spread, educational, management, economy, and events. Information about two aspects ‘management,’ and ‘educational’ increased phenomenally nearing the first lockdown in March (Figure 2). The fact that ‘management’ and ‘education’ were the two most important themes in Australian COVID-19 information flow disseminated through both the most influential media outlet and the Dept. of Health possibly points to a close interaction between government’s information policy around COVID-19 and information disseminated through mass media creating an information environment which helped to create a shared understanding of an impending crisis and a response to it.
From an information quality standpoint, it can be argued that the information created and disseminated through the Dept. of Health was objective, clear, timely, re-assuring, and credible. For instance, when first case of COVID-19 was identified in the state of Victoria the statement on the Dept. of Health website (dated January 25, 2020) read “Australia has world-class health systems with processes for the identification and treatment of cases, including isolation facilities in each state and territory, these processes have been activated.” This statement was clear and re-assuring to the masses that the Australian health and quarantine systems were robust enough to deal with this crisis. The information released in many instances was based on evidence either gathered from overseas and/or from multiple sources but analyzed and interpreted by experts—all of which added to the credibility of information. An example was on January 30th 2020 when the Dept. of Health noted that

“New international evidence suggest that asymptomatic or minimally symptomatic infection can occur, and that pre-symptomatic transmission has occurred in at least one case cluster. German case cluster: It has been reported that participants at a workshop in Munich had…”

It is important to note that uncertainties that could have important implications for COVID management were officially acknowledged. For instance, on March 4th 2020 the Dept. of Health noted that they don’t have a complete picture of what was happening especially in China and Iran in terms of actual number of COVID-19 cases and went on to recommend that government should focus on domestic containment and preparedness for a very likely COVID-19 outbreak in near future. A very important juncture in the journey towards first lockdown was the release of ‘Australian Health Sector Emergency Plan’ for COVID-19 on February 18th 2020. The documentation of this plan clearly laid out the steps to be taken and was accessible in audio format, big print and in a summarized form for people with special needs. In addition to the provision of information in different formats and media, some of the key points from important official documents and announcements were extracted by the ABC news and presented to people in an easy-to-read form. For example, on March 1st 2020 ABC reported that “Australia’s [emergency response] plan outlines responses to three levels of outbreak severity—low, moderate and high.

Under the plan, this is what would happen under a worst-case scenario:

“Large gatherings cancelled, People having to work from home, Mortuary services prioritised, Aged care homes locked down, and Childcare centres closed.”

This information enabled people to have optimum amount of information available to them from a lengthy document and facilitated their thinking (e.g., Keller & Staelin, 1987) about what could happen in the case of a lockdown. This re-packaging of information helped in educating people about the control-measures and to have a groundswell of support if these measures were to become a reality.
Despite efforts to provide timely, objective, clear, and complete information there were information imperfections that emerged and impacted on the efficacy of communication in the early times of COVID-19 outbreak. For example, inconsistencies were observed between federal and state governments’ messaging about the shutdown measures (Duckett & Stobart, 2020). This inconsistency was also noted in government messaging for the healthcare sector: for instance, the Australian Medical Association in the state of New South Wales voiced frustrations on the confusing information that medical professionals were receiving from the federal government and different state health authorities. This information problem was recognized by the Chief Medical Officer who stated

“I recognise that the evolving nature of this outbreak has required public health advice to evolve rapidly with the emerging epidemiology. This has made it more challenging for people to keep it up to date and has led to some confusion and a perception of inconsistency of information / information gaps [emphasis added]. We are addressing this and will enhance communication to primary care, starting with this letter…”

In addition to issues such as ‘confusing information’, there were instances where administrative failures led to key information not being communicated to relevant authorities leading to COVID outbreaks. For example, on 19th March 2020 Ruby Princess cruise ship docked at Sydney Harbour. Out of 2700 passengers on board about a dozen tested positive but this information was not communicated to other passengers and everybody was allowed to leave the ship. This information failure made this cruise ship as one of the biggest single source of COVID infections in Australia (Coronavirus: How did Australia's Ruby Princess cruise debacle happen?, 2020).

DISCUSSION
The data analysis was revealing from many vantage points. Specifically, the analysis showed that as the COVID-19 pandemic progressed so did the information flow both in qualitative and quantitative terms. In the early days of this pandemic the information released from the public media was about ‘outbreak and spread’ and the possible impacts of this virus on the Australian economy. However, as it started becoming apparent that this virus will hit the Australian borders as well so information to educate masses about the risks of this virus and the ways to protect oneself from it was also started to appear both in the public media and through the official source.

The Dept. of Health in the very initial stages (i.e. month of January 2020) of COVID-19 started to release information primarily about assuring people that Australia has robust healthcare system and also educating them about the nature of virus and its transmission. In a similar vein, the information disseminated by the ABC news in the later part of January 2020 aimed to develop confidence among people that Australia is well prepared to deal with this virus. ABC news also used the statements of the Australian Chief Medical Officer to enhance the credibility of its reporting.

As the government started to prepare for tougher control measures, various documents were released including ‘Emergency Response Plan for Communicable Disease Incidents of National Significance: National Arrangements’ and ‘Australian Health Emergency Response Plan’ for COVID-19. In addition to these plans, the government also launched COVID-19 campaign to reach out to all Australians on a very large scale. The ‘Australian health emergency response plan’ and the campaign were released in multiple languages and also made accessible in different formats in order to be accessible and usable to people from diverse backgrounds and/or with special needs – an approach that is considered by Hyland-Wood et al. (2021) very important in making government communication effective.

There were, however, very important information imperfections present in the COVID-19 information environment both in Australia and globally. In few cases, these information imperfections resulted in what Turner and Pidgeon (1997) described as information failures with serious health and safety consequences. For example, the BBC, at the very onset of COVID-19, raised questions about the accuracy of the numbers reported in Wuhan (https://www.bbc.com/news/health-51148303). Echoing BBC, the ABC reported on 10th January 2020 that according to WHO

"More comprehensive information is required to confirm the pathogen, as well as to better understand the epidemiology of the outbreak, the clinical picture, the investigations to determine the source, modes of transmission, extent of infection, and the countermeasures implemented.”

Further affirming the lack of information about the number of COVID-19 cases, the Dept. of Health stated on March 4th 2020 that due to immense pressure on healthcare systems of Hubei (China) and Iran it is quite likely that cases with mild and asymptomatic illness were under-reported. This absence of information may have seriously impacted the ability of governments to make head-start on measures aiming to control this virus.

In addition to the issue of incomplete information, challenges such as ‘confusing information’ and ‘absence of information’ were also noticeable in Australian COVID-19 information flow especially during the weeks leading to the first lockdown. The issue of ‘confusing information’ impacted on the ability of health care professionals to
decide on how to accurately test potential COVID-19 cases. The severity of these challenges started to decrease as consensus started to emerge among various federal and state agencies about the ways to manage COVID.

Recognizing widespread misinformation and disinformation during COVID, both Dept. of Health and the public media highlighted these problems to inform people about the potential risks that such kinds of information posed to health and community welfare. Misinformation about transmission of this virus which then led to some racist attitudes towards people of Chinese descent was dealt with early on by both the Dept. of Health and the ABC news. Some other instances of misinformation including, for example, that Bill Gates created this virus, one can be protected from this virus by drinking bleach, and some imported food in Australia is infected with COVID-19 were reported in the ABC with an aim to caution people against misinformation.

It can be proposed that COVID-19 information flow in Australia—preceding the first lockdown—exhibited an anatomy where at the onset information about the spread of virus was circulated closely followed by information concerning the varied risks posed by the pandemic and then including information which was highly educational in nature. One can see a near parallel upward surge in information about ‘education’ and ‘management’ both in ABC news and in the Dept. of Health information (Figure 3). Though this near parallel relationship was more pronounced in the case of ABC. This information flow aimed at preparing masses to fully grasp the enormity as well as the risks posed by the pandemic so the people could rationalise and accept the measures which the officials were about to implement—one of the longest lockdowns in the world.

![Figure 3. Comparison of news items from Department of Health and ABC News](image)

**IMPLICATIONS FOR INFORMATION POLICY**

As information policy encompasses decisions and activities about information creation, processing, flows, access and use (Braman, 2011) so one can use analysis of an information flow within an information environment to draw lessons for future information policy initiatives and COVID-19 provided just that opportunity. Based on our analysis of the information in this study, we argue that the Australian COVID-19 information flow presents very significant lessons for information policy. Specifically, it can be stated that the Australian COVID-19 information flow through the official government source as well as through the ABC news aimed at educating and preparing public through a clear, timely, objective, and fact-based information. When certain pieces of information were not available, instead of covering that uncertainty the information released by the Dept. of Health acknowledged the gap and used the best available sources to arrive at their recommendations. Information about key documents (e.g., health emergency plan) was provided in accessible formats by the Dept. of Health and synthesized in some cases by the ABC news to help people know the most salient points of key documents and announcements. Despite all of the preceding efforts, there were still some glitches in the flow of information from the Dept. of Health to medical practitioners. The issue of confusing information not only for public but also for health care professionals in the early days leading up to lockdown made it difficult to completely comprehend the policy imperatives concerning COVID-19. In its totality, the information flow about COVID-19 in Australia primarily used educational approach starting from informing people about virus, its possible means of transmission, no. of cases overseas and—then following small transmissions of virus in Australia—to the potential serious impacts of this virus on vulnerable communities and healthcare system. This information was augmented with the possible measures that should and must be taken now
and in near future to protect all Australians from this virus. We believe that in a pandemic or a catastrophe, the information policy of a government can be informed by some of the salient features of the approach taken to COVID-19 information flow in Australia.

LIMITATIONS
It is important to keep the limitations of this study in sight when considering the findings. The data set was limited to a time frame covering the first mention of the virus in news to the first lockdown in Australia thereby omitting the time following this snapshot. Another limitation of this research was a focus on two sources of information about COVID-19 excluding other public media outlets and social media. Thirdly, due to the inherent complexity of any information environment, it is quite likely that we may have missed some factors that must have played an important role in shaping the COVID-19 information flow in Australia. Consideration of information flow in later months will be essential for developing a comprehensive understanding of COVID-19 information flow. Finally, though an effort was made to cover all news items in the two sources, it is likely that inadvertent omission of some news items may have occurred.

CONCLUSION
Information policy is an important pillar of governance but it becomes more crucial in times of pandemics, natural catastrophes, and human-made disasters. This study set out to understand the Australian COVID-19 information flow with a purpose to identify important lessons for information policy. The data from the most prominent mass media outlet and the Dept. of Health were analysed covering a period of time starting from the first mention of COVID till the first lockdown in Australia. It was found that the Australian COVID-19 information flow in this study presented an anatomy in which two aspects (educational and management) predominated both the mass media and the Dept. of Health information whereas aspects such as economy, outbreak and spread, and events also were highly visible in the mass media COVID-19 information flow. Furthermore, the information disseminated by the Dept. of Health and the ABC news was timely, clear, fact-based, and in many cases was packaged in multiple formats to be inclusive of people with special needs. There were, however, presence of different information imperfections including missing information, confusing information, conflicting information, misinformation and disinformation in the COVID-19 information flow. The overall approach taken towards COVID-19 information flow in Australia created an information environment which was educational in nature, kept people informed about various control measures, and was mostly built on information that was factual, timely, and clear. It is hoped that the findings of this study will inform the future information policy measures aiming to deal with a pandemic.

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Towards Equitable Healthcare: A Cross Dataset Analysis of Healthcare and Telehealth Access

Al Haque, Ebtesam
George Mason University, USA | ehaque4@gmu.edu

Smith, Angela D. R.
University of Texas at Austin, USA | adrsmith@utexas.edu

Johnson, Brittany
George Mason University, USA | johnsonb@gmu.edu

ABSTRACT
History has repeatedly shown that when it comes to healthcare, there exist significant disparities across different sub-populations. Part of this problem is challenges with access to healthcare services and providers. In recent years, we have seen solutions emerge that attempt to address this issue, namely telehealth. But little to no work has been done to glean insights into factors contributing to lower access and whether telehealth adequately supports populations that struggle with physical access issues. In this paper, we present findings from an exploratory, cross-dataset analysis of healthcare access in Virginia, USA. We conducted quantitative and qualitative analyses to determine correlations between socioeconomic factors and physical access. We found that population density significantly impacts physical access to healthcare. We also found that lower income communities in rural areas appear to be less satisfied with the quality of care and less likely to have adequate access to alternative options such as telehealth services. Our work has implications for research aimed at understanding healthcare access and practice that aims to derive solutions to close the healthcare access gap.

KEYWORDS
telehealth; healthcare; disparities; access; social computing

INTRODUCTION
The concerns around healthcare access have increased in recent years as we experienced a global pandemic that led to a surge in healthcare services needed and being administered. Historically, one of the major concerns regarding healthcare access, aside from how we define it, are the differences in healthcare access across communities and solutions that can help fill gaps in access to healthcare services. When comparing rural and urban populations, rural American populations experience significant health disparities, often characterized by higher incidences of disease, higher mortality rates, lower life expectancies, and higher rates of chronic pain (Hartley, 2004; Miller & Vasan, 2021). Risk factors for health disparities include geographic isolation, lower socioeconomic status, higher rates of health risk behaviors, limited job opportunities, and limited access to healthcare specialists and subspecialists (Hartley, 2004). Despite the numerous risk factors, access to healthcare sets the baseline for all patient encounters with the healthcare industry. When a patient cannot access their physician, receiving medical care, building relationships with their providers, and achieving overall patient wellness are all impossible.

Access to healthcare has been a matter of concern for several decades. Access is a multidimensional concept that is influenced by a wide array of factors. The National Academy of Medicine defines access to healthcare as “the timely use of personal health services to achieve the best health outcomes” (IOM, 1993). Access to care consists of four components: coverage, services, timeliness, and workforce (Access to Care, n.d.). Telehealth technologies, or digital and internet-based tools used to administer healthcare services (e.g., online patient portals, mobile applications, telemedicine) have helped improve healthcare delivery and health outcomes for low-income and underserved patients (Follen et. al, 2007). The impact of telehealth has been studied by multiple researchers; however, these studies are usually scoped to specific chronic medical conditions (Barbosa et. al, 2021). While telehealth has been shown to improve health outcomes and reduce cost for some conditions, little work has focused on if and to what extent it is closing physical access gaps and supporting all populations. Furthermore, to reap the benefits of telehealth, users must have access to sufficient bandwidth to access these services reliably.

Our work aims to provide insights that can aid policymakers in identifying sub-populations that need more attention and exploring potential solutions. Through quantitative and qualitative analyses, we mainly focus on accessibility from the Theory of Access (ToA) framework. Considering Virginians as our population of interest, we analyze the current state of accessibility by deriving the average distance and travel time using different modes of transport to nearby healthcare facilities and gauging the quality of care received using publicly available reviews. We also study the correlation between access and socioeconomic factors such as household income and analyze the potential for telehealth to improve access to healthcare. Our study aims to answer the following questions regarding healthcare access in Virginia:

RQ1: How accessible are general acute care facilities for Virginians?

RQ2: What are the correlations between socioeconomic factors and healthcare accessibility?
RQ3: To what extent can telehealth help improve access to general acute care?

RQ4: What are the differences in satisfaction with healthcare services provided?

BACKGROUND & RELATED WORK

Over the years, many researchers have studied access to healthcare, what it means, and how we can best support it. Below, we discuss previous work focused on providing theoretical foundations for defining access, investigating disparities in access, and emerging solutions.

Theory of Access & Its Applications

In 1981, Thomas and Penchansky proposed a framework, known as the Theory of Access, which states that there are five dimensions to healthcare access: affordability, accommodation, availability, accessibility and acceptability (Penchansky & Thomas, 1981). A well adopted extension of this framework includes awareness, which relates to effective dispersion of information and communication with patients (Saurman, 2015). Theory of Access defines affordability as the ratio of the cost of care and patient’s ability to pay. This encompasses their income and insurance policy. Availability is the volume of existing services and resources with respect to the population. Accommodation refers to how well the existing scheduling and allocation of resources fit the patients’ needs. Accessibility is the relationship between the location of services and the location of the patients. Studies have shown that geographic access to healthcare services leads to improved health outcomes as individuals with better access are more likely to seek preventative care. Lastly, Acceptability is the relationship between the expectations of the key stakeholders involved in the system – patients and healthcare providers. Prior studies have incorporated Theory of Access into their work in different ways. Multiple studies have used the extended version of Theory of Access, which includes awareness as a dimension (Saurman, 2015). Kang et al. conducted a qualitative study to understand challenges faced by asylum seekers and refugees in the UK in accessing healthcare using the extended ToA framework for data analysis (Kang et al. 2019). Pass et al. conducted similar analysis to identify barriers faced by older patients in rural communities with chronic illness in accessing mental health services in Iowa (Pass et al., 2019). Best et al. used it to measure access to Home and Community Based Services for individuals with mobility impairment (Best et al., 2022). AlDossary et. al partially used the Theory of Access framework (excluding acceptability and accommodation) to understand community needs to successfully plan implementation of telehealth services (AlDossary et. al, 2017).

Exploring differences in healthcare access

Access to healthcare varies between rural and urban areas. Residents of rural areas often must travel great distances to seek healthcare services. According to a study conducted by Pew Research Center, rural residents travel approximately 10.5 miles to seek primary care while urban residents only travel approximately 4.4 miles on average (Lam et al., 2018). Over the years, there has been a decline in the number of rural hospitals, and this is projected to get worse (Casey et al., 2001). By analyzing data from the National Establishment Time Series, researchers discovered that the number of healthcare facilities dropped between 2000 and 2014 across more disadvantaged neighborhoods (Tsui, 2020). The lack of availability of healthcare facilities in these areas is primarily due to the difficulties in retaining the workforce to provide these services. Insurance providers are less incentivized to support these facilities, which further contributes to the difficulties in maintaining and operating rural healthcare facilities (Douthit et al., 2017). In addition, this poses a barrier for rural residents financially to seek healthcare services. These factors, compounded with cultural factors and lack of transportation contribute to poor access to healthcare for rural communities. Lack of transportation also introduces additional barriers to seeking care, such as childcare expenses, accommodation expenses, and missing work. This can impact both urban and rural residents.

The lack of proper access to healthcare has longitudinal effects on health and well-being; however, to truly improve healthcare, researchers and practitioners must understand the facts that influence communities’ decision-making. The correlation between access to healthcare and well-being is evident in a study conducted by NCD-RisC, which shows that 55% of the population with increased body mass index (BMI) between 1985 and 2017 belonged to rural communities (NCD-RisC, 2019). Analyzing access to healthcare would not be complete without exploring the quality of care received. Some key factors that affect the quality of care include health literacy and cultural competence. Migrating from rural to urban communities also introduces additional challenges. A study conducted by Morales et. al. on a Mexican immigrant community in New Jersey found that in addition to factors that are known to have an impact on healthcare, the paper also proposes rethinking how we define access to account for socio-cultural practices that may have an impact on health outcomes. (Morales et. al, 2015).

Evaluating solutions to healthcare access disparities

COVID-19 has driven the world to adopt ways to accomplish day-to-day tasks virtually. This drove the healthcare industry to improve telehealth services. A study shows that this has helped reduce the number of no-shows for hospital appointments due to patients not having to travel (Franciosi et. al, 2021). While telehealth helps bring
healthcare services to the patient, it introduces new barriers into the system. Paperwork involved in the existing healthcare system is inefficient, disjointed, and can be tedious. Patients without sufficient technical literacy can feel more overwhelmed going through the process digitally (Lopez et al., 2018). In addition, while designing the current telehealth systems, insufficient thought was given to accounting for the 61 million people (about twice the population of Texas) suffering from one or more forms of disability. This community, in particular, is marginalized by telehealth services (Valdez et. al, 2021). Furthermore, roughly 1 in 10 residents of Virginia do not have access to a broadband connection (Internet Access in Virginia: Stats & Figures, n.d.). This poses a barrier for them to access telehealth services. Jin Chong outlined factors that create a digital divide with respect to healthcare services and found that middle-aged white women from higher income brackets with health literacy and access to broadband are more likely to seek healthcare information online (Chong, 2006). Several studies agree that being insured has an impact on access to healthcare. However, a study done on rural communities in Pennsylvania shows that it does not have an impact on their community (Maganty, 2021). Currently, there is no similar analysis for the United States. Researchers suggest that the current healthcare system can be improved by scheduling better, training physicians to provide care with less biased judgment, and by placing healthcare facilities in convenient locations. In addition, physicians need to be incentivized enough to create an influx of care providers in rural communities (Butkus et. al, 2020).

**METHODOLOGY**

As emphasized by prior work, there is a need for more research and development centered on understanding and targeting causes of healthcare disparities, such as access. In this section, we outline the approach we used to answer our research questions with data on healthcare and populations in the US state of Virginia.

**Population Sample**

We focused our analyses on data from communities and healthcare facilities in the state of Virginia. Based on a report from the Virginia Department of Health on socio-demographic characteristics, Virginia has a well-distributed population with respect to different characteristics such as age, income, gender, race and ethnicity, and educational status (VIRGINIA HIV EPIDEMIOLOGY PROFILE 2016 Virginia Socio-Demographic Characteristics, n.d.). This provides us with an opportunity to collect and analyze data from diverse and representative communities to strengthen the potential for scalable insights.

**Defining Access**

One important aspect to our study design was defining what we meant by “access” and how we would measure it. For the scope of our work, access to healthcare refers to the accessibility dimension of the Theory of Access (ToA) framework which defines accessibility as geographic access, or proximity of patients to healthcare service providers. Based on prior work (Marrone, 2007), our research focuses on the following factors that relate to geographical access: median household income, population density, and health insurance.

**Data & Sources**

Given the goal of our study, we needed access to data that gives us information on Virginia hospitals and community socioeconomic characteristics. We were unable to find a single dataset that provided all the information we needed, therefore, we curated and utilized existing datasets. The American Community Survey (ACS) is administered annually by the Census Bureau to collect community-centric data (US Census Bureau, 2018). The dataset contains social, economic, housing, and demographic data for specific geographic areas. Table 1 outlines what data we used from this survey. The Homeland Infrastructure Foundation-Level Data (HIFLD) is a collection of open datasets provided by the Department of Homeland Security that includes national geospatial data (Homeland Infrastructure Foundation-Level Data - HIFLD, n.d.). As indicated by the name of the source, this dataset provides infrastructure-related information for communities. We used this dataset for information on acute general care facilities (e.g., hospitals). The Federal Communications Commission (FCC) is an entity that regulates the various modes of communication we utilize, including broadband internet. We used the FCC’s Fixed Broadband Deployment data (Broadband Data Collection, 2021) to evaluate the ability for telehealth to support the various communities in Virginia. The HUD-USPS ZIP Crosswalk dataset is a publicly available dataset provided by the U.S. Department of Housing and Urban Development (HUD) (HUD USPS ZIP Code Crosswalk Files | HUD USER, n.d.). The goal of this dataset is to support researchers and practitioners in mapping United States Postal Service (USPS) ZIP codes to geographical data collected by the Census Bureau. Lastly, given there was no existing dataset that contained Google Reviews (either generally or specifically for healthcare facilities), we wrote a custom web scraping script to collect Virginia hospital reviews from Google left by patients and responses to their reviews.

**Data Collection & Pre-Processing**

To answer our research questions, we curated and analyzed data on the geographical distribution of acute general care facilities and socioeconomic factors that research has shown to have an impact on geographical access. We also
collected and analyzed data to evaluate telehealth's potential to reduce the effects of these barriers. The datasets used for this work are outlined in Table 1. Our final analyses center on a total of 94 Virginia facilities.

<table>
<thead>
<tr>
<th>Data</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia ZIP codes, Population, Median</td>
<td>American Community Survey (ACS)</td>
</tr>
<tr>
<td>Household Income, Insurance</td>
<td></td>
</tr>
<tr>
<td>Hospitals &amp; Facilities</td>
<td>Homeland Infrastructure Foundation-Level Data (HIFLD)</td>
</tr>
<tr>
<td>Fixed Broadband Deployment</td>
<td>Federal Communications Commission (FCC)</td>
</tr>
<tr>
<td>ZIP - Census tract mapping</td>
<td>HUD-USPS ZIP Crosswalk</td>
</tr>
</tbody>
</table>

Table 1. An outline of the datasets curated for our study

To prepare our data for analysis, we first dropped duplicate records from each dataset. We focused our analyses on acute general care facilities, because they provide potential patients with access to primary care physicians. Studies have shown that better access to primary care physicians leads to fewer avoidable hospitalizations (Daly et al., 2017). Next, we calculated the haversine distance between the representative geocoordinate of each ZIP code to each acute general care facility. Using this metric, we identified nearby acute general care facilities from each ZIP code. To define nearby, we used findings from a survey conducted by Pew Research Center that included the distance to the nearest healthcare facility for the population of the United States (Lam et al., 2018). The survey found that 75% of the rural population lives within 21 miles of the nearest acute general care facility. Therefore, we defined nearby for our analysis as hospitals within a 21 miles radius from the representative geocoordinate of each ZIP code.

In addition, we calculated the travel time to nearby hospitals for each ZIP code by public transport as well as the drive time. We accomplished this using the Google Directions API, which combines Dijkstra’s and A* algorithms. Using this data, we calculated the average distance, average travel time by public transport, and average drive time for each ZIP code. The survey conducted by Pew Research Center shows that rural Americans live an average of 10.5 miles away from the nearest hospital. We used this as our threshold to identify regions in Virginia with below-average geographical access.

To gain insights into patient satisfaction, we used the Google Reviews dataset we curated. After manually validating our collected data, we found that the responses to negative reviews were just generic statements containing contact information to reach out to the hospital administration, and responses to positive reviews were just a thank you note. Therefore, we filtered our data to remove responses to reviews. We also dropped any duplicates, which left us with 27,002 reviews for 70 different hospitals. Next, as a part of our pre-processing steps, we removed non-alphabetical characters, tokenized the reviews, removed stop words, and lemmatized the tokens.

Data Analysis
To answer RQ1, we calculated the average upload speed and download speed available to each ZIP code. We first mapped the census tracts from the Fixed Broadband Deployment dataset to the ZIP codes using the HUD-USPS ZIP Crosswalk dataset and then grouped the data points by ZIP codes. To answer RQ2, we calculated Spearman’s coefficient for each factor to identify correlations between median household income, population density, being insured and the number of acute general care facilities near each ZIP code. To answer RQ3, we analyzed access to broadband internet for Virginia populations by ZIP code using both the current definition of broadband, which is 25 mbps download speed and 3 mbps upload speed (25/3), and the proposed update to 100 mbps download speed and 20 mbps upload speed (100/20). To answer RQ4, we performed sentiment analysis using an open-source model VADER (Valence Aware Dictionary and sEntiment Reasoner), which is explicitly optimized for identifying sentiments expressed on social media. VADER calculates the probability that a review is positive, negative and neutral. Using the probability measures from VADER, we classified the reviews into the following three classes: positive (reviews that reflect positive experiences), mixed (reviews that reflect a combination of positive and negative experiences), and negative (reviews that reflect negative experiences). After classifying each review, we grouped them by hospitals and determined the overall sentiment classification for each hospital. Next, we aggregated hospitals that could be accessed from each ZIP code and determined the overall sentiment for each ZIP code by finding the maximum occurring class.
RESULTS
In this section, we present the findings from our cross-dataset analysis of Virginia healthcare and telehealth access. This includes findings regarding access to healthcare (RQ1), correlations between access and socioeconomic factors (RQ2), access to telehealth services (RQ3), and satisfaction with healthcare services (RQ4).

Access to healthcare (RQ1)
Our analyses provided insights into geographic healthcare access across Virginia. With respect to access to healthcare facilities, we found that 13.18% of inhabited ZIP codes (118 out of 892) in Virginia do not have access to an acute general care facility nearby. For 68.694% of Virginia’s inhabited ZIP codes (613 out of 892), no public transportation is available that provides nearby access to acute general care facilities. On average, it takes 28.95 minutes to drive to the nearest acute general facility in Virginia and 121.66 minutes (about 2 hours) to take public transportation, where available. Figure 1 visualizes the distribution of nearby acute general healthcare facilities in Virginia. We can clearly see that while some areas of Virginia have a wealth of options for acute general healthcare (7 or more nearby), most have five or fewer nearby facilities. We also see that many areas, especially in central and western Virginia, have access to zero nearby acute general healthcare facilities. In Figure 2, we see that for communities that do not have access to nearby facilities, their commute to the nearest facility is >21 miles. This disparity is further highlighted in Figures 3 and 4, which visualize the average commute to the nearest healthcare facility. Many areas of Virginia have reasonable travel time to the nearest healthcare facility. However, our findings also indicate that the communities without nearby access must drive an average of 2-3 hours to the nearest healthcare facility. While public transportation may be an option for some, most of our findings suggest an even longer commute to nearest acute general care facilities via public transportation.

Correlations between access and socioeconomic factors (RQ2)
As shown in Table 2, we found that income, transit, and population density are strongly correlated with the number of acute general care facilities nearby in Virginia. Insurance was only moderately correlated with the number of nearby acute general care facilities. When considering distance (Table 3), we found no correlation between insurance and average distance to nearby acute general care facilities. We did, however, see some correlation between transit and average distance, though not quite a strong correlation. While we did not observe any statistically significant correlations between income, population, and proximity, we did find that some low-income areas that are densely populated have a number of acute general care facilities nearby. One example of such an area in our sample is Norfolk, VA, USA (located in eastern VA).
Table 2. Correlation between the factors and the concentration of acute general care

<table>
<thead>
<tr>
<th></th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>0.428</td>
</tr>
<tr>
<td>Transit</td>
<td>-0.455</td>
</tr>
<tr>
<td>Population</td>
<td>0.489</td>
</tr>
<tr>
<td>Insurance</td>
<td>0.261</td>
</tr>
</tbody>
</table>

Table 3. Correlation between the factors and the average distance to the nearest acute general care

<table>
<thead>
<tr>
<th></th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>-0.147</td>
</tr>
<tr>
<td>Transit</td>
<td>0.385</td>
</tr>
<tr>
<td>Population</td>
<td>-0.303</td>
</tr>
<tr>
<td>Insurance</td>
<td>-0.099</td>
</tr>
</tbody>
</table>

Access to Telehealth (RQ3)
We found a strong correlation between population density and internet speed. This also holds true for the population with below-average access to acute general care facilities. Based on our analyses, 82% of those who have below average access to a nearby acute general care facility also do not have access to broadband by its current definition (25/3). For 7.2% of those with below-average access to acute general care facilities, they also do not have access to broadband (25/3). When we conduct the same analyses with the proposed revision to the definition of broadband (100/20), we see a slight increase in the percentage of the individuals with below average access to nearby facilities that do not have access to adequate broadband internet (84%). With the proposed update (100/20), we would see an even larger increase in the percentage of those with below average geographical access that may not have access to adequate broadband internet (32.4%).

Satisfaction with Healthcare Facilities (RQ4)
Of the 27,002 reviews we analyzed, 12,470 were labeled positive, 8,737 were labeled neutral, and 5,795 were labeled negative. Table 4 summarizes the various descriptive statistics for the experiences reported in our dataset. We found that ZIP codes with a higher number of negative reviews had the lowest population and median household income, while ZIP codes with a higher number of neutral reviews had a higher population and median household income. In our dataset, the most positive reviews came from ZIP codes with the highest income and population density. We also found that while the communities within a 21 miles radius of acute general care facilities have an average internet download speed above 100 mbps, ZIP codes with a higher number of positive reviews had an average download speed of 224.73 mbps.

Table 4. Descriptive statistics for negative/neutral/positive experiences reported in our dataset

<table>
<thead>
<tr>
<th></th>
<th>Avg. Income ($)</th>
<th>Population Density</th>
<th>Avg. Download speed (mbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative</td>
<td>54668.60</td>
<td>5861</td>
<td>105.88</td>
</tr>
<tr>
<td>neutral</td>
<td>58201.32</td>
<td>2754</td>
<td>100.26</td>
</tr>
<tr>
<td>positive</td>
<td>74871.67</td>
<td>10652</td>
<td>224.73</td>
</tr>
</tbody>
</table>

Threats to Validity
This study provides useful insights into factors that may affect or correlate with access to healthcare services, as well as how we might use data to drive innovation and change in technology and policy. While we took care to conduct analyses that provide valid, potentially generalizable insights, there are a few threats to the overall validity of our findings.

External validity
As we previously acknowledged, and by design, our study focused on healthcare access in the state of Virginia. While we are confident that our approach would scale to other states or regions, it is unclear to what extent our
insights generalize outside of Virginia. Our future work will use our current approach on data from other states and regions to determine how much our insights generalize. Another potential threat to the generalizability of our findings is the datasets used in our analyses. We could only use datasets that were made publicly available, therefore may not be entirely representative or complete. To mitigate this threat, we made an effort to triangulate data from as many available sources as we could find. We focused our analysis on acute general care facilities. This is of course not exhaustive of the options communities may have for acquiring healthcare services. However, given the implications of access to primary care physicians mentioned previously (Daly et al., 2017), we focused our analyses on acute general care.

**Internal Validity**

Working with unstructured data, as we did in our study, is challenging. The results of our sentiment analysis could be affected by typos in the reviews. Existing autocorrect libraries have a high time complexity and would likely not yield significantly better results. Therefore, any error in our analyses arising from typos can be considered negligible. Another potential threat is that our analysis relied heavily on data collected from the American Community Survey. Any selection/sampling/nonresponse bias in their data collection would be carried over into our analyses. Additionally, the results from our broadband analysis may be more optimistic than reality. According to the FCC’s definition, if one or more addresses within a census block receives service from a broadband provider then the entire census tract is designated as fully covered by that provider. This is particularly misleading for rural communities where a census block may represent an area up to 117 square miles (about the area of Athens, Georgia, USA) (Commonwealth Connect Plan 1 Report on Commonwealth Connect 2.0: Governor Northam’s 2020 Plan to Connect Virginia Contents, n.d.). To mitigate these potential threats, we did our due diligence to find as many relevant datasets as we could get access to for this research.

**Construct Validity**

The goal of this study was to provide insights that can inform future efforts at understanding and improving regional healthcare access. In doing so, we initially planned to evaluate health outcomes to paint a complete picture of healthcare access and its potential effects for Virginia residents. However, we could not acquire the data from the entities that collected the data to do so. In addition, our study does not consider towns from neighboring states that may have nearby health facilities for residents near the border of Virginia. Given the potential for constraints on health insurance out-of-state, we scoped our initial analyses to healthcare facilities within Virginia. Furthermore, for many Virginia residents who do not live near the border, facilities in other states are even less of an option. Despite this omission, our insights still emphasize important barriers to accessing healthcare and telehealth services within the state of Virginia.

**DISCUSSION**

Our work takes a mixed method approach to derive insights from publicly available datasets. Our approach and findings can aid researchers, policymakers, and practitioners in providing informed insights, policies, and technology. Below, we discuss how our findings can and should inform research and practice related to healthcare.

**Using Data-driven Insights for More Equitable Healthcare Access**

In our study, we curated and analyzed data to better understand healthcare and telehealth access for communities in Virginia. While our findings indicate that many portions of the state have adequate access to healthcare services (whether physical or virtual), our findings also indicate that there also exist disparities with respect to physical and virtual access to healthcare for several communities in Virginia. More specifically, we found that low-income communities may suffer the most from inadequate access to healthcare services, particularly in more rural areas, particularly in resources (broadband internet) and infrastructure (public transportation options) to decreased satisfaction with the quality of care received, our findings and prior work suggest that the current healthcare landscape may be harming historically marginalized communities the most (https://www.prb.org/wp-content/uploads/2020/11/WPFP-2015-Report-Racial-Ethnic-Divide.pdf) and that there is much work left to do before we can realize truly equitable healthcare access. However, our findings illuminate the fact that insights such as these are attainable and can be used to better inform changes to the healthcare landscape (or any domain where technology has been or is becoming critical).

Given the scoping our analyses, it may be that our findings and insights do not scale beyond the US state of Virginia. While it may seem like a negative, in reality it is likely the case that this kind of scoping is important for making insights actionable. In fact, prior studies have shown that to best support specific areas, it is important to engage with those communities to best understand the relevant assets, needs, and values (Le Dantec, 2012; Israel, 1998; Israel, 2010). By intentionally focusing data collection, curation, and analysis on communities of interest, we can begin to tackle problems locally more effectively. For example, knowing that the entire nation has broadband connectivity issues feels like a large problem that involves multiple stakeholders and numerous external factors. This makes taking action, or coming up with a reasonable solution, a seemingly insurmountable feat. Whereas
focusing on the state of Virginia, where we have a much smaller set of factors and stakeholders to consider and engage, we can more reasonably make actionable plans for improving access within the state. Building these kinds of foundations can create a domino effect; as each state (or region or community) uses data-driven insights to improve access locally, we will start to see the tides of healthcare equity shift across the country. These insights can also inform local and national policy that can help build sustainable infrastructures to support the changing landscape.

Prior works have highlighted barriers such as no access to devices or the internet (Hirko, 2020; Cortelyou-Ward, 2020; Funk, 2021). Our findings suggest that, even with access to broadband internet, more barriers may be on the horizon and that we not only need to think about the availability of broadband internet but also access to internet with adequate download and upload speeds. Telehealth has become a regular part of the healthcare system and a safeguard for healthcare access during times of high stress (e.g., COVID). Our findings suggest that without access to physical healthcare facilities, even with telehealth some communities may not have access to healthcare services. This is especially problematic for historically marginalized communities that often experience the highest disparities and co-morbidity rates (Daly et al., 2017; Churchwell et al., 2020; Lopez et al., 2021). Furthermore, our findings shed light on the potential negative impacts uninformed policy, standards, and legislation changes can have on the populations they are meant to serve. For Virginia, an increase in speed requirements for broadband access will only serve to reduce access to healthcare services. This emphasizes the value of taking data-driven, and even community-centric, approaches to decision-making.

Re-thinking & Scaling the Theory of Access

Our study, like many others, used the Theory of Access to define access as geographic distance between patients and healthcare facilities (Penchansky & Thomas, 1981). We have already seen prior work call for extensions to the framework to more accurately reflect relevant considerations (Saurman, 2015). As telehealth technologies become more prevalent and necessary in times of exorbitant circumstances, our findings suggest a need to re-define the term access and investigate to what extent the components of the existing ToA framework, and other frameworks like it, scales to the current healthcare landscape (e.g., the use of technology to provide services). This is especially true given the findings from our study indicate that explicit considerations need to be made regarding access to the necessary infrastructure for using telehealth services. Regardless of the standard (25/3 or 100/20) being considered, our analyses found that most Virginians who do not have access to a nearby healthcare facility also do not have access to adequate broadband (and in some cases have no access at all). Given these insights, it is important we explicitly investigate the varying factors that impact an individual or communities’ ability to participate in this mode of receiving healthcare. One way to do this would be to add a dimension for technological access. For example, our research defined technological access, or access to telehealth technologies, based on broadband connection speed. Prior work has also implicitly suggested other ways to think about access to telehealth services, such as device compatibility (Wootton et al., 2020), availability of internet services (Franciosi et al., 2021), and adequate accessibility features (Valdez et al., 2020). There are factors such as technical literacy that can affect both technological access and engagement (Triana et al., 2020; Kruse et al., 2020). Future research and innovations should explicitly explore ways we can expand our thinking around the various dimensions of access and how we can make use of them to ensure access for all.

CONCLUSION

This paper presents a cross-dataset analysis of healthcare and telehealth access in the state of Virginia. We investigated geographic access to acute general care facilities amongst communities across the state and found that there are many communities that do not have adequate access to nearby facilities, even when public transportation is an option. We also found mild to strong correlations between socioeconomic factors such as income and the concentration of nearby acute general healthcare facilities. When evaluating access to telehealth as a solution, we found that for many communities’ inadequate access to broadband internet may be a barrier to engaging in this mode of healthcare. We also found that low-income communities may be having less than satisfactory experiences with their healthcare providers.

REFERENCES


Electronic Health Records and Cyber Hygiene: A Qualitative Study of the Awareness, Knowledge, and Experience of Physicians in Kuwait

Alkhaledi, Reem  
University of North Texas, USA | reemalkhaledi@my.unt.edu

Hawamdeh, Suliman  
University of North Texas, USA | Suliman.Hawamdeh@unt.edu

ABSTRACT
Threats against electronic medical and health records are on the rise. These threats include phishing attacks, malware and ransomware, encryption blind spots, cloud threats, and most important one is the internal threat caused by gaps in the level of awareness and knowledge of the employees and health practitioner of handling sensitive healthcare data. Cyber hygiene is a term used to describe both the technical and non-technical threats. In the same way, personal hygiene practices are used to maintain one’s own health and protect against diseases, cyber hygiene security practices are important in protecting and preserving sensitive electronic health information systems. In this paper, we report on the findings of a cyber hygiene study carried out in Kuwait with the objectives of assessing the level of awareness, knowledge and experience of physicians and healthcare professionals. The study identified seven different areas or barriers that impacted the cyber hygiene and the adoption of electronic health medical records in Kuwait. The seven areas include financial barriers, time, difficulty of using technology, lack of management support, negative attitude toward the use of electronic medical records, legal and ethical issues, as well as cultural barriers. Most of the physicians interviewed lacked the awareness and basic knowledge needed to practice cyber hygiene. Most physicians were not aware of regulation or standards pertaining to the use of electronic medical records.

KEYWORDS
Cyber Hygiene, cyber security, Electronic Health Records, Electronic Medical records, Kuwait, Regulations, Standards.

INTRODUCTION
The rising cost of healthcare and medical services due to growing population, aging societies, increase in life expectancy, and increase in the number of people with chronic disease and obesity is a major concern in both developing and developed nations. Advances in technology and electronic health record (EHR) systems have the potential to transform healthcare services by allowing physicians to do the right things at the right time. The recent experience with the COVID-19 pandemic highlighted the need for more efficient way of delivering health services online. EHRs make healthcare better for both doctors and patients by providing timely access to data for providing quality health care through knowledge of historical treatments. Adapting EHR technology into healthcare facilities can be challenging at first, but the result is worth the challenge.

There has been a steady increase in the adoption and implementation of EHR systems by healthcare institutions globally over the past few decades. This adoption was primarily motivated by the need for institutions to provide cheaper, better, safer, and more efficient healthcare for their patients. Research has shown that hospitals who adopted and implemented EHR or electronic medical record (EMR) systems had 3% to 4% lower mortality rates compared to those did not use or have EHR systems in place (Yanamadala et al., 2016). Furthermore, healthcare costs were reduced significantly using information systems (Ackermann, 1985; DesRoches et al., 2008). Kuwait has seen growth over the years in the use of digital health tools and information systems. Despite the progress made over the years, there are still area that are lacking.

Adoption of EHR systems in Kuwait’s healthcare has varied considerably, with only some government hospitals integrating their EHRs with other digital systems such as radiology and lab information systems, while other institutions only adopting fragments of digital solutions. This limited adoption is despite the establishment of central IT department to integrate electronic communication networks (Al-Askari, 2003; Almutairi, 2011; Al-Hazami, 2010; Alhuwail, 2019).

Research has clearly shown that EHR systems are necessary because they reduce costs and improve outcomes, ensure safety, improve service delivery, and ultimately patient satisfaction (Wager et al., 2009). Kuwait was one of the first countries in the Middle East in the 1980s that adopted information technology (IT) and the first Middle Eastern countries to have Internet services. Kuwait is known to be the third largest spender on ICT infrastructure in the region. The government established the National Accreditation Program for Hospitals (NAPH), which was developed by the Quality and Accreditation Directorate (QAD) under the Ministry of Health (Alhuwail, 2019);
Ladha-Waljee et al., 2014; Mitchel et al., 2014). The program has been an important steppingstone for the Ministry of Health’s effort in improving health information management systems.

Despite the heavy investment in ICT, Kuwait remains behind in EHR implementation and Cybersecurity readiness and adoption compared to developed nations. In this study, we investigate the barriers and factors impacting the adoption and implementation of EHR systems as well as the level of awareness, knowledge, and experiences of using EHR and practicing cyber hygiene by physicians and health care professionals in Kuwait.

**LITERATURE REVIEW**

The increased reliance on the Internet and Web Based applications has resulted in an increase in the number of cyber-attacks against various types of organizations including Electronic Health Systems (EHR). According to Nguyen-Dey (2018), EHRs have many benefits, such as centralizing a patient’s information and streamlining communication. These benefits with no doubt advance as technical advancements continue in the healthcare sector, but there is a need to ensure that patient privacy is maintained, and patients’ information is secure (CM, 2018). Along the same lines, Chaudhry et al. (2006) mentioned that “health care experts, policymakers, payers, and consumers consider health information technologies, such as EHRs and computerized provider order entry, to be critical to transforming the health care industry” (p. 742).

Ensuring EHRs are being secured and handled with precaution is because, with time, a patient’s medical record grows and contains important and private information, such as “identification, history of medical diagnosis, digital renderings of medical images, treatments, medication history, dietary habits, sexual preference, genetic information, psychological profiles, employment history, income and physicians’ subjective assessments of personality and mental state” (Appari & Johnson, 2010, p. 281). The lack of suitable security measures may result in many data breaches and allow patients to be exposed to economic threats, mental suffering, and possible social stigma, all indicating why a healthy budget must be allocated by IT stakeholders for EHR technology implementation. According to Almeida et al. (2017), “cyber hygiene initiatives aim at using cybersecurity best practices to appropriately protect and maintain systems and devices connected to the Internet” (p. 4). A major reason for users not participating in cyber hygiene behavior standards is because they do not have the right knowledge of the proper behavior that needs to be taken into consideration. Data and identity theft are usually linked to financial and reputational risks, but data and identity theft have a bigger threat to health care infrastructure and patient protection.

Many countries have laws to protect patients’ information privacy. The Health Insurance Portability and Accountability Act (HIPAA) increased awareness on the validity of protecting personal health information and introduced a regulatory framework to boost compliance; however, compliance does not usually translate into security. HIPAA safety strategies count on standard technological methods “of isolating critical data, but this recent study indicates that many attackers are bypassing these types of protections and do not require stealth techniques to do so” (Peraksis, 2014, p. 395). Magrabi et al. (2016) mentioned that concerns about data security provoked Health and Human Services (HHS) to update HIPAA and to increase security shields essential for health care providers that either contract or subcontract with business links to manage medical information.

There are specific legal requirements that hospitals and clinics must meet to ensure the security and privacy of patients’ medical information. The Internet age has increased the risk of malicious attacks against institutions EHR systems and compromise of patients’ private information because sharing of EHR has become more prevalent as data are stored in the cloud and not only patients but also hospitals and clients have adopted the use of mobile devices for EHRs (McGhin et al., 2019). Health information has become easier to access via technology between patients and their physicians, but it has also become easier to compromise. It is important for organizations to have ethics policies and proper systems in place for training and reinforcement to be conducted periodically to maintain and improve security within the organization and minimize the risk of exposure.

The level of EHR adoption in Kuwait according to Alhuwail (2018) is not on par with other countries in the west and the digital health tools and systems that are available are very limited. Despite Kuwait, being a rich country, it has no proper information governance via information management practices to have an effective digital health tools and systems. Alhuwail (2018) also identified a lack of information in regard to the challenges, gaps, and opportunities about information management performance in Kuwait’s healthcare institutions.

Alhuwail (2018) looked at EHR adoption levels in public hospitals in Kuwait, which vary significantly, and found that only two public hospitals integrated EHR with other digital systems such as radiology and laboratory information systems within their facilities. The remainder of the public hospitals applied only fragments of digital solutions that complete specific functions.

It is evident that the public hospitals in Kuwait are struggling with defining strong leadership and strategic directions for digital health informatics, that informatics education and training for hospital staff is lacking. Alhuwail (2018) stated that “analytical reports that help with real-time decision-making and long-term planning are either not
produced or not solicited” (para. 5). Moreover, it is not known how records are protected in hospitals in Kuwait, keeping in mind that privacy and security of health records is one of the highest priorities. Overall, the safety of patients’ information and making sure physicians maintain their cyber hygiene by gaining awareness through professional development events and reinforcement to avoid cyberattacks is what to look for when it comes to measuring the outcome.

Cyber hygiene resembles the concept of personal hygiene but instead of maintaining one’s own health, cyber hygiene practices are used to protect and preserve data and information generated and stored on individual and organizational systems. To date, however, there has been no consensus between organizations and experts on the definition or agreed practical meaning of cyber hygiene (European Union Agency for Network and Information Security, 2006; Vishwanath et al., 2020). Furthermore, there have been no measures for cyber hygiene, and existing research on cybersecurity in the social sciences has focused primarily on the users’ actions when it comes to security. These actions include password-related behaviors (Stanton et al., 2005) and email security related to end-user attitudes and self-beliefs (Ng et al., 2009). Egleman and Peer (2015) developed the four-dimensional Security Behavior Intentions Scale (SeBIS) that measures and evaluates the end users’ compliance and agreement with computer security advice. The measurement of such cyber safety behaviors is done by indirectly assuming that the users are attentive to these behaviors.

Current research of cyber hygiene has been conducted in the sense of hygiene viewed as a multidimensional idea with several elements that make up an individual’s hygiene and as a guideline for individuals about what to do using the example of hand washing and how to implement it (Vishwanath et al., 2020). These different views are due to contextual and cultural differences, making the definition of hygiene very broad with different meanings based on an individual’s personal understanding.

Ultimately, cyber hygiene refers to the practices that people engage in for cyber health or general behaviors for personal protection of electronic information from being compromised using routine checks and monitoring practices (Neigel et al., 2020). The definition and guidelines of cyber hygiene can be applied to a wide range of different consumers and can be molded to fit any specific professional or even cultural context.

**Methodology**

Mixed method approach was used to first identify the factors impacting the implementation and adoption of EHR in Kuwait and second, assess the level of awareness, knowledge, and experience of Kuwaiti physicians in Kuwait. A combination of content analysis methods provide higher flexibility when investigating behavioral issues and assist in understanding people opinion and attitude. Krathwohl (1998) extolled qualitative research as especially helpful for gaining with participants’ perceptions of a situation to understand their behavior. The semi structured interviews were used to collect information and drill deeper in the types of issues related to the awareness, knowledge, experiences of the participants. Semi structured interviews allowed for asking questions that explored the participants’ awareness, knowledge, experiences, behavior beliefs, and motivations in an in-depth manner.

The formulation of some of the questions were guided by the University of Michigan Public Health Institute, Ann Arbor (Mackison, 2011), this questionnaire was put together to collect information on lifestyle, behavior, social and environmental impacts that affect human health. The online questionnaire indicated that “permission has been obtained from the survey developers for unrestricted use of this survey; it may be modified or used as is without additional permission from the authors.” No permission was needed to modify any questions from it that were used in this research. The sample of 15 physicians was considered an adequate sample size because the physicians being interviewed are a homogenous group of people. According to Dworkin (2012), “an extremely large number of articles, book chapters, and books recommend guidance and suggest anywhere from 5 to 50 participants as adequate” (p. 1319). Due to the ongoing global pandemic and the current situation from COVID-19, the interviews were conducted virtually. Depending on the participant’s preference and the type of technology available to them, a combination of Zoom and WhatsApp applications were used to conduct and record the interviews. Snowball sampling method was used to recruit the physicians being interviewed.

An audio recorder was used to record the interviews while they were being conducted, after the interviews the audio content was transcribed and then coddled. Following the interviews, the recordings were transcribed verbatim for analyzing the participants’ data. When analyzing the participants’ data, specific things were looked at that included similar agreements or disagreements among the participants, as well as themes, patterns, and concepts. The interviews were conducted in the English language, translation was not required for the collected data. Data were analyzed by using NVivo (R-1) and Microsoft Excel software. Initially, all the transcripts were imported into NVivo (R-1) as separate files. In the first phase, all the transcripts were coded in NVivo (R-1). Next the frequencies and percentages were calculated in Microsoft Excel.
Validity testing was carried out to ensure the data are coded and transcribed accurately. Validity was established first by conducting a pilot study and then having an expert in the field (a physician) give their expert opinion on the questions and answers collected. The interview questions were pretested for construct validity, changes were made as needed. The interview questions were written with the CHB model in mind. Each part of the proposed model was set as a subcategory in the interview guide. Consistency was assured in the data collection by having the interview sessions recorded and transcribed verbatim. To avoid bias, the questions were read as they appeared on the guide. The physicians were not interrupted after the question has been asked.

Findings & Discussion

The search results for the systematic literature review were obtained using the following databases: (a) PubMed, (b) EBSCOhost, (c) The Cochrane Library, and (d) Google Scholar. The searches identified 202 articles from which a total of 36 full-text articles met the inclusion criteria. Exclusion criteria excluded duplicates, non-English articles, and articles not related to the topic or done in Kuwait but not directly related to EHR. According to Sampaio and Mancini (2007), the next stage was to analyze the methodological quality of the studies that were relevant with accordance to the inclusion criteria based on the quality of the methodology used and its relevance. A matrix was developed to classify the articles into categories or themes that deemed to constitute barriers and or major impeding factors. The results from the systematic review showed that the slow adoption and implementation of EHRs in Kuwait could be attributed to seven barriers identified in the 36 research articles. Figure 1 show the seven factors as well as compare the results from Kuwait with the rest of the GCC (Gulf Cooperation Council) countries.

![Figure 1. Barriers Reported in the Systematically Reviewed Studies](image)

The findings from the systematic literature review are also supported by the findings from the semi structured interviews. For example, Participant 12 stated that:

_Hospitals need to invest more in a flexible and a very reliable EHR and to also try to use a universal system, stick to one and not use different platforms which will confuse people. Have way better support and have staff available at all times because trouble shooting will arise and you should have super users which are people trained on this system available constantly at least the first year of implementation because when we did implement this and we would have issues it would take 30 minutes to one hour to get somebody to resolve a very simple issue and that does not help with the transition from paper to EHR._

Alaslawi et al. (2019) discussed the status and various trends of e-health tools in Kuwait and pointed out that different sociopolitical, financial, infrastructural, organizational, technical, and individual barriers are hindering Kuwait from implementing EHRs. Almutairi’s (2011) study was titled “A Strategic Roadmap for Achieving the Potential Benefits of Electronic Health Record System in the State of Kuwait,” and the author discussed the lag of implementation in Kuwait. The main factor causing the lag involved no clear plan for the implementation of EHRs in the country. Almutairi pointed out that the lack of clear direction, absence of staff training, and knowledge of the system have delayed the implementation of EHRs.

The results concerning awareness, knowledge and experience is rather interesting given the low adoption and implementation of EHR systems in Kuwait. Most of the physicians interviewed (80%) indicated that they worked in a medical facility that had an EHR system implemented, and the remaining (20%) physicians did not work in places with EHR implementation. From the 15 participants interviewed, only one participant was working in a place where the EHR system was fully (100%) implemented, and 20% of the participants mentioned they did not have a fully implemented system in place. Despite these numbers, more than half (67%) of the participants stated that they had
prior or current experience of working with an EHR system in their organizations and 33% did not have any experience working with an EHR system.

When physicians were asked about their willingness to participate in training others on the EHR system if needed, a little less than half (40%) were not willing to train others on the system and a small percentage (33%) were willing to participate in training other physicians on the EHR system. One of the main reasons most participants responded as not willing to train others on the system was, “I will not participate in training others since I don’t think I’m that knowledgeable to train others,” according to Participant 14. Participant 3 said, “No, I will not participate in training others I do not have the time.”

The participants who stated they were not willing to train others on the EHR system appeared to lack confidence in and knowledge about using the system. Figure 2 shows that most interviewed physicians were not confident using the EHR system in case of encountering privacy issues or cybersecurity threats. This finding reflects the lack of training the participants had during their careers.

![Figure 2. Level of Confidence](image)

When it comes to the implementation of the system, 87% of the physicians working in the hospital were not involved and only 13% were involved in the EHR system implementation. As to the various aspects of an EHR system used by a physician, the results showed that the percentage of participation was the following: (a) assessing patient information and writing notes (0%); (b) preparing the electronic charts including laboratory and radiology (7%); (c) viewing lab images and investigations of all aspects (40%); (d) inputting outpatient data, such as medical notes, treatment plan, and medications (07%); (e) reviewing patient history and diagnosis (7%); (f) logging progress notes and entry of lab orders and radiology orders and medications (7%); (g) making referral and appointments (13%); and (h) looking up prescribed medications, lab results, x-rays, and vital signs (13%). The EHR system charts were being used only by 20% of the physicians whereas 80% were not using the EHR system charts in place.

Participant 7 explained:

> We use it for ordering investigations finding the results, ordering radiology imagining and also looking up the results, and we use it for prescriptions and recently we moved, in the out-patient clinic, to writing our clinic notes on the electronic health record. It’s obviously better than paper charts because you don’t worry about losing the information, and it’s faster to get the information you need, and you don’t have to wait for the paper chart to arrive, and it’s more secure, and I feel it’s more private or confidential.

Based on the findings, more than half (60%) of the physicians were aware of the cybersecurity threats and less than half (40%) were not aware. More than half of the physicians (53%) expressed that they have no issues or concerns on the use of this system; 40% of the physicians showed concern that the system may be hacked, and patient confidential information may be stolen; and only 7% raised concerns that anybody can access patient notes and results. Participant 12 responded, “No, not really, I’m not aware of cybersecurity threats, [and I have] no privacy concerns with using EHR so far.”

Security measures adopted by different organizations to protect the access to an EHR system includes the use of antivirus programs (20% of the cases), user name and passwords (27% of the participants), and 53% of the participants were not sure about the use of security measures, as many of the physicians had the same answer as Participant 13, wo said, “I have no idea of any security measures.” The various aspects of the EHR system being used are generated from NVivo (R-1) and shown in Figure 3.
The fact that 40% of the physicians were not aware of cybersecurity issues affected their attitude and behavior toward the use of cyber hygiene. Participant 2 made this observation clear: “There is no privacy issue unless someone hacks the system.” Participant 3 said, “I’m not familiar with cybersecurity threats.”

With regards to experience and training, the semi structured interviews addressed the experience and training for EHR and cybersecurity (perceived behavioral control). Even though EHRs have been around for a while now, some physicians lack experience with technology. The number of years the participants had been using EHRs was widespread, but their work experience in years needs to be considered also.

Good training and practice build confidence when using EHRs. Physicians must be confident when dealing with EHR privacy issues and online security tools, and they should have the knowledge and training in case they face an issue and need to react swiftly. Only 2 of the 15 participants felt confident dealing with EHR privacy issues and online security tools. The most common answer among the 13 participants was typified by Participant 12: “I do not feel confident dealing with privacy issues and online security tools.”

One of the most important aspects of implementing EHRs successfully is to prepare physicians using the system in an effective and safe way. Being armed with the needed skills and knowledge of using EHRs might make the transition and implementation much easier and less stressful for EHR users. Figure 4 shows when the participants last attended a class on EHR and/or cybersecurity and where the class took place. Two participants had never attended any EHR or cybersecurity training during their careers.
An IT team should be available around the clock for support in the event the system crashes or if the physician on duty simply needs help. Also, periodical password changes for safety reasons are needed, and periodical training for all hospital staff on EHR systems was part of the recommendations. Participant 13 stated that:

*We need to train our physicians about the importance of patient privacy, as sometimes I don’t feel comfortable to go to government hospital if I have any medical issue. We need also to have good IT who knows how to deal with technical issues as many times they said we are not familiar how to deal with this issue. We also need to build more fixable system to edit the date as no modification can be done in case of wrong entry, and it will stick in [the] patient record forever.*

Clearly, experience and training lead to confidence in using the system as well as agreeing to train others on how to use the system. Having confidence is an indication of a control behavior which in return affects cyber hygiene. It was clear from Participant 4’s statement, “Yes, if I get asked and have full experience in all aspects of the electronic system at that time [I’m willing to train others].” Participant 13 said, “No, I will not participate in training”, and Participant 14 added, “No, I will not participate in training others since I don’t think I’m that knowledgeable to train others.”

Six of the 15 interviewed physicians were not aware of cybersecurity threats that could happen to EHR systems. While about half of the physicians interviewed showed no concerns about using the EHR system, the others expressed concerns about the possibility for the system to be hacked and patient confidential information may be stolen and compromised. Only one physician stated that anybody can access patient notes and results and did not believe cyberattacks would be a big problem. A major reason for users not participating in cyber hygiene behavior standards involved their lack of the right knowledge of the proper behavior that needs to be taken into consideration.

Assessing the participants’ knowledge about the security measures used at their workplace to protect from cybersecurity threats, many participants did not seem to know much about these. Participant 13 said, “I have no idea of any security measures.” Other participants seemed to lack knowledge of the security protocols or guidelines. Three participants mentioned the use of antivirus software. Four participants said username and passwords could protect against cybersecurity threats. Participant 12 stated, “I’m not aware of cybersecurity threats, [and I have] no privacy concerns with using EHR so far.” The results suggested that the major reason for users not participating in cyber hygiene behavior standards is the fact they do not have the right knowledge of the existing security measures or the cyber hygiene behavior they need to use. Maennel et al. (2018) pointed out that good password hygiene was related to training, awareness, monitoring, and motivation.

Regarding the level of awareness, knowledge, and experience with the use of cyber hygiene among physicians in Kuwait, the interviews provided insight into the participants duration of using EHRs, and their experience and training in EHR and cybersecurity. Four of the 15 interviewed physicians mentioned they had used EHRs between 2
to 5 years, and six physicians reported having 6 to 11 years of experience. Four physicians had over 13 years of experience.

Out of 15 participants, only one claimed having an actual encounter with a privacy issue or cybersecurity threat during their years of using EHRs. The level of confidence in dealing with EHR privacy issues and online security tools was surprising since 13 participants stated that they were not confident in dealing with EHR privacy issues and online security tools. Only two physicians felt confident dealing with any EHR privacy issues and online security tools.

Eight participants have had training in the last 5 years. To have a successful system, training must be part of the equation. Good training on EHRs can help physicians to be confident when using the system. Al-Azmi et al. (2009, p. 38) said, “This will help them to solve some simple computer and software related problems … which will eventually have a positive impact on the users … prior computer experience and training on the system is essential for success.”

Regarding training in the last 5 years, 67% of the physicians were involved in training, and 33% did not participate in EHR system-related training. When physicians were asked about their willingness to participate in providing training to others on the EHR system, 27% of the physicians did not give a response, 40% were not willing to train others on the system, and 33% were willing to participate in training other physicians on the EHR system. One of the main reasons most participants were not willing to train others was their lack of knowledge of the system. Participant 14 responded, “No, I will not participate in training others since I don’t think I’m that knowledgeable to train others.” Participant 3 said, “No, I will not participate in training others. I do not have the time.”

It is important to look at the work experience with EHR and cybersecurity outside Kuwait since many of the physicians in Kuwait choose to do their residencies abroad. Six participants stated they did not have any experience with EHR, and nine participants had experience using EHR systems abroad, mainly in the United States, Ireland, Canada, and Saudi Arabia. Six participants having no experience working with EHR and cybersecurity outside of Kuwait is a high number of physicians considering that EHRs have been available in many other countries.

The participants had many recommendations for Kuwait based on their current work experience. It is worth noting that 67% of the participants agreed with having a need to connect between the EHR systems using in all the hospitals in Kuwait to help with retrieving patients’ data more easily and diagnosing correctly. The 15 physicians suggested there is a huge demand for the implementation of EHRs in Kuwait. All the interviewed physicians referred to the urgency for such a system. Participant 2 spoke about its importance:

_Honestly, we would like to have this system to be applied in Kuwait. This will help all physicians, and not only radiologists, to access lots of info about the patient and lab results, and the communication between the physicians will be faster, and all the details about patient’s past medical history._

Also, the physicians’ stated clearly that there is a need for the implementation of EHRs. Participant 13 recommended the following:

_We need to train our physicians about the importance of patient privacy as sometimes I don’t feel comfortable to go to [a] government hospital if I have any medical issue. We need also to have good IT who knows how to deal with technical issues as many times they said we are not familiar how to deal with this issue. We also need to build more fixable system to edit the date as no modification can be done in case of wrong entry and it will stick in [the] patient’s record forever._

A few participants emphasized the importance of sharing information among healthcare institutions in Kuwait. It is common now in developed countries to have information shared among physicians after consent from the patients. In this regard, Participant 7 stated:

_My recommendation would be to go fully electronic, and it should be implemented at all hospitals, and it would be good if all hospitals can have a system where they can share the information with each other because every hospital has its own electronic health record, and they are not connected, and that would make it easy, because a lot of patients have follow ups at different hospitals so that would be good if they were all integrated in to one system and to obviously make sure it’s protected from hackers, which again I’m not sure if they have that in place or not._

**CONCLUSION**

The findings from this study supported and extended the earlier work by Alkhaledi et al. (2020) about the barriers to the adoption and implementation of EHRs in the GCC. The findings revealed structural and non-structural barriers to the adoption and implementation of EHR systems. Studies also showed that healthcare expenditure in the GCC region is less than the expenditure incurred in developed countries. The finding from the interviews provided...
insights and a better understanding of how physicians feel and think about the status of the EHR system they had in place at their workplace. In addition to physicians sharing their opinions and the attitudes they exhibited in terms of the norms and practices, and their perceived behavioral control toward the EHR, they also stated what needs to be done for EHRs to be successful at their workplace.

Many of the physicians did not work in places with a fully implemented EHR system, and only a few worked in places with an EHR system in place. Some worked with only components of an EHR system in place in their workplace. Results from interviews noted the lack of training for hospital staff. The lack of training and the low confidence the participants had in the EHR system explains the low number of participants willing to participate in training. This study had several limitations, one of the main limitations was that the study was conducted during the pandemic, so meeting physicians face to face was difficult. Physicians were extremely busy during the pandemic, which affected access to and the availability of physicians for participating in the interviews. The study was also delimited to Kuwaiti nationals working in Kuwaiti hospitals. Kuwait has a large working expat population, so limiting the participants by nationality could affect the generalizability of the findings. Another limitation was level of exposure. Not all participants had the opportunity to do their residencies abroad or go for training.

The data generated from this study can aid in creating awareness and, hopefully, lead to development plans by the Ministry of Health to encourage and convince physicians to practice good cyber hygiene. The recommendations made by physicians in this study serve as a call for action to develop awareness and training plans to educate physicians and healthcare professionals about the importance of practicing cyber hygiene. It is hoped that this research can represent the beginning of ongoing research regarding the barriers to using EHR systems since few studies have addressed the awareness, knowledge, and practice of cyber hygiene in Kuwait.

The results from this study concerning cyber hygiene by physicians can help the Ministry of Health create better guidelines and standards for physicians to access and share patients’ information and to inform policymakers to put in place a policy similar to HIPAA to ensure the protection of patient information. I hope that this research represents the beginning of ongoing research regarding the socioeconomic barriers to adopting and implementing electronic healthcare systems because Kuwait has the resources to make such implementation possible.

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“Finding a Way To Say ‘No’”: Library Employees’ Responses to Sexual Harassment as Emotional Labour

Allard, Danielle  
School of Library and Information Studies, University of Alberta, Canada | allard@ualberta.ca

Oliphant, Tami  
School of Library and Information Studies, University of Alberta, Canada | toliphan@ualberta.ca

Lieu, Angela  
Edmonton, Canada | lieu2@ualberta.ca

ABSTRACT
Patron-perpetrated sexual harassment (PPSH) is a form of gender-based violence and a pervasive problem in libraries. However, contending with PPSH requires the performance of emotional labour by library workers because of workplace cultures and professional values that prioritize patron and institutional comfort. To better understand library workers’ emotional labour as they respond to PPSH, we analyzed 510 survey responses where participants shared their experiences of, their responses to, and feelings about, PPSH. Three responsive strategies emerged: acceptance, indirect refusal, or direct refusal. Overwhelmingly, library workers reported negative emotions about the incidents. Despite these negative feelings, library workers consistently responded to PPSH by performing emotional labour that upheld “polite and professional” values. Our findings raise concerning questions for the field of library and information studies about the implicit and explicit expectations placed on library workers to perform emotional labour in response to PPSH, particularly within the context of a feminized profession and with the knowledge that PPSH harms library workers. Our goal is to support library workers and their institutions to “find a way to say ‘no’” to gender-based violence in the workplace.

KEYWORDS
workplace sexual harassment, emotional labour, library labour

INTRODUCTION
I love being a public librarian, but I believe the library profession does not take seriously the concerns of women regarding sexual harassment. We are almost constantly subjected to people making inappropriate comments and coming on to us without being empowered to handle it. The helpfulness ethic is so strong, and the fact that we are a profession traditionally filled with women, means that we are supposed to just smile and be nice.

Patron-perpetrated sexual harassment (PPSH), the sexual harassment of library workers by the very patrons they endeavour to support, is a form of gender-based violence and a serious problem for folks who work in libraries. Responding to sexual harassment is always challenging but can be even more so within library workplace contexts where “the customer is always right” and where the possibility of sexual harassment is always present. This paper focuses on how emotional labour is performed by library workers when they respond to experiences of sexual harassment. Emotional labour is a feminist concept that understands that the management of feelings and public facial and bodily display is performed by workers in ways that reflect institutional values and in exchange for wages (Hochschild, 1983). The concept of emotional labour is highly relevant to understanding the gendered nature of library work because it centres the feminized labour context in which librarianship occurs and because it accounts for and values this significant type of labour, so frequently performed by folks working in libraries.

To better understand how emotional labour is performed by library workers as a response to their experiences of PPSH, we asked library workers from across Canada to describe their experiences of PPSH, how they responded to PPSH incidents, and to describe how those incidents made them feel. Drawing from this data, we determined that multiple forms of emotional labour are frequently performed by library workers to respond to and manage harassing patrons. As a concept attuned to both library workers’ thoughts and actions, emotional labour provides us with a vocabulary to see and understand the complexity of library workers’ shifting responses to sexual harassment. It offers a way to examine library workers’ complex and sometimes painful experiences even when, on the surface, library workers react minimally and/or respond “professionally” and in alignment with their employers’ and/or Library and Information Studies (LIS) values. Understanding the distinction between what is performed as emotional labour and how library workers actually feel about their experiences of sexual harassment encourages us to look for and examine how library workers manage discomfort, uncertainty, fear, anger, and contradictory feelings about being sexually harassed as they also uphold and enact workplace and professional values. Library workers are often constrained by workplace expectations that encourage them to “find a way to say ‘yes’” to all patrons at all times. In this paper we argue that PPSH is a form of gender-based violence. Effective strategies designed to counter it must acknowledge the significant harm it creates for library workers when they endure it and when they respond...
to it in ways that do not centre their humanity or workplace rights. It is not only the responsibility of the individual library worker, but all of us, to support library workers and their institutions, to find a way to say “no.”

**LITERATURE REVIEW**

**Patron-perpetrated sexual harassment**

Patron-perpetrated sexual harassment (PPSH) is a form of workplace sexual harassment where workers are harassed by third parties, such as customers or clients, while doing their jobs. Part II of the *Canada Labour Code* defines “harassment and violence” as “any action, conduct or comment, including of a sexual nature, that can reasonably be expected to cause offense, humiliation or other physical or psychological injury or illness to an employee, including any prescribed action, conduct or comment” (Government of Canada, 2019). Particularly vulnerable to workplace sexual harassment are undergraduate and young workers, people of colour, and members of the LGBTQ2SIA+ community who experience intersecting forms of racialized and gendered oppression (Fineran 2015; Martin 2015). Within libraries, library workers are frequently harassed by the patrons that they serve. Although it is well known that workplace sexual harassment proliferates in feminized and service or care-oriented occupations, very little attention to this issue has been paid within Library and Information Studies. We recently conducted a Canadian survey of over 500 library employees working predominantly in public libraries that indicates that only 7% of participants have never been sexually harassed at work (Oliphant, Allard, Lieu, & Mallach, 2021). PPSH happens in-person, over the phone, online, outside of the workplace, and in every corner of the library. Library workers contend with different types of harassment ranging from being told inappropriate “jokes” to being asked out on dates to being stalked, touched, yelled at, and sexually assaulted. All library workers from library pages to CEOs are vulnerable to PPSH. However, our survey results indicated that library workers who are cis and transgender women and non-binary folks, younger (18-39 years old), and in public-facing positions experience PPSH most often. The same survey also suggests that, for a variety of complex reasons, library workers often do not report sexual harassment to their institutions. Some of the reasons that library workers don’t report harassment include the following: they feel that their experiences are not believed by their employers; they think that the incident was not serious enough to report, and; they fear negative professional consequences from their employer (Oliphant, Allard, & Lieu, 2023).

Within the context of academic librarianship, similarly alarming findings from two recent surveys are emerging (Barr-Walker et al., 2021; Benjes-Small et al., 2021). For example, a survey of non-student library employees of the University of California, San Francisco conducted by Barr-Walker et al. found that “Out of 579 respondents, 54% experienced and/or observed sexual harassment at work” (2021, p. 237). More broadly but certainly related, recent studies about patron violence in libraries also demonstrate that physical violence from patrons towards staff is common (Stevenson, 2022). In fact, the American Library Association recently released a statement condemning violence in libraries (ALA, 2022). Together, these studies paint a sobering picture of ongoing and frequently experienced workplace and gender-based violence directed towards library staff at their jobs.

**Emotional Labour**

Introduced by Arlie Russell Hochschild in 1983, emotional labour is a feminist concept often discussed in tandem with workplace sexual harassment (Kensbock et al., 2015; Williams, 2003). Hochschild defines “emotional labor to mean the management of feeling to create a publicly observable facial and bodily display; emotional labor is sold for a wage and therefore has exchange value” (Hochschild, 1983, p. 7). In other words, emotional labour is the paid work of regulating one’s own emotions and/or performing specific “sanctioned” emotions in the workplace in order to manage the feelings and experiences of customers/patrons/patients. In the context of feminized fields, such as service work and the “caring professions”, emotional labour theory posits that when interacting with patrons, (typically) cis gender women workers are expected to suppress and manage their emotions in the interest of satisfying their job requirements to provide good customer service and care (Forseth, 2005; Hochschild, 1983). Sanctioned emotional expressions in these contexts often include such emotions as friendliness, kindness, interest, accommodation, caring, and an otherwise full embodiment of the expression “the customer is always right.”

Related research demonstrates that performing emotional labour within the context of feminized fields including service, retail, and “caring” work, often invites sexual harassment and, conversely, is used as a coping strategy to manage sexual harassment (Good & Cooper, 2016; Kensbock et al., 2015; Virkki, 2008, Williams, 2003). For example, research about the restaurant and bar server population demonstrates that male customers often take liberties or assume that they are entitled to the bodies of their servers because staff are being nice to them (Good & Cooper, 2016). In these instances, friendliness or kindness is read as sexual interest and male entitlement takes precedence over women’s working conditions. On the other hand, feminist scholars also suggest that cis gender women employed in service and care work frequently perform emotional labour as a means to pacify aggressive customers and prevent violence and sexual advances—exchanging “niceness and empathy for non-violent treatment” (Good & Cooper, 2016; Kensbock et al., 2015; Virkki, 2008, p. 86). Indeed, the performance of emotional labour has been found to be especially onerous on and detrimental to employees experiencing sexual
harassment, who must “weigh up their feelings of being personally uncomfortable with the emotional labour requirements of the work to offer friendly, personalized customer service” (Good & Cooper, 2016, p. 462; Williams, 2003). Through the process of performing the caring and “service with a smile” inherent in service related job expectations, it sometimes becomes difficult for employees to recognize what is not “part of the job.” Service work emotional labour expectations create a workplace setting for employees that “blur[s] the lines between managing customer behaviour that is expected as part of the job, and dealing with inappropriate behaviour that could be considered sexual harassment” (Good & Cooper, 2016, p. 450). In addition to being (privately) upset with perpetrators of sexual harassment, performing emotional labour in the face of sexual harassment can make employees feel bad about their jobs, their employers, and themselves.

Importantly, from a management perspective, emotional labour also refers to “the act of expressing organizationally desired emotions during service transactions” (Morris & Feldman, 1996, p. 987). These are the emotional expressions that support the belief systems of the organization. Indeed, within specific workplaces, “management often sets rules about how employees should feel and specifically about how they should express their feelings” (Bright, 2018, p. 29). It is thus important to consider what desired emotions and related institutional values are expressed when library workers perform emotional labour in their patron interactions. More broadly, librarianship specific values and ideologies inform and impact the ways that library work is understood and performed. Service expectations of inclusion and universal access to information are identified by ALA as core values of librarianship, solidifying the rights of patrons, often at the expense of employees. For example, the Reference and User Services Association (RUSA) guidelines articulate what “good” reference service should look like which prioritizes the performance of emotional labor by library workers (Emmehainz, Pappas, & Seale, 2017). Similarly, Hicks and VanScoy (2019) note how RUSA and other core competency documents describe “appropriate” professional behaviors from the perspective of patrons, not library workers. Encoded in their professional guidelines, standards, and competencies as part of their professional identity and practice, library workers—like other care and service workers—are often encouraged to provide “service with a smile” and place the needs of patrons over their own. Although library workers are not specifically told to tolerate and endure PPSH (though our survey findings suggest this is sometimes implied by some employers), these aspects of the culture of librarianship make it difficult to label and confront issues like sexual harassment.

The concept of emotional labour has been increasingly taken up within LIS to examine a variety of facets of librarianship, with an emphasis on circulation (Sheih, 2013), library instruction (Julien & Genuis, 2009) and particularly reference services (Bright, 2018; Matteson & Miller, 2012, 2013; 2014; Shuler & Morgan, 2013). What these studies have in common is a recognition that folks who do public facing and service-oriented jobs in libraries are encouraged and/or often feel compelled to manage their own difficult emotions, to effectively perform aspects of their work that involve patron interactions. Much of this literature explores both the challenges and (sometimes) opportunities inherent in jobs defined by high emotional labour expectations (Matteson & Miller, 2012, 2013; 2014; Shuler & Morgan, 2013). Helpfully, this literature acknowledges that there is indeed pressure within librarianship to perform employment encouraged emotions. This work also explores the personal tensions that arise for individuals who must perform emotions that they don’t themselves feel (Julien & Genuis, 2009; Matteson & Miller, 2012, 2013; 2014; Shuler & Morgan, 2013). An important element of this literature are the recommendations aimed at individuals and workplaces to mitigate some of the challenges of engaging in emotional labour such as employing “coping strategies such as taking breaks away from the desk (or at least mental vacations), admitting the hurt, deep breathing, careful listening, and talking to a trusted friend or colleague to help let go of the problem” (Matteson & Miller, 2013; Schuler & Morgan, 2013, p. 122).

As noted by Bright (2018), what much of this literature fails to acknowledge is the gendered and racialized context that shapes power relations within the library. For example, feminized labour conditions that lead to high rates of workplace sexual harassment makes it more than just unpleasant, but also dangerous and harmful, to perform emotional labour during specific interactions such as when PPSH is occurring. This literature thus fails to problematize what should not be part of the job and/or consider when emotional labour should not be a job expectation.

METHOD

This paper is part of a larger research project that applies an intersectional feminist anti-violence theoretical framework to identify and document, understand, and resist PPSH in libraries (Allard, Lieu, & Oliphant, 2020; Oliphant, Allard, Lieu, & Mallach, 2021). In 2021 we conducted a national survey in Canada, soliciting responses from library workers (including librarians, supervisors, library assistants, pages, etc.) working at all types of libraries. Participant were recruited through provincial professional library listservs. We asked participants about their experiences with workplace PPSH as well as the related policies, training, and reporting mechanisms in place at their jobs. We received 505 valid responses. Employing a trauma-informed approach, our survey did not ask participants explicitly about extreme sexual violence though such incidents were shared by participants. All
participants were also provided with telephone support resources at the end of the survey. This paper focuses explicitly on participants’ feelings and responses to their experiences of sexual harassment during or immediately after harassment has occurred and is guided by the following research questions:

1) How do library workers respond to sexual harassment?
2) In what ways do library workers perform emotional labour when they are being sexually harassed?

Data from the survey questions were analyzed thematically to identify and code library workers’ responses to and feelings about their experiences with PPSH. Each survey participant was asked to describe in detail up to three PPSH incidents of their choice. A number of follow up questions about each incident elaborate participants’ responses. We used inductive qualitative analysis to analyze 510 incidents of PPSH that our participants selected to share, specifically analyzing the following survey questions about each incident for this paper: (1) Please describe or expand on one of your experiences of patron-perpetrated sexual harassment while working at the library; (2) How did you respond during the incident?; and (3) How did this incident make you feel? We also drew from other long answer survey questions as appropriate to analyze our data.

Although we received a large number of responses to our survey that clearly indicate that PPSH proliferates and is a significant problem in libraries, we cannot generalize or universalize our findings. However, clear themes emerged from our data regarding how participants responded to PPSH. Our participants were overwhelmingly consistent in describing their negative feelings about PPSH incidents. What became obvious in our early inductive analysis was that the way that participants responded to patrons during their experiences of PPSH did not match the way that they actually felt about what they were experiencing. Furthermore, when reflecting on their experiences, participants often expressed a great deal of mixed emotions and regret about their own responses to perpetrators and how it made them feel about themselves, their jobs, and their workplaces. We thus examined our findings through the lens of emotional labour by identifying participant expressions of emotional labour across participant response themes of acceptance of PPSH, indirect refusal of PPSH, and direct refusal of PPSH. How participants felt about PPSH incidents were also coded for emotions, counted, and then grouped by theme.

FINDINGS
This paper focuses explicitly on participants’ emotions and responses to their harassers during incidents of PPSH. It is important to acknowledge the institutional context within which PPSH occurs and is responded to. For example, responses to PPSH often include interactions with co-workers, managers, and the institution itself, sometimes through harassment reporting mechanisms. Participants also often informally discussed the incident with managers and supervisors after the fact. This paper does not address any secondary or institutional responses to PPSH. Instead we focus solely on the emotional labour performed by library workers when PPSH occurs.

Participant responses to PPSH
Workplace sexual harassment, by its very definition is unwanted and causes offense and/or humiliation. Almost all experiences of workplace sexual harassment reported in this survey involved some exertion of emotional labour by survey participants. In this study, participants responded to PPSH with calm, politeness, and professionalism, despite regularly feeling uncomfortable, fearful, angry, or embarrassed. Even when participants ignored or said nothing in response to harassment, they felt and endured the slight. Below, we describe how participant responses to sexual harassment can be broadly divided into 3 categories: (1) acceptance, (2) indirect refusal, and (3) direct refusal. In the categories of indirect and direct refusal, participants intervened in or responded to being harassed using a variety of active and passive oppositional strategies. In the category of acceptance, participants accepted or ignored the harassment, often out of fear of reprisal from the harasser, their employer, or both. Each response type is briefly described followed by a discussion of the emotional labour embedded within it.

Acceptance of PPSH
We use the term acceptance of sexual harassing behaviours to describe when a library worker is sexually harassed and chooses not to respond at all to their harassment or harasser. This can include ignoring the incident entirely. In some cases, it also includes appearing to consent or “go along with” harassing behaviours, either directly or indirectly. Examples of “going along with” harassment in this study include giving a patron a phone number after being pressured to do so, accepting unwanted gifts, or laughing at sexist or racist jokes that participants didn’t think were appropriate. The following quotations represent examples of acceptance responses to PPSH shared by participants:

Men will call me hunny, dear sweetheart, etc. Sometimes they hope to get better service. I just ignore the comments. It's better to not engage with them.

While I was working in the stacks (alone and relatively far from other library staff), a male patron struck up a conversation with me about me and my life. He was very polite, but clearly too interested in personal details. Eventually he asked for my contact information, which I did actually say no to and he left. I was 19
practices that strive to citing library rules to encourage appropriate library conduct. These verbal strategies are rooted in emotional labour

In the examples provided above, participants gently and politely redirect patrons back to library matters while also

The emotional labour in these examples is the work of remaining silent in the face of personal offense and injury. It is important to note that sometimes acceptance occurred because the participant was comfortable with or perhaps indifferent to the interaction, even though it was considered generally unwanted behaviour. This typically occurred during “minor” PPSH examples such as being leered at or called a pet name such as honey or sweetheart. Acceptance was also sometimes motivated by participants’ uncertainty about how to respond “appropriately” at work and within the constraints of professional library practice. Indeed, in the absence of clear guidelines about how to respond to sexual harassment at work, many library workers identified struggling to know what to do. As seen in the examples above, this sometimes resulted in doing nothing. Fear for participants’ or other patrons’ safety also sometimes resulted in accepting sexual harassment. This finding aligns with feminist research that recognizes that emotional labour is often performed to pacify aggressive customers and prevent violence and sexual advances (Good & Cooper, 2016; Kensbock et al., 2015; Virkki, 2008). Finally, the negative emotional consequences of participant silence is made clear when a participant describes the uncertainty and tension that they still feel in their own handling of a PPSH incident: “I still wonder why I acted like it was okay for him to open these pictures and leer at me to see how I reacted.”

**Indirect refusal of PPSH**

We use the term indirect refusal of sexual harassing behaviours to describe when a library worker did not directly counter or confront the PPSH to which they were being subjected; instead they used indirect or passive means to respond to, redirect, or withdraw from the situation. When participants engage in passive and indirect refusal of sexual harassment, they are working to end the interaction without directly confronting the patron about their harassing behaviours. The strategies under this umbrella were the mostly commonly employed strategies by participants across all forms of sexual harassment. These strategies are far ranging, creative, sophisticated, and include the following actions: (1) refusing to respond to inappropriate patron questions or comments; (2) redirecting the conversation back to library matters; (3) restating library rules and policies; (4) refusing requests for dates by telling the patron they have a boyfriend (but not saying no to the request directly); (5) moving away from the patron and/or creating space between the library worker and patron and/or leaving the situation; (6) asking colleagues to step in during an interaction, and; (7) [over the longer term] changing specific workplace practices and routines such as changing route home, eating lunch in a different location, and dressing differently or changing one’s appearance at work. The following quotations represent examples of indirect responses to PPSH shared by participants:

Patron came to the library almost daily over a period of a few months and would stand by the desk and talk to me. He would wait for other patrons to leave and continue conversations. I would often have to go to the workroom to get away. Asked me to go on a date several times. Tried to be polite and professional. Asked him if he needed help finding materials.

Over the course of several weeks, a man kept making inappropriate comments to me starting with mild comments and gradually increasing to comments such as ‘You are smiling because of me!’ or ‘Now you’re flirting with me!’ when I was trying to assist him with his inquiry. It got to the point where I tried to avoid him whenever he was in the library. I either ignored his comments or responded with ‘I smile at all customers.’

A patron I was helping at Customer Service kept wanting to shake my hand over and over but would not let go of my hand and caressed it with their other hand. I felt conflicted—I wanted to be friendly since he was a newcomer to Canada but I also didn’t want to touch this person. It made me feel very uncomfortable. This patron also asked me out for coffee as a way to ‘thank me’ for my help. I declined politely but he was very persistent. I tried to redirect the subject to the topic with which he needed help and told him that staff aren’t permitted to accept gifts for doing their job.

In the examples provided above, participants gently and politely redirect patrons back to library matters while also citing library rules to encourage appropriate library conduct. These verbal strategies are rooted in emotional labour practices that strive to persuade the patron to change their behaviour. The verbal strategies noted in the examples are
one tactic, among multiple strategies such as ignoring or walking away from the patron, that are used to maintain the comfort of the patron while the library worker uses a host of techniques and strategies to change themselves and their environments to subtly protect themselves and end the harassment without directly challenging the patron. The main difference between this category and the former, acceptance of sexually harassing behaviours, is that when library workers accept harassment they do not counter or resist the harassment at all. Here, resistance occurs but it doesn’t challenge the patron directly nor does it significantly imply that anything inappropriate has occurred. In other words, the library service value system that “the customer is always right” is maintained. Participants often stated that they enacted indirect refusal strategies because they believed that they were following appropriate “polite and professional” customer service practices required of their job. Similar to the acceptance of sexually harassing behaviours, participants often used these indirect approaches out of fear of both patron and/or employer retaliation.

Of note, multiple participants expressed mixed feelings and/or regret about remaining silent or using indirect refusal techniques in their reflections about their experiences of PPSH. This regret is described here as an expression of emotive dissonance, a concept developed by Hoschild (1983) and connected to emotional labour. Defined by Bright as “the strain of maintaining incongruent expressions and feelings of emotion” (2018, p. 169), emotive dissonance is the inner conflict experienced by folks as they navigate and/or reconcile specific expectations of emotional labour and their own, sometimes competing, emotions and desires. In our findings, participants regularly second guessed their own decisions and/or expressed regret about how they handled or felt that they needed to handle a PPSH response. The following quotation is an example of regret, an expression of emotive dissonance, shared by a participant:

A customer repeatedly asked if I would come to his house to help him learn English. He said he was new to America, and didn't know how to talk well and thought talking to a "pretty girl" would help him. I declined the offer. He offered to pay me. I declined again. We went back and forth, him refusing to accept no as an answer, me continuing to politely decline. After I had ended the interaction and gone into the back, he asked a co-worker for my contact information. I told him no, stood my ground, but did not insist that he stop asking. I wish I had done that differently.

In this example, the participant expresses regret that they didn’t say no more directly to their harasser. Identifying examples of emotive dissonance reveals how participants negotiate the tension between what they think is professionally expected of them in responding to sexual harassment and what they would rather do/wish they had done in response to their experiences of PPSH. It thus reveals how participants’ make sense of and navigate the complex intersection of professional values, feminized labour, and emotional labour in library work.

**Direct refusal of PPSH**

We use the term direct refusal of sexual harassing behaviours to describe when a library worker directly counters or confronts a patron who is sexually harassing them, indicating to that patron that the sexually harassing behaviour is inappropriate and/or that it is to stop. In other words, the library worker says no. While there are multiple examples of direct refusal within our study findings, it is nonetheless the most uncommonly used response to PPSH. Indeed, participants were discerning in their use of this strategy, often using it only when incidents were deemed very serious such as when harassing incidents escalated and/or felt threatening. The following quotations represent examples of direct refusal responses to PPSH:

Patron told me to smile and that it was my ‘job to make him feel better.’ Told him it was inappropriate and that it was my job to help him with research.

A patron asked a reference question, but it was clear that he was trying to stand too close to me, and he kept asking if library employees were allowed to talk to people. I kept trying to move away from him, but he kept moving closer and then tried to give me his phone number, but I refused to take it. He got angry that I was being ‘standoffish’ and then came back the next day to berate me for taking his intentions the wrong way and that I was being too unfriendly. The first day, I was very firm about telling him that I could help him with library questions but I wasn't taking his phone number, and the second day when he came back to berate me, I cut him off halfway through his sentence, and told him that everything about him made me uncomfortable, I had no interest in any kind of a relationship with him, I was not answering personal questions from him, and I wasn't going to discuss this again. I felt EMPOWERED. I don't know that I've ever said anything that made me feel so in control. He immediately left after I gave him an unequivocal ‘no.’

A patron threatened to rape me behind the library. I was alone in the back parking lot of the library with said patron (who was illegally parked). I explained that this behavior was unacceptable, took his license plate and said I was calling the police.
Direct refusal does not privilege or maintain the comfort of the patron in the same way as do acceptance and indirect refusal. Instead, participants clearly articulate their wishes (and legal workplace rights!) not to be harassed in the workplace. However, it should be noted that these responses are still typically delivered in a polite and professional manner (which can itself be challenging to do if one is scared or angry) and is therefore still defined as an expression of emotional labour. Perhaps even more telling, older participants who had worked in libraries for longer, and those in a supervisory or librarian role were more likely to enact direct refusal strategies. Sometimes they described dealing with patrons directly, especially on behalf of staff they were supervising, as part of their job responsibilities. This suggests that a combination of experience, workplace authority, and job security empowered these participants to respond directly to PPSH. Indeed, participants were more likely to respond to PPSH with direct refusal when they felt supported by their workplace.

**Participants’ actual emotions about their experiences of PPSH**

Although participants responded to sexual harassment with a variety of (almost always) polite and professional strategies that often centred the comfort of the patron, survey participants *almost universally* expressed negative emotions about their PPSH encounters. Keywords shared by participants in response to the survey question, “How did this incident make you feel?” are presented below to underline the fact that PPSH almost always created a context where emotional labour was necessary to bridge the divide between participants’ actual emotions and their beliefs about how they *should* respond based on their interpretation of their workplaces’ beliefs and practices.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Emotions or feelings</th>
<th>Times mentioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not in control</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>gross</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>nervous</td>
<td>16</td>
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<tr>
<td></td>
<td>objectified</td>
<td>17</td>
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<tr>
<td></td>
<td>unsafe</td>
<td>39</td>
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<tr>
<td></td>
<td>upset</td>
<td>19</td>
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<tr>
<td></td>
<td>violated</td>
<td>20</td>
</tr>
<tr>
<td>Fear and submission</td>
<td>creepy or creeped out</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>scared</td>
<td>44</td>
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<tr>
<td>Suffering</td>
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<td>Self-recrimination</td>
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<tr>
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<td>embarrassed</td>
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<tr>
<td>Anger/Irritation</td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>irritated</td>
<td>11</td>
</tr>
<tr>
<td>Total Number of Mentions of Negative Emotions</td>
<td>836</td>
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</tr>
</tbody>
</table>

Table 1. Survey participants’ commonly identified negative emotions following experiences of PPSH

The table above reflects the most cited keywords participants used to describe their emotions following experiences of PPSH. The categories are not mutually exclusive. For example, feeling unsafe can be related to fear, anger, or suffering. We ascribed the emotions or feelings to one category only in order to avoid duplicate counts of the feeling or emotion. Keywords expressing negative emotions were divided up into five broad themes: “Not in control”, fear and submission, suffering, self-recrimination, and anger/irritation. Keywords that were neutral or positive were also identified but not sub-divided. Overwhelmingly, negative emotions were identified 836 unique times while neutral or positive emotions were only identified 10 times. Of note, the term uncomfortable was used 139 times, angry was used 62 times, and unsafe or scared together totalled 83 citations. The “Not in control” theme was identified when
the library worker was not in control of the situation and where they felt the patron or institution held control over them. Expressed emotions included feeling cornered, dirty, horrified, hunted, trapped, and degraded. Emotions identified in the fear and submission theme included feeling afraid, fearful, shaken, terrified, uneasy, worried and many others. The theme of Suffering included emotions such as awful, disrespected, hurt, icky, isolated, sick, stressed, and worthless. Self-recrimination included emotions such as feeling humiliated, insecure, stupid, foolish, incompetent, young, and unimportant. Terms identified as part of the anger/irritation theme included incredulous, mad, outraged, shocked, surprised, wary, resentful, startled, repulsed, and on guard. These emotions were often directed towards the perpetrator but also sometimes the self, as well as co-workers or employers who didn’t adequately support the participant at the time of harassment or afterwards. Only 10 neutral or positive emotions were identified including feeling flattered, unsurprised, empowered, and fine.

Further analysis of emotion themes and keywords is warranted to more fully understand the impacts of PPSH on library workers but is beyond the scope of this paper. Here we acknowledge the wide range of complex emotions expressed by participants and directed at the perpetrator, employer, and often, the self. Indeed, as our data clearly indicates, library workers almost always responded to harassment in ways that were in stark contradiction to their own negative feelings about the PPSH experience (i.e. acceptance of PPSH and indirect refusal). It is telling that participants described their emotions as uncomfortable 139 times, yet the most frequently used response to PPSH, indirect refusal, centres the comfort of the sexually harassing patron as a central tenet of this response type. Perhaps most importantly, this table clearly demonstrates how bad it feels to be sexually harassed at work.

DISCUSSION AND CONCLUSION

An important finding of this research is that participants demonstrated a broad range of strategies and interventions to address PPSH that often relied on expressions of emotional labour. Library workers almost always responded to harassment in ways that upheld workplace and professional values of politeness and professionalism and were in stark contradiction to their own feelings about the PPSH experience. Emotional labour was present in all three types of participant responses to PPSH—acceptance, indirect refusal, and direct refusal. The most frequent and most typical responses to PPSH were acceptance and indirect refusal, strategies that have high levels of emotional labour embedded within them. These approaches maintain the comfort and authority of the patron even as he engages in behaviours that are, at best, not appropriate, and at worst, harmful acts of sexual violence. It should also be noted that even when library workers directly refuse PPSH, they remain polite and professional.

Because PPSH happens so frequently and can vary in its severity, participants had a complex and shifting relationship to the incidents they experienced. This complexity manifested in their responses to patrons, their emotions about incidents, and their own self-reflective reactions to PPSH after it occurred. Of note, participants often had to decide for themselves what were the workplace emotional labour ‘rules’ around sexual harassment; while PPSH often occurs at the library as an everyday part of patron interactions, there is little training and policy about it in library workplaces, it regularly goes under reported, and it has not received substantive attention in the LIS literature. Unlike other research contexts where emotional labour has been studied within library workplaces, participants were not often told by their employers’ directly to express specific forms of emotional labour in the face of workplace sexual harassment. Instead, participants’ post-incident reflections made visible how workplace expectations about being polite and professional influenced how they thought they should respond to PPSH, while they also managed their own individual fears, beliefs about sexual harassment, assessment of the situation, and personal preferences. Concepts such as emotional labour and emotive dissonance provide a vocabulary to “see” the complexity of these shifting responses. Indeed, drawing on the lens of emotional labour offers an alternative way to see “customer-library worker” interactions through the lens of the library worker rather than the patron.

Strategies that require emotional labour, especially indirect refusal strategies, are often encouraged and taught to library workers as customer service tools when they participate in library training programs targeted at providing “customer service” skill development and management. For example, redirection and de-escalation techniques are often taught as strategies to deal with difficult patrons. While certainly not denying the importance of these tools and their place in learning how to work well with library patrons, it’s also important to note that these strategies support the library ethos of the “customer is always right”, implying that library patrons need to be handled carefully and persuaded to do the right thing. The intention of redirection training, for example, is to maintain library safety for staff and all patrons, while using soft skills such as friendly persuasion to influence patrons to follow library rules. We need to consider however, the consequences for library workers of this orientation to “persuasion” and the ways that it may disempower them to stand up to instances of sexual harassment and abuse when being perpetuated against them.

Finally, it’s important to locate this research within the broader scope of research about emotional labour. Our findings resonate strongly with research that highlights the complex relationship between emotional labour and sexual harassment in service contexts, where emotional labour both encourages and is used as a defense against
sexual harassment (Good & Cooper, 2016; Kensbock et. al. 2015). Similarly, we found that patrons often misconstrued politeness as sexual interest. And conversely, library workers often tolerated or ignored sexual harassment out of fear for their safety. Our findings also support some of the LIS literature about emotional labour, particularly research that connects emotional labour practices to the feminization of librarianship, drawing on the concept of emotional labour to reveal how gendered practices of service provision and care work manifest in library work (Bright, 2018; Emmelhainz, Seale, & Pappas, 2017). However, we also wish to respond to some of the emotional labour research in LIS by noting that while there may well be opportunities to encourage positive emotional labour outcomes for library workers in some contexts (Schuler & Morgan, 2013), there should be no way forward that embraces any form of emotional labour as a strategy to address PPSH. PPSH is a form of gender-based violence that library patrons must understand is not acceptable. Effectives strategies designed to counter it must acknowledge the significant harm it creates for library workers when they endure it and when they respond to it in ways that do not centre their humanity, stories and experiences, personal feelings and emotions, and especially workplace rights. There is no silver lining associated with using emotional labour to manage harassing patrons. Our own program of research on the topic of PPSH continues to examine how library workplaces can more effectively respond to PPSH. Further research is urgently needed that considers instead how we can empower library workers and their workplaces “to find a way to say no.”

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Stronger Than Yesterday: Investigating Peoples’ Experiences of View Strengthening on Social Media

Beall, Sabrina  City, University of London, UK | Beall.Sabrina@gmail.com
Makri, Stephann  City, University of London, UK | Stephann@city.ac.uk
McKay, Dana  RMIT, Australia | Dana.McKay@rmit.edu.au

ABSTRACT
Polarization of views (known as ideological polarization) is one of the greatest societal challenges of our time, potentially sewing distrust and hate among individuals and communities and threatening to undermine the fabric of democracy. Divisive issues such as abortion and gun control are ever-present and can drive issue polarization, and even affective polarization—a disdain for ‘the other side,’ which can further divide society. Social media has been flagged as a breeding ground for polarized views, with private groups and personalized algorithms facilitating self-creation of echo chambers that may lead to polarization. While there is prior research on the technological influences on view strengthening, scant Human-centered research exists and most of it has focused on view change in general, rather than view strengthening specifically. To investigate peoples’ experiences of view strengthening on social media, we interviewed 10 people who recently strengthened their views on important topics. While some took steps to avoid creating echo chambers (e.g., by seeking out opposing views), others intentionally created them to allow their views to strengthen without interference. These findings have important implications for designing social media platforms that support careful and conscious view strengthening while mitigating against the risk of information manipulation.

KEYWORDS
Human-Information Interaction, echo chambers, personalization, view strengthening, polarization

INTRODUCTION
Polarization is a complex phenomenon and can be political (divergence of political attitudes away from the center), ideological (what we think about an issue) or affective (how we feel about people on the other side of the debate) (Kubin and von Sikorski, 2021). Recent years have seen a sharp increase in polarization of all forms (Iyengar, et al., 2019), a change often been blamed on the internet or social media. While there is strong evidence that broadcast TV reduced polarization (Campante and Hojman, 2013) and that mobile internet has increased it (Melnikov, 2021), studies on social media have been mixed (Ferguson, 2021, Lee, et al., 2022). Polarization, particularly affective polarization, has deleterious effects on society: dehumanizing ‘the other side’ does not allow for the productive discussions necessary for a healthy democracy (Helberger, 2011) and can result in political divisions that outweigh considerations of honesty or decency. Understanding polarization is thus a highly socially important goal. While much work has pointed to the role of technology in polarization, we lack an understanding of the human perspective of how people move toward stronger, and thus potentially more polarized views.

While there is significant work understanding the causes and impacts of polarization, little work has focused on the role of human information interaction (HII) in this process. Research examining the role of HII in view change has noted that view strengthening is one possible outcome (Buchanan, et al., 2022, McKay, et al., 2022), but has not focused on view strengthening (and thus possible polarization) specifically. Understanding the human experience of digital information in view strengthening is key to understanding how we might design information and interfaces to reduce or mitigate polarization, and it is this issue this paper examines. We report on semi-structured interviews with 10 participants who had recently experienced a strengthening of their views on an issue of importance to them, to examine the under-explored question ‘what is the nature of HII-facilitated view change?’ Participants described a variety of factors as contributing to their view strengthening, including emotionally captivating images or video, deliberate avoidance of disagreeable information, and algorithmic support for highly personalized feeds.

The rest of this paper is structured as follows: first, we examine the literature on polarization, focusing on the role of social media to frame our research question. Next, we describe our data collection and analysis method, including ethical considerations. We then present our findings, before discussing them in the context of prior work and using them to propose design recommendations. Finally, we present conclusions and suggest avenues for future research.

BACKGROUND
Concerns about increased polarization characterize our era. Brexit (Hobolt, et al., 2021); the Trump presidency (Iyengar, et al., 2019) and, more recently, the COVID pandemic (Stoetzer, et al., 2023) have seen deepening differences in ideological position. These divisions in turn that make it hard to have the productive conversations and find the necessary consensus to live in a functioning society (Helberger, 2011). More worrisome than the ideological split, though, is an increase in affective polarization, where it is not just the views held by ‘the other
side’ that are held in disdain, but the people who hold them. This reflects the nature of polarization, where people ‘deny the existence of degrees’ by (over)simplifying an issue to ‘true’ or ‘false’ (Badia, 2019, p.309). In the case of affective polarization, people consider those who do not share their black-and-white views as objectionable. This can create a sense of group identity that influences their willingness to accept information (Haider & Sundin, 2022) and can push individuals to more extreme views in the direction of their prior-held views, known as ‘group polarization’ (Sunstein, 2019).

The internet in general and social media specifically have been blamed for a rise in affective polarization (Ferguson, 2021, Iyengar, et al., 2019, Kubin and von Sikorski, 2021, Lee, et al., 2022, Munn, 2020, Rathje, et al., 2021). There is some evidence to support this: while broadcast television increased consensus and reduced polarization (Campante and Hojman, 2013), the introduction of mobile internet, allowing people to readily access a huge array of information (and misinformation) from their pocket, appears to have increased it (Melnikov, 2021). While it is easy to blame social media, with its highly personalized feeds, results of studies of social media use are mixed: some show an increase in polarization (Lee, et al., 2022), others show no change (Ferguson, 2021). No study has shown a decrease though.

So why might the internet in general and social media specifically promote polarization? One leading theory is the notion of ‘selective exposure’ (Kelly, 2009, Valentino, et al., 2009). The internet allows people to find others with interests similar to their own and engage more strongly with information they agree with (Bruns, 2019), even if that information is highly biased (Bakir and McStay, 2018). One common way of discussing this phenomenon is through the notion of an echo chamber (Sunstein, 2018): people prefer to surround themselves with people and ideas they agree with and algorithms support this approach, either because they are designed to (Pariser, 2011), or because people ‘curate’ or train them to provide the kind of information they prefer to see and keep other information out (Lee, et al., 2022).

This theory is appealing and easy to support, with studies showing little engagement with news from a different political polarity (Bakshy, et al., 2015, Flaxman, et al., 2016, Weeks, et al., 2016) and people avoiding conversations on social media with those with whom they disagree (Sargeant and Tagg, 2019). Conversely, though, it has been argued and demonstrated that people are unable to entirely insulate themselves from disagreeable views (Bruns, 2019, McKay, et al., 2022), and that in fact, regular exposure to views from the other side actually increases polarization (Bail, et al., 2018). Furthermore, views from the other side are more likely to be shared on social media and generate stronger emotional reactions than the views people agree with (Rathje, et al., 2021). One attempt to explain increased polarization in this context is the notion of the ‘backfire effect’, where exposure to views other than one’s own serves specifically to entrench views (Nyhan and Reifler, 2010). Another hypothesis is the notion of ‘sorting’: that while traditionally we have shared some views and disagreed on others with most people, digital media is influencing us to have fewer cross-cutting opinions, creating ideological in-groups and out groups. The mechanism by which this is thought to occur is that, in being exposed to several views other than our own online, we become irritated, and influenced to shift our weakly-held views to align more closely with people with whom we share strongly held views (Tömpberg, 2022). This theory fits with recent studies of debunking misinformation, which have shown debunking is most effective when it comes from those like us (Lewandowsky, et al., 2012). At this stage, though, sorting theory is conceptual; it has not been empirically validated.

Understanding how polarization (particularly affective polarization) occurs is a key challenge of our time, as we try to decrease social division and preserve democratic values. It is perhaps surprising, then, that little work has examined the human experience of becoming polarized. Which do people experience as more important in influencing their own? Shared views or opposing views? What kind of information plays a role in this process? Is social media an important factor? In this paper, we begin to address these questions from the perspective of understanding the role of social media on view strengthening, recognizing that, at an individual level, polarization is a specific form of view change: strengthening one’s views.

While there is an extensive literature on view change in psychology (Petty, et al., 2003, Wood, 2000), it has not examined strengthening views specifically, nor has it focused on the information that contributes to view change. A recent study on the human experience of information in view change observed some instances of view strengthening, where people thought their views had become stronger over time, but also did not investigate view strengthening specifically. That study demonstrated that view change is often seeded by a passive information encounter on social media, and that many of these encounters are with emotionally impactful images or video (Mckay, et al., 2020). After this initial encounter, follow-up information seeking supports the view change. We cannot say, though, whether these patterns are true of view strengthening. This paper begins to address this gap.

**METHOD**

To understand peoples’ experiences of view strengthening on social media, we conducted semi-structured interviews with 10 social media users, lasting 45-60 minutes. We now explain and justify our participant recruitment, interview and data analysis approach and associated limitations and ethical considerations.

Ten participants were recruited through the primary researcher’s networks, social media and snowball sampling; we looked specifically for people who had experienced view strengthening as a result of information interaction on social media. This sample size is not unusual for studies of human information interaction, especially where the experience under investigation may be hard to pinpoint, see for example (Makri, et al., 2014, Marshall and Bly, 2005). Of our participants, six identified as women, three as men, and one as non-binary. All participants lived in...
Europe, the UK or the US; all were 18-35. Prior to participating in the study, participants completed a screening
survey where they briefly overviewed the view that had been strengthened. This was to avoid discussing views that
either the participants or the researcher would find upsetting to discuss. No participants were excluded from the
study on this basis.

We conducted semi-structured interviews by Zoom with all participants. Online interviews allowed for
geofraphically diverse participation and allowed participants to screenshare information that supported their view
strengthening. In the interviews, we asked participants about information-related aspects of their view strengthening,
including: what information they found on social media that had strengthened their views, what they did, thought,
and felt when they found the it, how the information strengthened their views, and the effect this view strengthening
had on their subsequent beliefs or behaviours. While these topics were covered with all interviewees, the interview
style was discursive and curiosity-driven, to elicit as much detail as possible from participants about their
experiences. To avoid shaming participants for their views, we took an empathy-first approach to interviewing,
much like that described in (McKay et al. 2020), which focuses on view change generally rather than view
strengthening specifically.

Interviews were transcribed automatically into Dovetail, which was used to support an inductive, reflexive thematic
analysis (Clarke and Braun, 2021). Transcripts were supplemented by screenshots from the screen recordings; when
an interviewee referred to a specific social media post/image/video, we pasted a screenshot of it in the relevant
transcript section. This facilitated easier and more in-depth analysis and reporting. Initial codes were formed, then
iteratively refined and grouped into themes. For example, this segment from P1’s transcript was initially coded as
‘importance of other people’ and ‘importance of empathizing with others’ for strengthening views: “You see that
this TikTok resonated with other real people...that further supports that there are real people affected by
this...because this had one million likes at one point...” These codes were then organized into the overarching theme
of ‘Empathy is the main driver for view strengthening.’ Data collection and analysis was iterative; we analyzed each
interview before conducting the next to alert us to interesting emerging findings.

The study was approved by our university ethics committee. Given the sensitive nature of many of the views,
participants were reminded they could pause or stop the interview at any time; the interviewer retained the same
right. Participant debriefs were conducted immediately after each interview to ensure participants were not
discomfited by the experience. No participant expressed negative emotions during the debrief, and many explicitly
described having the opportunity to reflect on their experiences as positive. While our findings may be
misappropriated to manipulate people into strengthening their views these risks are already at play on social media
(e.g., the Facebook emotions study (Kramer, et al., 2014)), this research does not pose additional risks, and may
offer opportunities to mitigate them.

Our study has two main limitations. The first is lack of participant diversity: nearly all were the researchers’ social
contacts, and all were college educated and aged 20-35. While our findings may not be generalizable beyond this
group, previous research has demonstrated that education level and age do not increase the likelihood of being in an
echo chamber (Dubois & Blank, 2018). The second limitation is recall bias. This study relied heavily on participant
recall, which may be unreliable. To mitigate against this, we focused on specific, concrete examples, and told
participants it was fine if they couldn’t remember specific aspects of view strengthening.

FINDINGS
In this section we present our findings. We first explain how it takes only a single information encounter to incite
view strengthening, then address the role of algorithms in those encounters. Next, we examine the role of emotional
content, and discuss information verification practices in view strengthening, before moving on to the role of
previously known information. Finally, we discuss avoiding and engaging with opposing views, before
summarizing.

It Only Takes One Encounter: Passively Encountered Information Catalyzes View Strengthening
While previous studies of the role of HII in view change found a one-off information encounter is not enough to
change views outright (McKay et al., 2020), we found a single passive information encounter (Erdelez & Makri,
2020) was responsible for view strengthening in nearly every case. This is, perhaps, because view strengthening is
even more incremental than outright change. These information encounters were often on social media feeds, and
highlighting the importance of passive encounters on social media for strengthening views. As an example, P3
strengthened his view on the severity of climate change by passively encountering, on social media and elsewhere,
information about ‘Fridays for Future’ - a school-aged student strike where youth skipped Friday classes to advocate
for climate change action. Being exposed to this information from several channels contributed to P3’s greater
climate awareness and the strengthening of his view on the issue. P3 stated “it was everywhere. It was in the news, it
was in newspapers, social media, in conversations. That was definitely a driver to get deeper into the topic.” P3
explained “the strengthening probably wouldn't have taken place without the topic being discussed and without
having the awareness."

For P9, an infographic (Figure 1) encountered on TikTok sparked her awareness of food regulation differences by
country, leading her to be more conscious about the food she eats in the US. She stated “I actually never questioned
it before I saw the TikTok or the side-by-side comparisons. ” Had it not been for this single serendipitous information encounter, P9 may not have felt the shock that led her to educate herself more about food ingredients.

![Image of food ingredients comparison](image)

Figure 1: Infographic in a TikTok video illustrating a side-by-side comparison of ingredients comparable ‘Quaker’ oatmeal cereal in the US (left) and UK (right)

It is notable that almost all view strengthening was facilitated by information that was passively acquired, as passive acquisition requires relatively little effort as compared with active seeking. This can be considered both a blessing, as it allowed participants’ view strengthening journeys to progress naturally in response to incidental information exposure, and a curse, as once started, these journeys often continued despite the lack of intent to progress them.

**Who’s in Control? User vs. Algorithmic Agency in View Strengthening**

While most participants perceived they had full control over their view strengthening, the strong role personalized algorithms played in curating and promoting content in their social media feeds highlighted a blurred boundary between user and algorithmic agency in view strengthening. For example, after P9 encountered the TikTok video comparing food ingredients in the US and UK (Figure 1), she actively searched for information on what ingredients were used in the US but banned elsewhere, and how to avoid them. She found an abundance of information that compared food ingredients in similar products across different countries, leading her to believe that people were becoming more aware of this issue. However, she still questioned the algorithm’s role: “the algorithm has definitely picked it up on Instagram and TikTok...this infographic wasn’t the only one I’ve seen. I would say people are taking a stronger stance on it. But I could just be influenced by the fact my algorithm has picked it up.”

In contrast to P9’s experience was P5, who was attempting to transition from vegetarianism to veganism. He explicitly sought out and followed certain types of content to ‘create a bubble’ of information by following organizations such as Greenpeace, who posted information he related to veganism, such as climate change news. He argued that this could be a positive way of allowing his views on vegetarianism to strengthen: “I realized that, if you want to be vegetarian or vegan, you kind of have to create your own bubble and find your own websites, social media platforms, friends, and realms...which makes it, on one hand, easier for you to stay vegetarian or vegan and on the other hand it gets you more information. You then realize this is a good thing to do, because if you don’t, you are always confronted with the opinions of others that contradict yours.” (P5).

This highlights a blurred line between whether peoples’ views are strengthened autonomously, or due to algorithmic curation of their social feeds – where content is personalized partly based on previous information consumed. This blurred line may make it difficult for people to detect when their views are being unduly influenced by personalized content. Furthermore, it highlights the risk of passively encountered information reinforcing a particular viewpoint and potentially influencing peoples’ views as a result, such as by strengthening them.

**I Feel for you: Empathy is a Key Driver for View Strengthening**

Empathy with the personal experiences of others was a key driver for HII-facilitated view strengthening. These experiences were often reflected in comments made or videos posted on social media by people who want to share their them. While no participants discussed examples where their view strengthening process had been manipulated by misinformation evoking empathy, the persuasive power of empathy-evoking information was considerable, and this had a strong impact on view strengthening. Understanding the personal experiences of others was crucial for many view strengthening journeys. For example, P2 expressed how others’ personal stories made her feel stronger in her pro-choice view, to the point she would advocate for and discuss it (despite originally being neutral and avoiding discussion on the topic). She stated that articles featuring the personal abortion stories of women “would strengthen my view...for me, the personal stuff is really what makes me more active.” Similarly, P4 stressed that
“hearing from all the sex-trafficking survivors...that really strengthened my viewpoint...it's just so impactful.” As most informational catalysts for view strengthening were passively encountered (e.g., on personalized social media feeds) this highlights a compound risk of manipulation through empathy-evoking content. Participants did, however, demonstrate awareness of some risks of information manipulation on social media through empathy evocation, such as the risk of impersonation. For example, when viewing personal experience posts on social media, P8 said she would routinely view the profiles of those sharing personal experience posts to ensure they were really the person they claimed to be--and sometimes she found that they were not: “I would always check who the posts are from...I would try to make sure they are not from some random individual...I ran into a bit of a problem there.”

Even the perception that others empathized with a post could strengthen viewpoints. For example, P1 based her perception of others’ viewpoints on the amount of likes and comments on a particular TikTok video (Figure 2) which humanized women who have abortions. She stated “you see that this TikTok resonated with other real people...that further supports that there are real people affected by this...because this had one million likes at one point, one million people who supported it. I know that the numbers don’t always matter, but at the same time...in the comments you're going to see people who probably relate to it.” While, on one hand, this illustrates that engagement measures such as likes and comments can be useful in supporting view strengthening, on the other it highlights the risk of placing disproportionate weight on the views of a subset of the population, which may make a view appear to have greater support than it really does. This can potentially bias view strengthening.

Figure 2: TikTok video humanizing women who have abortions (left) and example comments on it (right)

Built on (Potentially) Shaky Ground: View Strengthening Based on Unverified Sources
None of the participants described examples of view strengthening that seemed to be based on demonstrably false, or misleading information. However, some did describe trusting information that displayed only surface-level credibility indicators (e.g., cited sources, trusted author, source or brand names) and, crucially, participants rarely verified this information (e.g., by looking up the cited sources, or the author/source/brand). This highlights a possible risk of people placing misplaced trust in information that looks credible on the surface, but is actually false or misleading, and strengthening their views based on this ‘bad information.’ For example, P6 considers herself pro-choice (supports the right to abortion). She passively encountered an infographic on Instagram shortly after the overturn of Roe v. Wade (a US Supreme Court case making the right to abortion law, which was overturned in June 2022). P6 felt comfortable trusting the infographic as it cited the source of its data. P6 stated “it has a source, NPR 2022, on the first slide. So, I know that it's factual. It basically debunks some commonly held misconceptions of abortions...but it also strengthened my view.” P6 demonstrated an awareness of the importance of not grounding her views in unreliable information, stating “I never want to be hypocritical or ignorant about my views. So, I did my best to search for pieces of information with sources.” However, notably, she did not actually visit the source to verify its credibility, or its contents, and the source itself was not clickable to facilitate this. Although NPR is generally considered trustworthy, content may creators to falsely cite a credible source to gain trust and people may therefore strengthen their views based on misinformation. On one hand, participants demonstrated an awareness of the importance of credibility on social media. On the other, they rarely verified information found on it, instead often taking trustworthiness at face value.

Shaped by What I’ve Seen Before: Interpreting Information in Light of Prior Information Consumed
In line with prior work, previous information participants had consumed shaped the way they interpreted future information (Badia, 2019, p.309) and this often encouraged them to continue strengthening their views in a direction they had already started to travel in (Sunstein, 2019). For example, P10 had already begun to question the common but incorrect view that PCOS (Polycystic Ovary Syndrome) only affects women’s reproductive systems, by actively seeking PCOS information. She later came across an infographic on PCOS (Figure 3), which claimed to compare the myths and facts about the condition. She stated she “liked it a lot because it did address what I thought I
knew...what I was told...that PCOS just affects your reproductive system.” This helped strengthen her pre-existing view that the symptoms of PCOS are not all ovary-specific. Notably, however, although P10 said she appreciated information that cited its sources, she discussed an example where she had trusted information that did not cite its sources but mirrored her existing knowledge and beliefs, without verifying it. This may reflect confirmation bias, as she may have allowed her previous knowledge to convince her that this information was factual. It also likely reflects selectively choosing what information should influence one’s viewpoint based on information previously consumed (see later discussion on selective exposure). On the one hand, selective choice in light of prior information allows for regular reflection on one’s views, which may prevent the risk of manipulation. On the other, it might lead to manipulation by reinforcing views grounded in false or misleading information. While we cannot assume P10 was manipulated through confirmation bias, this example highlights the risk of over-relying on existing beliefs when interpreting new information.

Interpreting new information in light of previous information did not always nudge views in an existing direction, according to a pre-established trajectory. Sometimes apparent contradictions or inconsistencies between the pre-existing view and new information spurred participants to question their beliefs and, on occasion, change their views and then embark on a new, gradual view strengthening journey. For example, P5 was very aware of, and felt guilty about, inconsistencies between his current view on veganism and a documentary he had watched—‘Seaspiracy,’ which spotlighted animal welfare issues in factory farms. He stated “the reasons for me being vegetarian always made me a bit ashamed because they’re the same reasons why you should be vegan. I’m trying to save animals and I’m trying to save the climate...I am still eating, for example, cheese or eggs...Most of these things still contribute to factory farming.” This resulted in him attempting to transition from a vegetarian to a vegan lifestyle (based on a strengthening of his views on the importance of minimizing consumption of factory-farmed products).

P2 also expressed discomfort with the way she finds news: “I’m never really happy how I gather information. ‘Cause my main source is Instagram and I just think it’s so bad, so I try to make it better.” Despite her discomfort, P2 continued to utilize Instagram, particularly linked articles posted on Instagram stories, including from news sources, as her main way of consuming abortion-related news. To alleviate this discomfort, she deliberately diversified the news media accounts she followed on Instagram, to expose herself to a wider range of sources and opinions.

P5 stated he deliberately watched difficult media to shape his views in response to it, thereby confronting his cognitive dissonance. Non-deliberate information consumption (e.g., passive, incidental encounters) also built on prior information engagement. For example, when P5 happened to watch a cooking show that (presumably accidentally) ran a “cute” lamb video during an ad break and a demo of how to cook a lamb steak shortly after it, he felt shocked and disgusted at the juxtaposition. However, he recognized that he likely would not have had the same reaction years ago, when he was not yet vegetarian. This demonstrates that P5’s views, and associated view strengthening, were shaped by his prior information consumption. On one hand, this has the potential to guide people along a journey of gradual opinion discovery, perhaps strengthening their views along the way. On the other, if the prior information they build on is incorrect or unreliable, they may end up led the garden path rather than guided.

Choosing not to Hear: Selective information Avoidance Influencing View Strengthening

Some participants practiced topic-based selective information avoidance, where they avoided engaging with information about issues that had become emotionally distressing for them, such as animal welfare, abortion or gun control. Certain participants, such as P2, selectively avoided information to inhibit view strengthening: they did not wish to become further polarized. P2 selectively avoided all abortion-related information due to her overwhelm from the abundance of abortion-related information she encountered, particularly in her social media feeds. She was
conscious that, given the emotive impact this issue had on her, any information about Roe v. Wade, regardless of stance, was going to anger her and strengthen her view: “It was just basically everything I heard about it. It didn’t matter what medium, it didn’t matter what opinion, which side of the story. I just got really angry, and it strengthened my opinion.” P2 therefore temporarily selectively avoided all abortion-related information to try to prevent the emotional impact this issue was having on her from strengthening her pre-existing view further.

In contrast, some participants wanted to continue strengthening their view, and made a deliberate decision to selectively avoid opposing views to do so. In stark contrast to P2, P1 avoided information that opposed abortion, expressing her fatigue with hearing views from the ‘other side.’ She therefore only intentionally consumed pro-choice information that she agreed with. This allowed her to continue strengthening her view without having to consider opposing viewpoints, besides when (unavoidably) exposed to information incidentally. P5’s attempt to curate his feed was also an attempt to avoid information he did not wish to engage with; he stated: ‘you then realize [curation] is a good thing to do, because if you don’t, you are always confronted with the opinions of others that contradict yours.

None of the participants who practiced selective avoidance was entirely successful in completely shutting out opposing view; all reported, for example, passive, incidental exposure to the opposing view through social media feeds. This supports the argument that it is impossible to entirely insulate oneself from information on a particular topic (Bruns, 2019, Fletcher and Nielsen, 2017) and therefore highlights that echo chambers are more permeable than they are traditionally considered to be.

**Other Views Welcome? Opposing Views Strengthened Pre-Existing Views**

While some participants selectively avoided opposing views, others sought them out. This was often because participants were aware of the concept of an echo chamber and did not wish to become trapped in one. Take P7, for example: “you surround yourself with groups you agree with and in doing that, you create an echo chamber for yourself. So, you're not getting conflicting views anymore. I can even see that with myself...you're only getting people that agree with you and then you start to resent the people that disagree with you. I'm aware that this is a thing, so I try not to let it happen to me too much.”

While we did not observe the ‘backfire effect’ described in (Nyhan and Reifler, 2010), engagement with opposing views did not necessarily result in questioning or reflection, even where participants claimed this was their motivation for seeking these opposing views out. We did, however, see some instances where engaging with opposing views increased disdain for ‘the other side’ - a symptom of affective polarization. For example, P1 posted on Reddit to gain clarity on certain pro-life arguments on abortion, even though she was pro-choice. She did this not to reconsider her pro-choice view, but to understand the opposing logic and how to counter it. This strengthened her pre-existing view: “I posted because I couldn't really wrap my head around some of the arguments that I wanted to discuss...It was valuable too, because some doctors would respond... and I was like, ‘you know, the DNA argument, do we consider something that has DNA as existing?’ They responded ‘well, if I had a big vat of DNA in a soup, would you consider it murder to kill that?’” This can be considered an example of finding out enough about the opposing view to convince themselves their pre-existing view was correct. It does not demonstrate a ‘backfire effect,’ but a confirmation effect - it strengthened P1’s view by confirming rather than challenging it.

P7 expressed that opposing information, if rooted in fact, could encourage him to change his viewpoint. He stated “when I find new information on something that I believe and the new information disproves it, I tend to gravitate towards the newer information, because that's just how science works, right? Your viewpoint changes based on new information.” While he stated he trusted science and would alter his views in light of new facts, when he encountered opposing views, his view strengthening accelerated. When asked about the important factors in his view strengthening, he mentioned apathy amongst those who were against gun control in the US had played a key role.

For P2, reading the opinions of those against her own viewpoint directly led to strengthening her own view. “I'd read one article about people who are ‘Pro-Life’ and even that will strengthen me. I just see the bullshit they're talking about. It's basically just like, I cannot take you seriously.

Some participants tried to avoid entering echo chambers by staying aware of when they were about to enter one. This was to ‘keep in’ alternative views and avoid a scarcity of viewpoint diversity influencing the strengthening of their views (by leaving them unchallenged). For example, P7 was aware that self-creating an echo chamber would shut out opposing views and could result in affective polarization, so tried to avoid it by actively seeking out opposing viewpoints. He stated “you surround yourself with groups you agree with and in doing that, you create an echo chamber for yourself. So, you're not getting conflicting views anymore. I can even see that with myself...you're only getting people that agree with you and then you start to resent the people that disagree with you. I'm aware that this is a thing, so I try not to let it happen to me too much.”
Summary of Findings
Information from social media played a fundamental role in view strengthening. Usually, it was passively encountered rather than actively sought and often only a single piece of information was needed to drive view strengthening. Of particular concern is that, while some discussed curating algorithms, they may have less agency in influencing their personalized feeds than they think. Most informational catalysts were videos and this media type often grabbed peoples' emotions; empathy was the main driver for view strengthening. While several participants claimed to value source credibility, especially on social media, few invested efforts to verify content and platforms did not make sources easily scrutable. Peoples' views were shaped by information they had seen before, often encouraging them to continue on a pre-established view strengthening trajectory. Sometimes, however, contradictions or inconsistencies with prior information prompted them to question their existing views. Whether participants intentionally sought out opposing views or selectively avoided them, view strengthening still occurred as a result. Furthermore, they did not always selectively avoid opposing information to allow their views to strengthen; sometimes they did so to pause strengthening (e.g., when faced with too much emotionally distressing information). We now discuss the implications of these findings and propose design suggestions aimed at reducing the effect of polarization through social media.

DISCUSSION
In this section, we discuss our findings in the context of previous work. We first provide an overview of the polarity of information that strengthened views relative to participants own views. Next, we discuss the key role of information encountering, and the importance of algorithms, before broadening to discuss the role of social media in polarization. Finally, we examine the role of algorithms and the agency people may (or may not) have to influence what information they are exposed to. Based on this discussion, we then make design recommendations for social media platforms.

Selective Exposure, or Opposing Views? It's Complicated
Our findings paint a complex picture of the role of information on social media in view strengthening. We noted some behaviors that align with notions of selective exposure: our participants stated they wished to avoid information they disagreed with, and some of them even used the language of echo chambers and filter bubbles; for example, P5 described deliberately ‘creating a bubble’ and P7 wanted to avoid ‘creating an echo chamber’. This selective exposure was used by some participants to strengthen their views, as in the case of P5 and P2, but not by all; P1 wanted to avoid strengthening her views and practiced deliberate selective exposure to achieve this aim. Moreover, while participants described sometimes wanting to entirely avoid information reflecting opposing views, none of them were completely successful in this attempt, supporting previous work (Dubois and Blank, 2018).

Alongside those who inadvertently engaged with opposing views, and in contrast to selective exposure theory, we also found some participants consciously chose to engage with opposing views. They did this to avoid falling into an echo chamber, in pursuit of factuality, and to deliberately keep an open mind. While these are laudable aims, our study found consuming information reflecting opposing views clearly strengthened pre-existing views. It might be tempting to dismiss this as the backfire effect, particularly when P2 describes the views of others as ‘bullshit’. However, most of our participants described carefully considered approaches that seem far removed from accidental backfire.

In contrast to those who wanted to open their minds, some people engaged with information they disagreed with to strengthen their own views, by formulating counterarguments. This replicates findings of previous studies (McKay, et al., 2022, Weeks, et al., 2016), and supports the presence of confirmation bias. Our finding that peoples’ views were strengthened when they encountered information that echoed information they had previously consumed also supports the presence of confirmation bias.

Overall, participants engaged with and deliberately avoided information that both reflected and opposed their pre-existing views, for various reasons. Some wanted to strengthen their views. Others wanted to involve their views intensifying, which they saw as negative. Regardless of participants’ intentions, though, both selective exposure and exposure to opposing views did result in view strengthening. This paints a complex picture of view strengthening that demonstrates a variety of information contexts in which it can occur and highlights the complexity of issue and affective polarization, and may support the partisan sorting hypothesis, though more work is needed (Törnberg, 2022).

Importance of Information Encountering
A consistent feature of view strengthening was the pivotal role of information encountering (Erdelez & Makri, 2020). Rather than deliberately and actively engaging only with information they agreed with (and potentially becoming more polarized as a result), all participants strengthened their views as a result of passively encountering information in their feeds. This aligns with a previous study’s findings on HII-facilitated view change, which demonstrated it is often seeded by a serendipitous encounter (McKay et al., 2020). In contrast to that previous study,
though, and of deep concern in an era of widespread polarization is our finding that a single information encounter was responsible for view strengthening in nearly every case. In the previous study, multiple encounters played a role. Another difference between the view strengthening in our study, and the view change in that previous study is the limited verification our participants undertook. This contrasts sharply with the extensive follow-up information-seeking conducted in that study and may be explained by view change being ‘higher stakes’ than the incremental strengthening of a pre-existing view and therefore being perceived to require more supporting information.

**Role of Emotion**

Another common pattern of HII-facilitated view strengthening was the considerable emotional impact information encountered had on participants; all the view strengthening examples in our study reflected strong empathy. This strong emotional impact aligns with previous studies of view change generally (Petty, et al., 2003, Wood, 2000), which often have an affective component, and with studies of HII-facilitated view change specifically, which is often a result of an encounter with images or video that have a strong emotional impact (McKay et al., 2020).

Prior work on polarization also highlights emotion as playing an important role (Iyengar, et al., 2019, Lee, et al., 2022), and studies of how best to debunk misinformation show that appealing to emotion alongside fact can be helpful. Interestingly, negative emotion is also one of the drivers of sharing content on social media (Rathje, et al., 2021) (particularly negative emotion toward those who do not share one’s views) and that videos juxtaposing one’s views with those from another video are a particularly common and effective form of partisan communication on short video social media platforms, such as TikTok (Serrano, et al., 2020). Recent studies of news have shown an increasing preference for emotional content over fact based content in news, too, increasing the use of social media as a news source (Vosoughi, et al., 2018). It is clear that emotion is important, but the nature of its impacts present an interesting challenge: we now know that serendipitous encounters with information that provokes a strong or empathetic emotional reaction might change someone’s view or strengthen it. Understanding how we might predict the influence of a particular piece of information on someone’s view remains a key challenge for future work.

**Role of Algorithms**

Knowing that strong emotional resonance drives engagement on social media leads to a discussion of the respective roles of people and algorithms. We know that engagement drives social media algorithms (e.g. (Munn, 2020; Boeker and Urman, 2022). Indeed, Facebook has been accused of making algorithmic design decisions that exploit emotions such as anger and fear to drive further engagement, creating hate as a byproduct (Munn, 2020). Our study replicates previous findings that exposure to opposing views facilitated view strengthening (Bail, et al., 2018, Lee, et al., 2022), confirming that social media may be a driver of polarization, albeit indirectly and not in the way previously thought. Another way social media algorithms may drive emotion is by presenting increasingly extreme content, as occur when going down YouTube recommendation ‘rabbit holes’ (Ledwich and Zaitsev, 2020). More polarized information is likely to increase the strength of emotional responses, whether positive or negative, increasing engagement and affecting polarization in complex ways.

So how did participants describe the relationship between themselves and their social media algorithms? Some described deliberately curating their feeds to strengthen their views on certain topics, such as P5 who ‘created a bubble’ to support his transition to veganism. In contrast, others described their algorithms making decisions for them, such as to present similar information to that they had already consumed. While generally our participants expressed a high level of agency, it is unclear from our findings how much agency they actually had to manage their feeds. A recent study of interactions between people and when curating personalized TikTok feeds demonstrated that people found the algorithm surprisingly effective in selecting information to show them (Lee, et al., 2022). An examination of TikTok usage, though, shows that while there is some attempt to curate algorithms (as seen in our study and other work on view change), most of the control of the feed is ceded to the algorithm (Kang and Lou, 2022). While our participants attempted to exercise control and, for the most part thought they were in control, it is likely that, at least some of the time, they were overestimating their own autonomy.

**Does Social Media Polarize?**

Our participants described passive encounters with information that has a strong emotional impact as being a primary driver of view strengthening. While at first glance, this could happen with information in any situation, we see from the studies described above, that social media platforms specifically may be making view strengthening more likely. People are more likely to share social media posts showcasing the opposing views that sometimes drive polarization (Rathje, et al., 2021), meaning the feed of any given user is more likely to contain information of this kind than other kinds of information. The same study found that agreeable information was a high driver of likes; another signal of engagement. Engagement, in turn, drives the algorithms that construct feeds, potentially creating a vicious cycle. Passive consumption of information in feeds is key form of interaction with social media platforms (Kang and Lou, 2022, Lee, et al., 2022, McKay, et al., 2022), so how feeds are constructed is important.
Our participants demonstrated a desire to have input into the content of their feeds, both in terms of topic, and polarity of that content - a finding also echoed in other studies (Kang and Lou, 2022, Lee, et al., 2022, McKay, et al., 2022, Seargeant and Tagg, 2019). What we did not see, however, was an attempt to curate feeds based on the emotional strength of the content. It is thus up to social media designers to make this decision, and it seems likely that strongly emotional content is preferred, as it drives engagement.

Taking emotions and algorithms together, it seems possible that social media could drive polarization and we can see that, for our participants at least, interactions with social media did strengthen their views. However, these same features (the nature of the feed and highly emotional content) also drive view change (Mckay, et al., 2020). Therefore, the case for social media driving polarization only, as an inevitable outcome of view strengthening, is weak; it is likely that social media can polarize in certain, but not all situations. A future research challenge involves better understanding the situations in which polarization through engagement with social media can occur.

Design Recommendations
As we clearly found that information on social media strongly influenced view strengthening, the risk of polarization remains. Although how best to reduce the risk of polarization on social media is a question for further empirical research, we present three design recommendations that represent possible first steps. These recommendations focus on reducing the risk of affective polarization, on controversial issues.

Firstly, given the high emotional valence of information that prompts both view change and view strengthening, it is possible to adjust algorithms to promote more factual, and less emotional information on controversial topics. Previous studies have demonstrated that a feed of fact-checked information reduces polarization, while personal anecdotes increase it (Kubin and von Sikorski, 2021). As social media platforms can adjust what is presented based on its likely emotional impact (Kramer, et al., 2014), these approaches typically used to generate further engagement (Munn, 2020) can also be used to reduce the risk of polarization.

Secondly, social media platforms could encourage empathy-building, with people on all sides of controversial issues. While a social media user may not agree with another’s viewpoint or the ideology behind it, revealing commonalities with those with whom we disagree may reduce the sorting effect and thus the risks of dehumanizing the other side. Dehumanizing is a common feature of affective polarization (Hobolt, et al., 2021, Iyengar, et al., 2019, Lee, et al., 2022, Rathje, et al., 2021). Conversely, showing information presented by someone relatable is one of the more effective ways of combating misinformation (Lewandowsky, et al., 2012). Our participants highlighted the importance of empathy. Therefore, feeds could leverage this willingness to empathise to support social cohesion.

Finally, social media platforms could reflect the emotional valence of a feed and allow their users to curate their feeds for emotion, alongside topic and polarity, to reduce affective polarization. This would allow users to ‘turn down’ the emotion-provoking content in their feed when, for example, they notice their views are strengthening regardless of whether they consume agreeable or disagreeable information. Indeed, many of our participants said they did not wish to have their views strengthened and the only way to avoid this at present is by avoid certain topics entirely. Reducing emotionally impactful content could support people in staying informed, without necessarily becoming emotionally invested. How best to implement these recommendations remains an important question for future work.

CONCLUSION
Viewpoint strengthening is an important phenomenon that deserves to be acknowledged from the point of view of those experiencing it to better understand its causes and impacts. To understand the human experience of view strengthening, we conducted 10 semi-structured interviews with people who had recently strengthened their views based on information they found on social media. The findings provide new insights into the ways views are strengthened by digital information and emphasizes the crucial role of passively encountered information. The findings also highlight just how influential information that evokes empathy is; this type of information led to the strongest and most impactful view strengthening experiences.

While participants described both selectively avoiding and consciously engaging with information they disagreed with, the key role of passive encounters highlights the importance of algorithmic feeds on social media. Participants described both attempting to curate these feeds and being surprised by how the feeds responded to their information engagement. Both seeking out and deliberately avoiding information reflecting opposing views strengthened views though - so a diverse feed is no guarantee of reduced polarization.

We contribute novel insights into the role of social media in a specific type of view change (view strengthening). We now know the importance of emotional content and algorithms, and the complexity of engagement with opposing views. Based on these insights, our study offers several avenues for future work. These include investigating the role of sought information in view strengthening (social media is driven by passive engagement), the long-term effects of algorithm curation, and how best to tone down emotional content on feeds while still promoting engagement and support people in weakening their views, should they wish to do so. Understanding view strengthening from a Human-Information Interaction perspective can reveal new insights that, in the longer-term, may shed new light on how best to tackle the dangerous societal problems of polarization.
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The Hipátia Model: Paths toward the Brazilian Archival Digital Preservation Era

Braga, Tiago  IBICT, Brazil | tiagobraga@ibict.br
Alves, Larissa  IBICT, Brazil | larissaalves@ibict.br

ABSTRACT
This paper presents how Brazilian judiciary organizations are advancing towards a preserved digital environment, and how this process is improving the country’s legal system. First, it analyzed the legal norms published by some of the most relevant Brazilian institutions and how these norms fostered the major courts to immediately start projects related to digital preservation. Second, the major challenges faced by these organizations while fulfilling the legal requirements were listed, and a general strategy to attend to them was defined. Subsequently, a model was established to fulfill these requirements. The model was structured to consider the possibilities of future expansion. As the main result of this research, a model capable of setting archival digital preservation projects was designed for the first time, enabling their consequent application by judiciary institutions in Brazil.

KEYWORDS
Data dictionary; Digital archival preservation; Judiciary information systems; Repositories.

INTRODUCTION
Digital preservation is one of the biggest challenges of this era, as the amount of data and information produced by society continues to increase daily. A few decades ago, discussions regarding digital preservation started being promoted by several researchers and institutions who were worried about how human beings would be able to access all the knowledge developed by us and the predecessors’ generations. Initiatives such as Mundaneum, promoted by Paul Otlet and Henry La Fontain (Pinheiro & Pereira, 2000), show the importance of keeping organized and accessible known information. With the advancement of digital information, new requirements have emerged, such as the maintenance of format compatibility, the need to assess risks related to digital infrastructure security, and the connection between distinct databases and repositories. All these aspects highlight the necessity of a well-designed and applied digital preservation plan.

Aiming to evolve the way digital information is organized and preserved, the European Bureau of Library, Information, and Documentation Associations (EBLIDA) has selected two main aspects to be considered in digital preservation strategies. The preservation of cultural heritage and scientific information was set as the top priority (EBLIDA, 2010) in the digital agenda for Europe. Proposals, such as those published by EBLIDA, were defined by other institutions around the world, and a diversity of standards and formats were made available. It is possible to highlight the Open Archival Information System Reference Model (OAIS) as an attempt to advance towards the organization of resident information technology (IT) infrastructure. The reference model was published by the International Organization for Standardization (ISO), and established general requirements that need to be covered by any digital information system (ISO, 2012) that aims to preserve digital information. The Library of Congress of the United States of America has also worked to improve the preservation of available resources. The institution developed the BagIt File Packaging Format (Kunze et al., 2018), which was used to organize the data and information into a hierarchical structure. Reference institutions from other countries have published guidelines to allow the implementation of IT systems that are capable of applying the requirements required by digital preservation standards. One of these institutions is the Brazilian National Council of Archives (CONARQ), which published a guide (CONARQ, 2015) to support the implementation of Trustworthy Archival Digital Repositories (TADR).

Although all these initiatives lead to better availability of digital preservation structures, the practical implementation of a TADR requires an in-depth understanding of organizational IT and documentation structures. The research conducted by the Brazilian Institute for Information in Science and Technology (IBICT) aimed to organize a series of methods and actions needed to understand institutional IT and documentation structures and provide the conditions for establishing a reliable TADR. This paper presents the Hipátia Model as a result of IBICT’s efforts to build a digital preservation informational structure that will allow Brazilian institutions to implement their own TADR based on a qualitative perspective and supported by an exploratory approach.

ARCHIVIST DIGITAL PRESERVATION
The methodological procedures defined to achieve the proposed objectives focused on the identification and analysis of the requirements of the TADR and building an applicable model. First, the most relevant norms were analyzed. The selection of these norms was based on the previous work of Pignataro et al. (2022). The requirements and structures published in these documents were considered during the subsequent phases. Second, some partner
organizations shared information about their IT and documental structures. This information was analyzed and used to propose practical actions based on an exploratory approach. Finally, while applying these actions, all steps were documented to allow future replication. The resulting document was organized as a model that received the name Hipátia.

**Norms**

In the last few decades, a series of specific norms have been published to foster and support the implementation of digital preservation projects. These documents cover aspects such as the characteristics of data storage and transfer, archival openness, audits, and certifications of trustworthy digital repositories, archival descriptions, and metadata.

Most of these norms aim to improve the way data and information are stored in digital systems and can be applied together, as they are complementary. Pignataro et al. (2022) published a list of these most known documents.

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISAD (G)</td>
<td>2000</td>
<td>General standard for archival description.</td>
</tr>
<tr>
<td>OAI-PMH</td>
<td>2002</td>
<td>Open Archives Initiative Protocol for Metadata Harvesting supports the extraction of data and metadata.</td>
</tr>
<tr>
<td>Trusted Digital Repositories: Attributes and Responsibilities (An RLG-OCLC Report)</td>
<td>2002</td>
<td>Describes the attributes and responsibilities that need to be covered by a trusted digital repository.</td>
</tr>
<tr>
<td>ISO 14721: 2012</td>
<td>2012</td>
<td>Reference model to support the development of open archival information systems.</td>
</tr>
<tr>
<td>ISO 16363:2012</td>
<td>2012</td>
<td>Establish the steps to audit and certificate trustworthy digital repositories.</td>
</tr>
<tr>
<td>METS</td>
<td>2018</td>
<td>The Metadata Encoding &amp; Transmission Standard uses an XML Schema to describe and manage a digital library</td>
</tr>
<tr>
<td>EAD</td>
<td>2019</td>
<td>Also using XML, the standard establishes how to encode documental description</td>
</tr>
</tbody>
</table>

Table 1. List of most important publications related to digital preservation.

The fact that the ISO published a set of standards covering digital preservation between 2012 and 2014 has fostered the emergence of initiatives in Brazil. In 2015, CONARQ published guidelines for establishing the requirements related to TADR implementation.

Although the requirements and instructions are publicly available, the practical implementation of a TADR requires institutional action regarding the configuration of IT and documental structures. These actions are not simple and require effort and compromise from the IT team, documental team, and high administration board. It also requires that complementary aspects be considered. The next section discusses these aspects.

**Challenges implementing TADR**

During the research, IBICT shared information and supported some institutions, such as the Tribunal de Justiça do Distrito Federal e Territórios (TJDFT), the Arquivo Nacional (AN), and the Tribunal de Justiça de Minas Gerais (TJMG). These organizations provided valuable information and identified difficulties in implementing the TADR.

The team decided that the TADR should be strongly based on ISO standards, especially ISO 14721 and its Open Archival Information System (OAIS) Reference Model. This decision was supported by the fact that the Brazilian Archival Council chose this reference model for TDAR projects. The reference model presents preservation planning and its phases, namely ingestion, data management, archival storage, and access. It also includes three actors, namely producers, management, and consumers.

The phases need to use three specific packages to be successful: the submission information package (SIP), archival information package (AIP), and dissemination information package (DIP). Regarding the role of the actors, they could be executed by people of systems, that is, the case of the producer and customer, or simply by systems, that is the case of management. Management can also be considered as TADR itself.
With this reference model as the foundation of TADR, the identified challenges can be separated into three categories. IT and documental categories were previously identified by CONARQ (2015), but IBICT’s analyses identified that without organizational commitment, it would not be possible to move forward. Hence, these categories can be separated into IT, documental, and organizational categories.

**IT challenges**
The first IT challenge faced during this study was to identify software that could cover the phases proposed by the OAIS reference model. Because the company Artefactual has been working with archival systems for a few years, Archivematica and AtoM have been considered since the beginning. The AtoM fits almost all access requirements, whereas Archivematica covers aspects of the archival storage phase. The software to support the ingest phase is the hardest to find once it needs to be integrated into the producer system. During the research, it was determined that this phase must use software that can be configured to connect with more than one producer system. The research team then decided to build new software called BarraPres, which is composed of a solid structure that can receive different configurations through a data dictionary. The software was built in Python, and its configuration module allowed almost any producer to connect to the TADR once the correct data dictionary was prepared.

Once BarraPres was developed, the TADR had to install and configure three main software packages, BarraPres, Archivematica, and AtoM, and a few auxiliary software packages, such as MySQL, Python, and PHP. All these installations demanded a very specific configuration that allows information to be shared in a secure environment. The proposal identified as the most efficient was to create independent virtual local area networks (VLAN). This type of solution segments the organizational network and increases security once it is accessed through specific paths.

**Figure 1. OAIS reference model (ISO, 2012)**

**Figure 2. Software and VLAN configured during the implementation of a TADR**
Another IT challenge is related to the security. As the repository is intended to be the ultimate source of reliable information and document access, this question is one of the most important considerations. To increase the way TADR faces risks related to security issues, each application was installed in a different network segment; hence, there was no easy way to access data and information without an explicit connection. This process also contributed to the organization of the different modules and steps while implementing the TADR. An event-based application called Kafka was used to establish communication between the VLANs. This software allows message exchange between the networks and software.

Once the network hierarchy was defined, the team found that access control was necessary to guarantee correct communication during the TADR phases. Each software package was configured to have only essential access, thereby increasing the security and maintenance of the entire process. Consequently, the IT team was trained to understand and maintain the aftermath of the IT structure.

**Documental challenges**

One of the major challenges faced during the implementation of a TADR is related to its documental structure. To properly archive documents stored in an information system, it is important to understand their characteristics in detail. The format, available metadata, document extraction method, and related digital objects must be described. During the research, it was clear that, although the documental team knew a considerable number of characteristics related to the stored documents, some vital information was visible only to the IT team, and they were never accessed by archivists. To understand the available information and how it could be used, the team chose to deepen knowledge of the database. This allowed them to understand the hidden data and how they could be used to improve the storage process.

Once the data and metadata are listed, the documental team must build a data dictionary that can be used as a template to package the information extracted from the production system. The data dictionary must include the data identification, type, format, and location. In addition, it was used to assemble the BagIt file with several others.

![Figure 3. Data dictionary example](http://www.cnj.jus.br/tempos-guia-intercomunicacao-2.3/processo% all='ht)

Another challenge identified by the documental team is related to the manner in which the documents are disseminated during the last phase, as proposed by the OAIS reference model. The dissemination phase presupposes that the document and all data and metadata needed to bring the document context will be available. This means that the classification used to store the document in the producer system must ideally be used by the consumer. To enable this classification, the documental team proposed the use of two metadata standards: ISAD(G) and Dublin Core.

ISAD(G) is the general standard for archival description, and is used by Archivematica to provide a wide description of the stored document. Although ISAD(G) is a great standard, it is not recognized by AtoM to represent the document. Instead, AtoM uses Dublin Core, which is a metadata schema that provides broad coverage to represent almost any document type. Both metadata schemas are encapsulated by the submission information package and used at the right time by the TADR.

The documental team identified several other challenges. The definition of resources, such as the temporality table and business process management, is important for supporting digital preservation phases. Although they are not directly related to TADR implementation, they are crucial for the success of the process.
**Organizational challenges**

Organizational challenges focus on two main areas: financial sustainability and team integration. These areas are essential for ensuring long-term results and mapping risks associated with TADR implementation. In addition, the organizational team, composed of the institutional board, should define mechanisms to guarantee that the digital preservation project is endorsed by all teams.

There is no shortcut to financial sustainability. The funds must be allocated because once a digital preservation project is set, any lack of resources can be critical. Certainly, strategies can be proposed to soften the impact of such long-term commitments. In this project, the organizational team supported the use of open-source software. Thus, other institutions can contribute to the evolution of software. Additionally, it makes it easier to find partners and IT staff suppliers. However, the option for an open-source IT structure also implies that the institution will need to maintain a regular maintenance process as new vulnerabilities are quickly discovered and explored.

Although expense optimization is a very efficient strategy, it is not sufficient to guarantee a project’s financial sustainability. To do so, the organization also needs to allocate funds through long-term commitment. This is difficult because there is no certainty regarding the future scenarios. When discussing public organizations, there is a complication related to budget allocation, as there is no guarantee that it will be prioritized by the next government in the future. To address this challenge, the organizational team worked to establish partnerships with similar institutions. The fact that the Brazilian National Council of Justice published national norms covering digital preservation stimulated other institutions to join the initiative.

Once the financial challenge was solved, the organizational team had to deal with another important challenge related to the preservation culture. It is common for different teams to work independently; however, this approach does not work when discussing digital preservation. As the activities of the IT and documental teams depend on each other, they need to exchange information and procedures to optimize their actions. However, these teams were not used to working together. The activities executed by archivists tend to be associated with physical archives. On the other hand, the IT team are commonly linked to computational activities but not to the core understanding of the process. To face this challenge, the organizational team chose to programme an interchange agenda; hence, the teams had the opportunity to share their discoveries and support each other’s actions.

A vital step in achieving this cultural change was to integrate the teams. A documental team member was asked to join IT team meetings, and the opposite was true. This integration allowed the teams to understand what was happening in each area and to improve their own activities based on the results obtained by the other team.

These three challenge categories—IT, documental, and organizational—covered almost every difficulty encountered during the research. Integration of the strategies defined by each team is fundamental for developing an institutional strategy to implement TADR. This strategy was then schematized to allow for replication. This is how the Hipátia model emerged.

**THE HIPÁTIA MODEL**

The actions, methods, and procedures defined during the research were organized to allow replication. The schematization process was executed by IBICT’s team, which collaborated with teams from other institutions, such as TJDFT, AN, and TJMG. Hipátia was the chosen name for this model and refers to a woman who was considered the only female scientist in history for the fifteenth century (Cunha et al., 2015). Hypatia developed studies in mathematics, philosophy, physics, and astronomy in the Library of Alexandria and, after her murderer, most documents to which she was referred were destroyed; however, some of her studies and her role in coordinating the Library of Alexandria were rescued.

As previously discussed, the model is based on the OAIS reference model, but it is organized into five phases: data producer, extraction, packing, preservation, and dissemination. All phases need to be executed by integrated teams covering people from IT and documental areas. The model presupposes that all data, metadata, and documents will be shared through specific packages.

First, from the data producer phase to the extraction phase, all digital content is shared in an unstructured format, following the conditions provided in phase one. This digital content can be extracted using web services, the best choice, database direct access, and even physical file access, the last option to be considered. There is a module in BarraPres that is prepared to extract the information, and it can be configured for integration with any computational system. After this extraction, no access to any external system is required. All the other requirements can be internally covered by Hipátia.

The second phase sends information acquired from the data producer to the packing phase. During this process, a data dictionary is considered and used to organize and fulfill all requirements. The related metadata using both the ISAD(G) and Dublin Core schemas are aggregated and stored inside the initial transfer package. All documents...
were inserted into the package based on a hierarchical structure. This step is also covered by a BarraPres module, and the resulting package can be considered as the SIP presented by the OAIS reference model. This package will not be stored or shared; its use is temporary, and once it is analyzed in the following phase, it can be eliminated.

The next phase, preservation, was more intense. It is based on Archivematica software and is responsible for permanently storing digital content. After receiving the SIP, several microservices are executed to validate a wide number of characteristics. These microservices are divided into those focused on transfer and those focused on ingestion. As an example, transfer microservices can check the file structure, rename, generate a unique identifier, generate a METS document, scan for viruses, and so on. The ingest microservices can execute activities such as name verification, normalization, metadata processing and prepare the AIP and DIP packages.

All these microservices are executed internally in Archivematica; however, a comprehensive log is generated to allow the individual verification of all executed actions. An example of how microservice execution is checked by the software is shown below.

![Figure 4. Microservices executed by Archivematica](image)

If the preserved information can be shared, the DIP is created during the preservation phase and then sent to the dissemination phase. The dissemination phase is the last phase, and it focuses on making the preserved information available to customers. The Hipátia model proposes the utilization of AtoM to implement this phase, but other software, such as DSpace and Tainacan, can also be used. One important action executed during this phase is the recovery of the original document’s classification from the data producer phase. This is possible because all contextual information is stored in a database structure that is accessible from the dissemination software.

The figure below illustrates how these five phases are integrated and the main informational resources used by any one of them.
Given the execution of the five phases presented above, it is possible to analyze how Hipátia’s proposal can be used to establish a practical, feasible, and reproducible flow that considers the integration between concepts from the information and IT areas. Thus, in addition to enabling the implementation of TADR, the model reinforces the need to guarantee the chain of custody of digital archival documents, which is understood by Flores et al. (2016) as an unbroken custody line in the implementation of computerized systems for management, preservation, and access to digital objectives.

ADVANCES AND FUTURE PERSPECTIVES
The research is still in progress, and new features, concepts, and resources are constantly being added to the Hipátia model. In the near future, most justice institutions are expected to adopt it. Hipátia also fits with archival institutions, such as national and regional archives. Some partners have already identified the need to expand available modules. The digitalization module is one of the most required modules and probably will use artificial intelligence to recognize texts.

Other aspects to consider are related to integration with other initiatives and projects. As Hipátia is being adopted by several institutions, it is desirable that the model be coupled with management systems and initiatives. To achieve this objective, a strong institutional network must be developed around the Hipátia model.

Finally, Hipátia has been successfully adopted in Brazil, but it is expected to be adopted by institutions from other countries. Hence, it is important that documents, tutorials, codes, and interfaces are translated into languages such as Spanish, English, and French.

CONCLUSION
Ensuring that the content and context of the digital object remain accessible and authentic over time is characterized as the essence of digital preservation. Preserving archival documents and information from government institutions is a social concern related to the access and dissemination of national memory. The large volume of digital information produced and the need to ensure the security and authenticity of information make digital preservation the main priority when discussing the national informational agenda.

Considering the importance of the relationship between digital preservation and the construction and maintenance of a country's memory, this study aims to present some paths adopted by Brazilian organizations to structure a preserved digital environment based on a practical series of recommendations and actions. This methodology was organized and presented as the Hipátia model, which covers the implementation of the TADR.

To think about digital preservation involves considering aspects related to information, technology, and management. The development of this research on digital preservation, with an emphasis on the implementation of TADS, demanded collaborative and complementary work by a multidisciplinary team. The categorized challenges, IT, documental, and organizational, allowed us to understand how deeply the institutions needed to understand their own structures to succeed in implementing a TADR.

Finally, any initiative related to archival preservation will only be successful if the informational and computational aspects are considered by the administration. In addition, it is important that the teams have the autonomy to propose customizations, as the Hipátia model is a work in progress.
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Bratt, Sarah
University of Arizona, School of Information (iSchool), USA | sebratt@arizona.edu

ABSTRACT
This study develops a grounded theory of how social scientists facilitate qualitative data deposit and the impacts on making data FAIR and CARE. Drawing from 15 semi-structured interviews with U.S. academic social science faculty who deposited data to ICPSR, I take a resource-centric perspective to address the need for theorizing scientists’ use of resources to bridge the gap between underspecified, heterogeneous data practices and repository requirements. The two primary contributions of the study are: First, the identification of three types of resources that social science faculty use to structure data deposit routines, namely: 1) bottom-up, 2) top-down, and 3) borrowed resources. Second, I import a theory from crisis informatics, ‘routine infrastructuring,’ to explain how social scientists deposit data to ICPSR. Results reveal that the resources social scientists use function as ostensive routines. I argue routine infrastructuring is not only a way to enact routines but also creates routines. Findings also show ‘in-house’ resources have a mix of beneficial and negative impacts for data FAIR- and CARE-ness. This study advances the small but growing body of literature that examines routine dynamics in research groups from a resource-centric perspective to explain qualitative data deposit to research data repositories.

KEYWORDS
Research Data Management, Data Repositories, Qualitative Data, Routine Infrastructuring, ICPSR

INTRODUCTION
Since the inception of cyberinfrastructure (CI) and spurred by federal data sharing mandates (Diekema et al., 2014), organizations have provided resources to assist scientists with research data management (RDM) and data deposit. Academic libraries have offered support in the form of data management planning (DMP) workshops. Data repositories provide tutorials to demonstrate how to add metadata to the submitted dataset. However, while the ‘best practices’ for managing and depositing datasets to open research data repositories are relatively straightforward in some fields, other fields are grappling with challenges for creating general principles for data management and deposit, such as scientists in fields largely generating and (re)using qualitative data. Scientific norms are still emerging for data management and data deposit. For example, Leahey (2008) found that social scientists lack shared norms for editing data. Granted, many centralized resources do exist to guide the process of managing and depositing qualitative data. For instance, the Inter-university Consortium for Political and Social Research (ICPSR) offers a rich collection of tutorials, frequently asked questions (FAQs), a podcast, and synchronous consultations with ICPSR “support staff” (Swanberg, 2017). These resources are used by the community to navigate the deposit process. Nonetheless, qualitative data is heterogeneous, requiring scientists to improvise to manage and deposit data.

Yet, studies of data management in the social sciences reported a lack of convergence on norms for preparing qualitative data for deposit (Antes et al., 2018). The heterogeneity of qualitative data can pose challenges to developing generalizable best practices (Elman et al., 2010; Mozersky et al., 2021), a lack of convergence on norms for managing and depositing qualitative data that can lead scientists to improvise data management practices (Bratt, 2022, 2023). For example, scientists’ practices of anonymizing data to prepare interview transcripts for deposit can be ad hoc (Crowston & Qin, 2011). In other words, studies show qualitative data are heterogeneous (Antes et al., 2018; Mozersky et al., 2021), making it difficult to converge upon a universal set of guidelines or at least formally recognized best practices for requirements for deposit to ICPSR such as anonymization (Tsai et al., 2016), adding appropriate metadata (Antes et al., 2018), and defining the scope of the dataset (Elman et al., 2010). A critical gap remains between local data practices and repository requirements that social scientists must bridge to deposit data. As Gerson & Star (1986) emphasized, all standards are underspecified with respect to how to take specific action in a particular local context, which can impede “getting things done” including data deposit (Gerson & Star, 1986, p. 23). Bridges this gap can even determine whether scientific problems are “do-able” at all (Fujimura, 1987).

In recent years, the CARE and FAIR principles for data stewardship have taken a central role as important goals for research. FAIR requires that data is made Findable, Accessible, Interoperable, and Reproducible (Wilkinson et al., 2016). CARE requires data to have Collective benefit, to give individuals the Authority to Control, to invoke Responsibility, and to be sensitive to Ethics (Carroll et al., 2020). FAIR and CARE set forth ideals for data stewardship that are important. They allow us to accelerate social problems by enabling the “big data revolution” (Atkins, 2003), and leverage the explosion of digital traces and computational resources. However, under specification of how to manage and deposit qualitative data can undermine FAIR and CARE goals. For example, the...
Reproducibility dimension of FAIR is threatened by instances when ad hoc approaches to data management occur. That is, idiosyncratic documentation means that the processes that led to creating and processing the data are hard to reproduce. To take another example Interoperability can be undermined by the lack of convergence on metadata norms; Let’s say one researcher describes their dataset collected from people who are in prison as “felons” and another uses the term “incarcerated individuals” and still another uses “perpetrators.” While these terms can be reconciled to create a data collection for criminal justice scholars, without the work of synonymy and applying standard metadata, these disparate datasets would remain unconnected, thus lacking Interoperability. In addition to these technical issues, there remains a broader argument advanced by Sabina Leonelli (2018) that qualitative datasets may not need to have Reproducibility as a goal at all. For example, ethnographic approaches aim to achieve epistemic validity through other approaches than reproducibility (Leonelli, 2018). In addition to the negative impacts of the lack of agreed-upon norms on FAIR, the CARE principles can be undermined as well.

Amplifying these challenges, social scientists are increasingly facing pressure to share data in open research data repositories. The pressure applied by funders, federal mandates, and disciplinary norms (Kim & Stanton, 2016) to share data requires more resources to manage data and prepare data for deposit. On top of pressures to deposit data, the U.S. academic crediting culture remains publication-centric, disincentivizing data deposit (Allen et al., 2014). Given these challenges, social scientists face several barriers to managing and depositing data. Nonetheless, scientists deposit their data into data repositories; that is, submit datasets that are subsequently approved by ICPSR staff, and the datasets are published in the data archive. There are currently approximately 18,734 studies with associated datasets in ICPSR (ICPSR Data Archive, May 2023).

Scientists’ deposit of data to ICPSR given the underspecified disciplinary environment poses a dual puzzle for information scientists and organizations aiming to understand and support researchers in managing and depositing their data: First, how do social scientists deposit data in a research environment that disincentivizes deposit? Second, How do scientists decide what are the resources and best practices to draw from when norms for doing so have not yet converged? Although these questions are urgent, we lack an empirical understanding of the spectrum of practices and resources that enable data deposit. Moreover, we have not examined the implications of the lack of convergence on data preparation norms on scientists’ on achieving FAIR and CARE goals for research datasets.

To date, much of the work in research data management in library and information science (LIS) research has focused on the formal resources that researchers draw on to manage and deposit data. These include university resources such as academic library guidance for writing a data management plan and data repository tutorials for submitting datasets (e.g., the NIH’s YouTube series on using BankIt to submit to GenBank1). In contrast, scholars from the field of computer supported cooperative work (CSCW) have developed theoretical concepts that help us to understand how coordinating artifacts can facilitate data management. For example, boundary objects and their many variants, e.g., boundary negotiating artifacts (Lee, 2007), are useful for explaining how scientists coordinate materials and understandings across information worlds. While valuable for understanding the end of the research data lifecycle, the LIS studies tend to overlook how scientists bridge the gap between local practices and repository requirements to deposit datasets. CSCW theories like boundary objects and infrastructure perspectives foreground coordination concerns. By focusing on coordination, they explain how scientists bridge the gap between repository requirements and local practices. In this study, I argue if we continue to focus on institutional resources only, we run the risk of gaining only partial understanding of the artifacts, processes, and practices that culminate in data deposit. Failing to identify these resources in situ undermines long-term research data sustainability.

In this study, I address these gaps by developing a grounded theory of how scientists use resources from both outside their organization and within their research group. I contend there is a gap between the heterogeneous local practices and repository expectations. To examine this data-to-repository gap, this study takes a sequential exploratory case study approach (Creswell et al., 2007) guided by three sequential research questions:

RQ1: How do social scientists deposit data to research data repositories?

We observed that social scientists deposit data by drawing on resources that facilitated data management and preparation for deposit to ICPSR. For example, ICPSR requires data anonymization. There is not widespread convergence on how to anonymize specific datasets in many social sciences disciplines. Social scientists lacked guidance for precisely how to anonymize their specific dataset. As such, they improvised by searching for best practices and devices to anonymize data, and techniques that would make anonymization easier. These observations of the use of various materials and techniques led to the second research question, related to resources:

RQ2: What resources do social scientists draw from to facilitate data deposit practices?

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1 For example, see “Webinar: A Submitter's Guide to GenBank, Part I” https://www.youtube.com/watch?v=OZxxsRm0pP4
Based on the resource-centric lens suggested by observations in the first phase, we focused on the tools and techniques social scientists used to assist them with data deposit. Social scientists described the materials and techniques that supported data deposit, some of which were used in well-established routines but some of which created structures where before there was little or none. We noticed that by creating these structures and routines had impacts on data FAIR-ness. The potential impacts of resource use, routine development, and FAIR data led to RQ3:

**RQ3:** How does the use of these resources (and practices) impact the FAIR-ness (Findable, Accessible, Interoperable, and Reproducible) of the deposited dataset?

To address the RQs, I draw from semi-structured interviews with U.S. academic social science faculty (n = 15) who deposit data to the Inter-University Consortium for Political and Social Research (ICPSR) repository. First, the study identifies three types of resources that social scientists use to manage data: 1) Top-down 2) bottom-up and 3) borrowed. Second, the study deploys ‘routine infrastructuring’ to conceptualize the resources and improvisational practices social sciences develop, appropriate, and adapt to manage and deposit data.

**BACKGROUND**

Researchers in computer supported cooperative work (CSCW) and science and technology studies (STS) have theorized how scientists deal with uncertainty, especially with respect to trying to meet the requirements of a data repository. The literature in infrastructure and boundary objects in the context of scientific data management can offer a foundation for the present study given its focus on how social scientists deposit to ICPSR and how the resources they use help or hinder making datasets FAIR and CARE. In the following sections, I review relevant literature in infrastructure studies and define concepts related to ‘routine infrastructuring,’ a concept developed in crisis informatics that deploys a resource-based perspective to investigate the research questions.

**Routine Dynamics in Everyday Research Data Practices**

People engage in routine practices in their daily lives – routines like making breakfast, going to work or the gym, and watching a movie involve routine practices to carry them out. Organizational scholars have conceptualized routines as identifiable patterns of action which multiple actors engage in within a specific context (Feldman, 2000; Semaan, 2019). Martha Feldman (2000) overturned the traditional notion that routines are fixed and resistant to change, showing empirically that people exercise agency to modify existing routines and develop new ones. This generative view of routines – known as routine dynamics – shows that routines have two interacting parts: the ostensive part and performative part (Feldman & Pentland, 2003; Pentland et al., 2012).

The ostensive part refers to the abstract patterns that people use to guide, account for, and refer to during specific performances of a routine, often codified in documents. The performative part refers to the actual actions people take to carry out the generalized routine. As Feldman & Pentland (2003, p. 101) define them, the ostensive part is an “abstract, generalized idea of the routine,” whereas the performative part consists of the “specific actions, [done] by specific people, in specific places and times.” For example, to make breakfast, the ostensive part is the conceptual steps such as ‘scramble some eggs,’ and might be codified, in part, in a recipe. The performative part is when you carry out the activities in context, with a specific carton of eggs in your kitchen. As such, a routine can be performed differently, depending on the context, e.g., using a whisk rather than a fork to scramble eggs.

In scientific practice, researchers carry out their work by engaging in routines to handle research data. The performance of data management steps is guided by ostensive disciplinary rules and norms for how to clean, store, and analyze data. Such rules and norms for data routines can often be codified in ostensive artifacts, e.g., lab handbooks, to make sure the data is handled in a relatively consistent manner. Data management routines vary between disciplines and represent shared challenges. ‘Big science’ disciplines like astronomy and genomics may appear to have tightly linked ostensive and performative routines. However, many early science studies have documented that even big science projects with mature cyberinfrastructure face challenges in managing data (Borgman, 2015), such as managing the interoperability of diverse LSST data in Astrophysics (Jenness et al., 2016), challenges with version control in Gravitational Waves at LIGO (Collins, 2003), and variations how and by whom data management tasks are performed (Scroggins & Pasquetto, 2020). In other words, even if there are computational scripts that tell computers how to handle the data (ostensive routines) they are not always specific enough to guarantee an exact execution of the process (performative routines). The social sciences may represent even greater challenges, given the relatively increased heterogeneity of data and ambiguous ostensive routines (or none at all) specifying the data management actions to take (Borgman et al., 2021; Mozersky et al., 2021).

**Infrastructures as Resources Supporting the Enactment of Routines**

To carry out routines, one entity people rely on is infrastructure. Bridges, highways, the power grid – these are what we traditionally think of as infrastructure: the underlying foundations, or supporting frameworks, of large-scale systems. Society relies on infrastructures as resources which enable us to carry out routine activities. Scientists rely
on computing infrastructures as resources to routinely do research, e.g., conduct experiments. Systems, like freeways, support routine travel to and from school.

While infrastructure is often thought of as physical (e.g., bridges) and technical (e.g., wireless networks), Star & Ruhleder (1994) showed how infrastructure is sociotechnical. That is, social practices animate the physical, technical, and information infrastructures, and that the physical and technical infrastructures are inextricably embedded with human relationships and organizations. According to Star "[a]n infrastructure occurs when the tension between local and global is resolved" (p. 114), where technologies provide affordances to users to serve their local needs. Furthering this work, human infrastructure is a key aspect of sociotechnical infrastructures. Lee et al. (2006) defined it as "the arrangements of organizations and actors that must be brought into alignment in order for work to be accomplished." Thus, the physical, technical, and information infrastructures depend critically on human infrastructure to effectively function, and, in turn, human infrastructure relies on infrastructure to support routines.

Prior research has shown that boundary objects are important for coordinating the work of disparate actors (Bowker et al., 2016; Burnett et al., 2014; Lee, 2007; Levina & Vaast, 2005; Star, 1989). Star (1989) and Star & Griesemer (1989) identified types of artifacts as boundary objects, data repositories. Lee (2007) nuanced the discussion of boundary objects, as material artifacts that coordinate routines across disparate "information environments," arguing that the term is not monolithic. Lee (2007) adds nuance in a research study of designers “using artifacts and surrounding practices to iteratively coordinate perspectives and to bring disparate communities of practice into alignment, often temporarily, to solve specific design problems that are part of a larger design project” [CITE]. Artifacts can change purpose, given their context of use. Lee (2007) identified sub-types of boundary negotiating artifacts, including "structuring" and "borrowed" artifacts. Structuring artifacts are coordinative schemas, objects, and/or materials provide direction by framing an ambiguous or underspecified step in the work process (ibid). Borrowed artifacts are defined as artifacts “taken from its creator in one community of practice and used in unanticipated ways by those in another community of practice” (Lee, 2007). In Lee’s study, the museum exhibit designers borrowed artifacts from communities of practice who were “in close proximity” to the designers. Like scientists facing uncertainty on best practices of managing data, the designers resolved uncertainty by appropriating from outside sources to address goals and problems as they arose.

‘Routine Infrastructuring’ in Social Science Data Practices

People use improvisational, creative, and adaptive processes to manage unexpected challenges and to bridge gaps in infrastructures when formal support is absent, ambiguous, or insufficient. To carry out these adaptive processes, they need resources, so they turn to those embedded in the ready-at-hand infrastructures. Prior work by scholars in crisis informatics find that people often improvise equipment or tools to perform tasks (e.g., Bratt et al., 2017). For example, studies show how people use the ready-at-hand resources, though not explicitly intended for the task, to respond to the aftermath of natural disasters like hurricanes, where people have creatively used doors as stretchers when formal medical resources are lacking.

In a similar way, scientists draw from a variety of infrastructures – physical, technical, informational, and human infrastructure – in their everyday data practices to carry out data management and deposit routines. Institutions like repositories and universities provide institutional resources, designated specifically to support data management and deposit. However, these resources a) do not always fill all data management needs, and b) cannot specify all the steps that scientists must take to make data deposit work, no matter how detailed the directions are (Gerson & Star, 1986). Therefore, scientists are forced to draw from resources, from both inside and outside of their discipline, and do the work of knitting together institutional resources with local resources to bridge the lack of centralized, formal resources to overcome a problem or function effectively – known as an "infrastructural gap" (Vertesi, 2014).

In this study, I argue that to bridge the gap between local practices and repository requirements, social scientists engage in routine infrastructuring practices, that is, “the intentional production of infrastructure as a means of achieving a particular goal or the desire to solve a particular problem” (Semaan, 2019). Semaan (2019) develops the concept ‘routine infrastructuring’ in the context of disruption and resilience – how people manage their everyday lives using technologies to enact their routines. Using examples of prolonged disruption, such as war, personal crises, and LGBTQ+ transitions, routine infrastructuring is a concept developed in crisis informatics to describe how routines are performed when a disruption in workflow occurs to bridge infrastructural gaps. Routine infrastructuring depends on the informal and formal resources – materials, know-how, or practice that are ready-at-hand, familiar, or just to “make do” in specific situations – to make local adjustments and assemble an infrastructure supporting the routine.

While it may appear that research data management in academic research is a radically different context than crisis informatics (e.g., war, personal crises), the lack of resources scientists experience is a type of disruption – it disrupts the flow of work, data management routines, and effective function of their team – a ongoing disruption which scientists ameliorate and bind back together through infrastructuring to enact and create routines for data
management and deposit. Like first responders who used a door as a stretcher in the aftermath of a hurricane, social science researchers use resources from informal or external sources to manage lack of ready-at-hand, internal, and/or formal resources. For example, information science studies surveying faculty data management practices show that scientists use unconventional resources to manage data, such as sharing data not via an institutional repository but using email or social media (Akers & Doty, 2013; Bratt et al., 2017). Another example is the use of dental software to protect data privacy when there were no non-cloud-based systems available. In this study, I argue scientists are deploying creative, improvisational, and adaptive processes to manage and deposit data through ‘routine infrastructuring.’

**METHODOLOGY**

This study follows an exploratory sequential case study approach (Creswell et al., 2007). I employed semi-structured interviews to collect data, selected for its utility in investigating a specific issue to best understand the perceptions of researchers as they recalled data deposit processes (Creswell et al., 2007). A protocol was created with questions and prompts so the interviewer interacts face-to-face or through synchronous video conferencing in an alternating series of questions and responses. The exploratory sequential case study approach was used for its ability to build on previous findings from the study in a step by step process. The use of the case study approach was selected because it allows for a flexible research design to capture the recursive nature of “real life events” in context. An advantage of a sequential exploratory case study approach is that it can address complex factors that captures the richness of a phenomenon in its organizational and social milieu (Lalor et al., 2013), such as in the case of social scientists who face multiple motivations and pressures to deposit datasets to ICPSR. The exploratory case study approach is a method that is appropriate for “how” and “why” research questions (Creswell & Poth, 2016), as in this study of how scientists deposit their data, and how and why they make decisions as to the resources they use.

The criteria for recruitment for participation was research-active faculty at R1 U.S. academic institutions who submitted to the Inter-University Consortium for Political and Social Research (ICPSR) within the last 6 years (2017-2021), and the data submitted is qualitative (can be part mixed methods). As a research site, ICPSR is an excellent space to examine a context in which there are growing guidelines, policies, and norms for research data. A total of 15 participants were interviewed for the study (Table 1).

<table>
<thead>
<tr>
<th>ID</th>
<th>Gender</th>
<th>Position/Title</th>
<th>Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Non-binary</td>
<td>Assistant Professor</td>
<td>Sociology</td>
</tr>
<tr>
<td>P2</td>
<td>Female</td>
<td>Associate Professor</td>
<td>Epidemiology</td>
</tr>
<tr>
<td>P3</td>
<td>Female</td>
<td>Clinical Assistant Professor</td>
<td>Learning health sciences</td>
</tr>
<tr>
<td>P4</td>
<td>Male</td>
<td>Professor</td>
<td>Criminology</td>
</tr>
<tr>
<td>P5</td>
<td>Male</td>
<td>Associate Professor</td>
<td>Criminology</td>
</tr>
<tr>
<td>P6</td>
<td>Female</td>
<td>Associate Professor</td>
<td>Health sciences</td>
</tr>
<tr>
<td>P7</td>
<td>Male</td>
<td>Professor Emeritus</td>
<td>Social epidemiologist</td>
</tr>
<tr>
<td>P8</td>
<td>Female</td>
<td>Associate Professor</td>
<td>Public policy</td>
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<td>P9</td>
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<td>Associate Professor</td>
<td>Adolescent development</td>
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<td>P10</td>
<td>Female</td>
<td>Assistant Professor</td>
<td>Health services and policy</td>
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<td>P11</td>
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<td>Epidemiology</td>
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<tr>
<td>P12</td>
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<td>Professor</td>
<td>Survey methodology</td>
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<td>P13</td>
<td>Female</td>
<td>Adjunct Associate Professor</td>
<td>Criminology</td>
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<tr>
<td>P14</td>
<td>Female</td>
<td>Assistant Professor</td>
<td>Health services</td>
</tr>
<tr>
<td>P15</td>
<td>Female</td>
<td>Associate Research Scientist</td>
<td>Social work</td>
</tr>
</tbody>
</table>

**Table 1. Study Participants**

Participants were recruited by email. The interviews were conducted via zoom video conference in September – November 2021. The average interview length was 75 minutes. Interviews are audio-recorded and securely stored before transcription into a document for analysis. For confidentiality, individuals were assigned a unique ID (P1-15) in chronological order of the date of the interview. Sensitive information was removed from the transcripts (e.g., names of persons mentioned, discipline and university-specific information that may disclose the person’s identity). The audio files of the interviews were transcribed using the semi-automated software Rev.com and a verification of
transcription accuracy was executed by listening to each interview while following along with the textual transcript and correcting any errors while anonymizing the data.

The data was analyzed using content analysis and the constant comparative method (Glaser, 1965). Given the exploratory nature of the study, the sample of fifteen individuals who submitted to ICPSR for interviews was justified by consulting qualitative analysis sampling guides. The intention was not to generalize results to a broader population (Bauer, 2000, p. 200) but rather as an approach to surface initial themes and patterns among research experiences. Content analysis proceeded by identifying themes and sub-themes, concepts, and patterns in the participant responses and analyzed in chronological order of interview. The codes were analyzed for relationships, and the concepts and topics were discussed, iteratively, with 3 rounds of axial coding (Elo & Kyngäs, 2008). An inductive approach informed the three rounds of analysis, drawing from grounded theory (Strauss & Corbin, 1994). Grounded theory is premised on iterative coding of emergent themes, topics, and concepts. A coding scheme was developed based on the themes that emerged in analysis. The study was approved by the university IRB. The manuscript was sent to participants for their feedback on the interpretation of their interview data.

**ROUTINE INFRASTRUCTURING RESOURCES SOCIAL SCIENTISTS USE TO MANAGE AND DEPOSIT DATA TO ICPSR**

In the following sections, I describe the resources scientists use in ‘routine infrastructuring’ to bridge infrastructural gaps. In the case of the Inter-University Consortium for Political and Social Research (ICPSR), studied here, social scientists drew on three types of resources: ‘Bottom-up,’ ‘top-down,’ and ‘borrowed’ resources.

**“Bottom-up” Resources: Defining Ostensive Routines for Data Management and Deposit**

*Bottom-up resources* refers to the support systems researchers draw from by creating their own documents, templates, and procedures to bridge the infrastructural gap in existing resources for research data. For example, in the absence of institutional resources, that is, a lack of precedent, guidelines, or standard operating procedures (SOPs) for faculty to follow, faculty developed in-house documents. Participants created several documents, codifying the ways that had worked in the past to manage data, and facilitate deposit, including lab handbooks, interview study checklists, data management PowerPoint presentation slides to orient newcomers (e.g., students), medical acronym “cheat sheets,” and “quizzes” to train qual interviewers. Table 2 offers examples from my analysis and describes the relationship between the type of resource, their function, the participants, and whether the resource was developed in-house or externally.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
<th>Participants</th>
<th>Source</th>
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<tbody>
<tr>
<td>Lab handbook</td>
<td>A compendium containing information pertaining to research group expectations for data use, file location information, and guidelines on how to store, find, or use data. Handbooks are usually stored as a digital file, but some faculty print the document.</td>
<td>P2, P3, P5, P7, P10, P13, P14, P15</td>
<td>Developed in-house, revised as technology changed</td>
</tr>
<tr>
<td>Data management plan</td>
<td>A written description of the data artifacts and processes expected to be carried out during the research project. Include plans for accessing, storing, analyzing, and sharing data. Includes specific ways that data will be preserved and disseminated at the project’s end.</td>
<td>P1, P4, P5, P6, P8, P9, P11, P12, P15</td>
<td>Required by an outside entity (e.g., funder, publishing venue), developed adaptations in-house</td>
</tr>
<tr>
<td>Data analysis templates</td>
<td>Files that serve as a guide for new research with a preformatted layout. Include Google sheets and Word documents, e.g., qualitative data analysis.</td>
<td>P1, P2, P3, P5, P7, P9, P10, P11</td>
<td>Developed in-house, acquired from colleagues</td>
</tr>
<tr>
<td>Training materials</td>
<td>Educational or orientation documents and artifacts to train newcomers (e.g., data collection staff, students) on data management aspects. Include checklists, forms, “quizzes,” and presentations.</td>
<td>P1, P2, P3, P7, P9, P12, P14, P15</td>
<td>Developed in-house, required by outside entity (e.g., CITI certification, NSF’s RCR training)</td>
</tr>
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**Table 2. Resources Faculty Developed to Bridge an Infrastructural Gap**

These resources helped to align the requirements from the ICPSR data repository and local researchers’ data management needs by coordinating among the research group. Surprisingly, the faculty in this study reported few...
lab handbooks or lab notebooks, a standard and widely used procedure for provenance in many of the natural sciences (Kanza et al., 2017; Schraefel & Dix, 2009). But other “template”-type documents were frequently used. The documents served to help organize lab workflows and reduce the labor needed to teach newcomers data procedures. Streamlining function was evident in the case of P2, a pre-tenure epidemiology faculty who specialized in qualitative data collection:

“You have to give students a template for the interviews or they're not going to all have the same font size and same formatting and whatever else. And the IDs need to kind of be consistent. Or should be, right? It's better for people accessing it if it is consistent.” (P2, epidemiology faculty)

P2 created templates when there were no guidelines for orienting newcomers. The formatting and font templates were one piece of an elaborate ecology of training and procedural documents. These documents did not exist on their own but were imbricated into P2’s data collection processes, and were carefully designed and coupled with other practices to achieve the desired outcome – in her case, data quality and thoroughness. The use of templates helped to ensure consistency and reliability for working with the data. Similarly, P11, a pre-tenure professor in public health described how she created templates after learning lessons from previous studies:

“We definitely had some templates when I started [Project X] … We were using Excel for a lot of things…So we had some shared templates for calculating hospitalization rates and I was like we should be doing this in SAS. This kind of fell by the wayside…When we're just focusing on analysis for the [Project Y] study there's definitely lessons learned that we have from the [Project X] study like the missing data” (P11, public health faculty)

The templates P11 described became taken-for-granted and naturalized as part of the research group’s infrastructure. The templates help to guide routines, serving as ostensive elements in performing data management routines. While at the start of P11’s project, Excel and SAS were considering for us, indicating an ambiguity in routines given the shifting between different technologies and discussion of which was better. Over time, SAS stabilized as the standard practice for templates for data analysis to be used. These templates had important implications beyond controlling data workflows. Not only did the template serve in ensuring data was collected consistently, and controlled according to faculty specifications, but had other results, some unexpected, such as scaling up the number of manageable students in a lab. P5, a tenured faculty studying criminal justice, explained how scaling a project meant a more complex division of labor. As a result, P5 needed to create standardized protocols for data management, in the absence of institutional resources:

“We had to have a level of organization that we didn't have in the past. Originally when we wrote the proposal, we said that we were going to use paper and pencil to go into prisons and collect data. Paper and pencil interviews, you know, in retrospect that's just silly. It's just that's not the way you collect data. Or at least it's not an efficient way to collect data. We had to hire the right people, the right research assistants and so on. And then we had 70 different interviewers that we trained on this project to conduct these interviews, whether it was in person in the prisons… Or if it was over the phone, which is what we did with the re-entry interviews.” (P5, criminal justice faculty)

The increased training and “level of organization” P5 describes made it easier to take on a larger number of students. The faculty directing the project did not need to apply as much effort to train students in data handling.

“Top-Down” Resources: Appropriated Artifacts to Manage and Deposit Research Data

Top-down resources are the tools, artifacts, and procedures and other supportive infrastructure that researchers appropriated from existing formal sources. For example, organizational policies or legal dictates – rules intended for purposes other than data management – were appropriated to coordinate data management and deposit.

A major motivation for re-appropriating existing formal resources for data management and deposit was to collaborate. Making routines explicit through shared documents, common rules, and centralized resources which people were already familiar with smoothed out and helped to coordinate among research collaborators. For example, P11, a pre-tenure faculty in public health explains how she created a shared document infrastructure to manage the moving parts of data across the research team and over time:

“We have a running Google Doc that we're calling our methodology report that, when we just realized this isn't going to be a summer project, this is COVID, it is not ending, let's, like, formalize some of these things. And we just started adding lots of information in there about things like weighting [variables]… So we had people on the team who are postdocs and leaving and we were going to lose that knowledge. We're like ‘let's start documenting.’ We were like ‘write that down because we're going to have to train somebody new on it and we don't know what you're doing’.” (P11, public health)
Some implications of the documents and standardized and centralized resources were making it easier to communicate with a distributed team, where the division of labor was modular. Common documents facilitated collaboration. Another example is faculty appropriated formal agreements and shared documents to organize data among a distributed research group, such as a Data Use Agreement, or a Memorandum of Understanding (MOU). Such agreements were often used to coordinate between centralized resources, such as core facilities, or have legal documents that describe the terms of use, e.g.: “We shared the data after the two universities signed the contract agreement, the data transfer agreement.” (P8, social epidemiology).

Because routine infrastructuring involves the work of re-aligning the goals of various stakeholders, which occurs where there are situations of uncertainty, the documents established certainty and understanding among stakeholders in advance. These clear rules and agreements helped to settle ambiguity to enact data management routines. For example, in the case of P3, a tenured epidemiology faculty, using a core facility or a recharge center, multiple participants have reported some of the documents they use:

“The ordering system helps you pinpoint the structure you need in your files and then [the manager] speaks to the programmer in language, the programmer will understand to set up the file structure and so it's kind of a process where I create specifications using words, like, I'll write a paragraph or a list, and then they take that structure and...they highlight the specific files that the information is going to come from and the specific variable names that are needed and say...exactly what to do.” (P3, epidemiology)

Similarly, participants reported how the use of core facilities, data analysis centers, and what some participants referred to as “recharge” centers served as structures for data management. These centers were used for data analysis, resources provided by the university. These documents and centralized resources are indicators of institutionalization, that is, becoming taken-for-granted and an almost invisible part of the workflow. Participants emphasized how these centralized resources were becoming taken-for-granted, indicating the establishment of more mature systems for data management in their research groups. As P3, described:

“So first off, I think it's important to understand that here at the [University of X] we said we have a Center and it's housed in the school of pharmacy and the center is called Pharmaceutical Research Computing [PRC]. Pharmaceutical Research Computing has a data use agreement for Medicare, a 5% random sample of Medicare data – and that's very common, a 5% sample is a common sample that CMS sells, through their contractor – so the 5% sample is housed over in PRC and they have it for years 2006 through 2018 at this moment. Medicare data tends to lag two to three years; you can't always get your hands on it right away. What PRC has done – and I've been working with PRC for several years – so PRC they're considered to be a 'recharge center,' meaning that they can't technically make money, but what they can do is they can't profit but they earn their money through people like me who get grants and pay them.” (P3, epidemiology)

The taken-for-granted nature of the data processes are evident in a few aspects of P3’s comment – first, that there is a center for research computing specific to the pharmacy school that has been well-established, and is familiar with Medicare data, another centralized data source. Second, the reference to the “very common” standard of a 5% sample indicates that it’s a taken-for-granted standard, one which the community has converged upon. The industry standard for sampling is understood along the division of labor, to the extent that it is codified in procedures, documents, and the technologies for data processing used by the research computing center.

In addition to these taken-for-granted centralized processes, standards, and data handling understandings is a rising trend of using contractors and other means of outsourcing data activities, e.g., for survey data collection. This is in parallel with the contracting of sequencing in genomics, i.e., sending out data for analysis to an external or internal entity. They involved the use of standard procedures, documents (e.g., spreadsheet templates detailing what was needed for the analysis), shared and/or controlled vocabulary. For example, P4, P7, P11, P12 and P14 all reported using contractors for transcription, data processing, or survey research. As P12, a tenured faculty studying survey methodology described:

“So we often use contractors. We pay somebody else to collect the data for us, then they deliver a data set to us that has been de-identified. Everything gets stored on password protected servers only people who have been approved and gone through the IRB training and all of that can get access to those data then, are kept on the servers for the lifetime of the project and then archive as needed for purposes of replication depending on what the project is and the journal, and the grant funding requirements (P12, survey methodology)

Centralized resources also came in the form of funding, where reports documents and entities supporting data management were well-equipped with resources, such as personnel and a budget for research data management. While unexpected and unintended, an outcome of the use of these resources was they provided infrastructure to achieve data management outcomes in the form of ostensive routines. Formal processes, documents, and plans were associated with less data precarity.
“Borrowed” Resources: Adapting Legitimizing Principles for Data Management and Learning from Others

_Borrowed resources_ are the tools, techniques, and materials that faculty researchers adopted to help manage their data. For instance, faculty adapted or reapropriated software (e.g., Dental client database software). They also drew from legitimizing principles, and best practices from colleagues and other disciplines to systematize their data management workflows. Scientists engage in routine infrastructuring to move data closer to repositories by borrowing documents, code, legitimating principles for handling data and other resources from outside disciplines (Figure 1).

Coordinative artifacts (Bardram & Bossen, 2005) like documentation, code, and templates help to move the data by iteratively checking datasets to enable them to be deposited. Faculty drew from standards established by America Speaks, a national survey administrator. As P13, a tenured professor in public health, describes she borrows from other sources to prepare data for deposit by checking for data quality:

> “I did not do all the checks. We are actually working with a survey administrator we had contracted with at a national research Center. They run a panel called America Speaks, which operates and utilizes them on other studies as well. When I got the initial data from them we, to our benefit, inherited many of their protocols and processes for our project, which are guided by best practices and a few other kinds of, not accrediting bodies, but kind of professional oversight bodies. And so, all of that is in the documentation as well as includes some of the details of how their panel is structured should anyone, you know, really want to get into those details of how they create their lists and weights.” (P13, public health)

Similar to P13’s experience with borrowing the “protocols and processes…which are guided by best practices,” P15, a tenured faculty in public health services, used external standards and guidelines as part of her process of checking for data quality. Her process also reflected how she “inherited many of their protocols and process,” but instead of from a professional oversight body, it was from her training as a clinician:

> “The thing that probably influenced me is I came from the clinical trials world where documentation is so tightly monitored. You have auditors coming in and auditing medical charts and study documentation. So that probably influences how I think about documentation a little bit as well.” (P15, public health services)

Likewise, P6 reported that it was a “godsend” that they were able to borrow from a previous project that used similar software, and could inform their data management process: “There was a large study in in criminology that was done before us that used it and that study started in 2000 and continued to like 2007, and so we drew on their experiences from [the prior study]” (P6, tenured criminology faculty). Multiple participants had similar experiences, where they borrowed the infrastructure from previous projects to use in later projects. The systems they put in place, then, created a type of momentum ¿ where important Faculty described learning from other faculty, including mentors and webinars, borrowing the techniques discussed in other fields.

**DISCUSSION & OPPORTUNITIES FOR DESIGN**

Based upon the semi-structured interviews with U.S. academic social science faculty who submitted data to ICPSR, I have determined that scientists draw from three types of resources used to do ‘routine infrastructuring’ (as exemplified in Table 1). The three types of resources served to create supporting infrastructure to manage and deposit their research data: 1) bottom-up resources, 2) top-down resources, and 3) borrowed resources. Perhaps researchers do not rely as much on centralized, formal institutional resources as much as suggested by the explosion of survey studies of researchers’ needs for resources for data management (Akers & Doty, 2013; D’Ignazio & Qin, 2008; Hemsley et al., 2020, p. 202; Sewerin, 2015; Van Tuyl et al., 2015; Whitmire et al., 2015).

**Research Reproducibility: Does the Use of Informal Resources Inhibit Data Provenance?**

Research reproducibility is enhanced by documentation of the data provenance chain, which is made possible by explicating the set of steps taken on the data. Documentation and explicating of data provenance relies on ostensive routines - i.e., the formal rules and the artifacts which encode them – and performative routines – the steps taken to follow the rules for data documentation. Therefore, if researchers borrow or appropriate resources from outside their home disciplines, how applicable are borrowed artifacts and processes? Routine infrastructuring involves improvisation and creative re-appropriation of the tools which are ‘ready-at-hand.’ Yet, improvisation is not easily documented or structured because of its unpredictable, in-the-moment nature, raising the question: Does resource borrowing and improvisation hinder the research reproducibility?

In the study, results showed that researchers “borrow” artifacts, processes, and other resources to enact data management routines. Just as Lee (2007) showed in her development of the boundary-negotiating artifacts, we find that scientists appropriate tools and norms of other communities when the social sciences lack convergence on norms, or when no tools fit social scientists’ data management needs. Because there is a lack of precedent or due to high turnover in academic research projects, data loss is often attributable to research team members leaving – and a
lack of organization or set of rules for the continuity data management, e.g., where it should be stored, who is responsible for it, how it is described, and a contingency plan for backup. Future work in this area can assess whether there is questionable reproductivity, as the interview data suggests. This work can inform recommendations as to develop tools for the community and/or to capture improvisational activities in para data (Dahlström, 2020).

**Beyond Bureaucracy: Does Infrastructuring to Manage and Deposit Data Shape Research Design?**

Recent work in research data management has tried to shift the narrative away from research data as administrative (Wilkinson et al., 2019). However, the interviews and prior literature shows data management is constitutive of research; that is, filling out forms and identifying appropriate metadata scheme are part of data management, and while they may appear *prima facie* as perhaps “mindlessly” bureaucratic, findings from this study suggest data manage is expertise laden, is a learning process with “intellectual content.”

Here, the empirical results add a nuance to existing theory, suggesting ‘routine infrastructuring’ is not only a way to *enact* routines, but one that *creates* routines, which develops momentum that structures future practice. Lee (2007) made a similar claim, arguing that “artifacts can serve to *establish* and *destabilize* protocols themselves.” Specific to the ICPSR context, findings show that routine infrastructuring practices have ‘downstream effects’ – that is, the tools, practices, and conventions that are established ‘stick around.’ As seen with the criminology and epidemiology faculty, the routine infrastructuring done from prior projects form the “installed base” upon which the next projects are structured. This finding that infrastructuring to manage data shapes research has important implications for a perennial concern in the information science literature: how to make scientists data management routines more “mature” – e.g., using a capability maturity model for research data management (CMM for RDM) (Crowston & Qin, 2011). They face publish-or-perish pressures where data products are not foremost in their evaluation priorities.

Moreover, studies show scientists want to do science – seeing RDM as an “administrative task.” Prior studies show that scientists do not want more bureaucracy. But we still lack an explanation for why they reject models like CMM from a social, cognitive, or economic perspective. This study addresses this gap by importing ‘routine infrastructuring’ from the crisis informatics literature to argue that scientists need to adapt policy to their local circumstances; the CMM model underspecifies how to implement research in their local context. The interviews in this study also showed the role of *anticipation* in data management and deposit. If scientists anticipated the deposit of data from the start of a project, they had an “installed base” (Star, 1999) upon which to support data management processes. The scope of this project was limited to describing the resources and routines scientists adopted to manage and deposit data. Future work can build on these insights by identifying the resources that scientists use to deposit and to identify places in workflows where institutional resources fall short, addressing data loss.

**CONCLUSION**

This study investigated the research questions: *What resources do U.S. academic social scientists use in managing and depositing data to research data repositories? What are the implications for FAIR and CARE? Through an analysis of semi-structured interviews with U.S. academic faculty who deposit data to ICPSR, and deploying resource-centric theory from crisis informatics, that of ‘routine infrastructuring,’ I identify three types of resources researchers appropriate to manage and deposit research data. I show how the use of informal resources and resources external to their immediate research group and/or discipline can positively impact FAIR and CARE outcomes – e.g., preventing data loss and enabling participant privacy – but that scientists’ appropriation of outside resources can pose a threat to research reproducibility by impeding the creation of consistent provenance documentation. The three types of resources I developed may be used to inform science policy and create resilient systems for qualitative research data management and deposit to research data repositories such as ICPSR. Given the difficulty in creating resources that will apply to the specifics of every situation of each research study, the concepts presented related to routine infrastructuring and the sharing and repurposing infrastructure and practices is important both from a theoretical perspective and for actual practice in supporting data curation and deposit.*

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Exploring Information Behavior Patterns in Response to False and Misleading Health Information

Bressel, Paulina  
Berlin School of Library and Information Science, Humboldt-Universität zu Berlin, Germany  
p.bressel@hu-berlin.de

Dewitz, Leyla  
Berlin School of Library and Information Science, Humboldt-Universität zu Berlin, Germany  
leyla.dewitz@hu-berlin.de

Greifeneder, Elke  
Berlin School of Library and Information Science, Humboldt-Universität zu Berlin, Germany  
greifeneder@ibi.hu-berlin.de

ABSTRACT

False information, also known as misinformation or disinformation, has long been a serious concern in health information behavior research. The phenomenon of false information in health information behavior is complex and multifaceted, and it involves a range of factors related to the production, dissemination, and consumption of health information. This paper aims to understand through which channels people receive false health information and which information behavior patterns exist towards this kind of information. Based on 21 qualitative semi-structured interviews with interactive and visual participative elements, five patterns of health information behavior towards the receipt of false health information were identified. Further, a strong relationship between these patterns, the context in which false health information was encountered, and the information source was observed. Additionally, two specific information behavior patterns (information avoidance and intentional non-information behavior) as well as the urgency and impact of false information on the health of individuals and society, were identified as potential drivers for the dissemination of false health information.

KEYWORDS

health information behavior, qualitative research, information avoidance, false health information, misinformation

INTRODUCTION

The proliferation of digital media has led to an exponential increase in available online health information. While this has the potential to empower individuals to take control of their health and to make informed decisions, it also creates new challenges related to the quality and accuracy of health information. False information, also known as misinformation or disinformation, has long been a serious concern in health information behavior research (Karlova & Fisher, 2013). The spread of potentially false or misleading health information can have serious consequences for individual and societal health outcomes, including reduced vaccination rates, increased prevalence of preventable diseases, and a general erosion of public trust in scientific institutions (Dewitz et al., 2022). Previous LIS research has provided less clarity from an information behavior perspective on how people respond or react to false health information. Instead, there are interdisciplinary examples that examine psychological responses to health misinformation, such as factors influencing susceptibility to health misinformation (Nan et al., 2022) and the impact of misinformation on vaccination attitudes (Loomba, 2021). Therefore, the aim of this paper is to better understand from which sources individuals receive false health information and how they respond in different circumstances. Further, the aim is to identify potential drivers that promote or reduce the dissemination of false health information. The phenomenon of false information in health information behavior is complex and multifaceted, and it involves a range of factors related to the production, dissemination, and consumption of health information (Islam et al., 2020). The term false information encompasses both disinformation and misinformation. These two terms differ in the intention behind the creation or (re)sharing of the information. Disinformation refers to false information intentionally spread by individuals or organizations with malicious intent. On the other hand, misinformation refers to false information that arises from unintentional mistakes or misunderstandings. Since it is not always possible to trace the intention in the reception path, the authors of this study use the term false information to encompass both disinformation and misinformation. (Baines & Elliott, 2020).

In certain contexts, false information is more likely to spread, such as on social media platforms, where the algorithms that drive content dissemination may favor sensational or emotionally charged content over accurate and evidence-based information (e.g. Riaz, 2021). This has led to a predominance of studies focusing on social media (e.g. Koohikamali & Sidorova, 2017; Chou et al., 2018; Wang et al., 2019). This study not only focuses on social media as a driver of false health information dissemination but also examines multiple everyday health information interactions of people, which opens up possibilities to investigate behavioral attitudes towards health (false) information from a holistic perspective. This includes interpersonal physical and interpersonal digital interactions.

Despite the growing recognition of the importance of false information in health information behavior, relatively little is known about how individuals perceive and respond to false health information. Understanding the ways in which individuals engage with false information, as well as the factors that contribute to its dissemination and
impact, is essential for developing effective strategies to combat their spread. This paper aims at investigating
people's information behavior with a focus on identifying behavior patterns related to receiving potentially false
health information. For this purpose, 21 qualitative in-depth interviews with interactive participatory elements were
conducted and analyzed using a grounded theory approach with adult individuals between 20-76 years of age.

This paper is structured as follows: in the background section, we describe related works on health information
behavior and false health information. Afterwards, we describe our research design and our results. A discussion on
those results as well as limitations conclude the paper.

LITERATURE REVIEW
Health Information Behavior
Information behavior refers to the various ways in which humans interact with and react to information (Greifeneder
& Schlebbe, 2023). It encompasses the complexity of these interactions, which can involve actively seeking or
passively encountering information through different sources and channels (Wilson, 2022). Humans may engage in
a variety of behaviors related to information, such as seeking, managing, sharing, or even avoiding (Bates, 2017).
Health information behavior examines how people interact with health information, e.g. how people seek, use, avoid
or evaluate health-related information (Johnson & Case, 2012). It encompasses a wide range of studied health
practices in digital and physical environments as well as activities and contexts of health and specific illnesses
(Lambert & Loiselle, 2007). Especially information avoidance is a common phenomenon related to health
information (Sun et al., 2022), which is mainly researched concerning genetic risks (e.g. Bosompra et al., 2000;
Brashers et al., 2002; Cutler & Hodgson, 2003), and diseases, as for example cancer (e.g. Lambert et al., 2009) or
Covid-19 (e.g. Kim et al., 2020; Siebenhaar et al., 2020; Link, 2021, Song et al., 2021; Soroya et al., 2021). Health
information avoidance refers to a phenomenon where individuals actively or passively avoid or delay receiving
potentially unwanted information, which can also include avoidant behaviors (Affifi, 2009; Sweeney et al., 2010).
Studies have shown that health information avoidance can be influenced by a variety of factors, including fear,
stigma, lack of trust in healthcare providers, and negative emotions associated with illness (Howell et al., 2020).
Varieties of information avoidance were identified depending on underlying intentions and embodiments (Golman et
al., 2016). Information avoidance as well as other information behaviors may lead to increased levels of stress and
uncertainty. Kim et al. (2020) state that information avoidance is connected to misinformation and that uncertainty
about information can lead to seeking additional information (sources) as well as serving as a trigger for avoiding
information, similarly to Sun et al. (2022).

In information behavior research, the phenomenon of information sharing or information exchange is widely
discussed (Wilson, 2010; Pilerot, 2012; Savolainen, 2017). Syn and Oh (2009) have explored the underlying reasons
that motivate individuals to share information on social media; these include “enjoyment, efficacy, learning,
personal gain, altruism, empathy, community interest, social engagement, reputation, reciprocity” (p. 559). In
addition, Bao & Bouthillier (2013) identified information sharing as a collective and mutual benefit behavior, which
affects relationships. Individuals who engage with health information may evaluate and filter information to
subsequently share it with others (Tanja & Hansen, 2006) to educate, raise awareness, promote their own beliefs,
share experiences, back up opinions, or demonstrate knowledge (Bao & Bouthillier, 2013). Contrary to this, people
also tend to not share information for various reasons. Huisman et al. (2020) describe this phenomenon as part of
“non-information behavior” (non-IB). They emphasize, in relation to health, that understanding why people do not
share information is essential for understanding the process of how people interact with information and, more
importantly, how people respond to information. Two other relevant concepts for this research in health information
behavior are information resilience (Lloyd, 2014) and information resistance (Kitzie et al., 2021). Health
information resilience refers to information literacy practices for handling situational interferences to existing
knowledge (Montague, 2022). The concept of information resistance on the other hand is focusing on the
counteracting against discursive powers. This concept was identified, for example, by trans-identifying individuals
resisting cultural stereotypes (Huttunen, 2022) or members of the LGBTQIA+ community imagining alternative all
embracing information worlds, including themselves (Kitzie et al., 2021). For the purpose of the analysis, we will
use the broadest term intentional non-IB, which encompasses all facets of non-sharing, resistance and resilience.
This term should be further discussed in the IB community, as the phenomenon is a refusal behavior that differs
from other avoidance behaviors in IB research. For clarification, non-IB implies that the decision not to engage with
information also involves a conscious behavioral intention.

False and Misleading Health Information
As Nguyen et al. (2023) demonstrate on the basis of a systematic literature review over the last 12 years, false
information, referred to as misinformation, has already been studied on health matters in our field, focusing on
vaccination concerns, healthcare risk management, medical treatment and Covid-19. The internet and social media
have made it easier for people to access a vast amount of health information (Fox & Rainie, 2002), but at the same
time it challenges people's abilities to evaluate and make sense of the health information received in form of
information literacy (e.g. Pian et al., 2016; Huo et al., 2018, Chi et al., 2020). This became especially apparent during the Covid-19 pandemic (Islam et al., 2020). Tandoc et al. (2018) have proposed that being exposed to false information can prompt individuals to seek out more information in order to verify its accuracy. This can lead to individuals seeking out information from their social circle or other sources to confirm the validity of the information, particularly if they are unable to judge the source of information based on their own knowledge or to correct their understanding of a particular topic (Lewandowsky et al., 2012).

Factors that motivate individuals to share accurate information, such as emotional resonance and personal relevance, are also likely to be the same drivers that contribute to the widespread sharing of false information (Allington et al., 2021). According to the findings of Chen and Sin (2013), individuals primarily share misinformation with the objective of seeking opinions of others, expressing their own views, and engaging with other people. Emotions also play a role, because information that triggers high emotions, both negative and positive, is shared more often than information without an emotional dimension. In addition, despite the distrust in misinformation, various motivations for sharing, including entertainment, sarcasm, and education were identified by Metzger et al. (2021). Buchanan (2020) further found that individuals who encounter false information on social media often actively propagate it by sharing it, regardless of their level of digital literacy. Those who believed the false information to be true or had pre-existing attitudes that aligned with it were most likely to share it. Further Zhao & Tsang (2022), who analyzed the sharing intentions of individuals, identified a strong link between the content and falsity of false information and the tendency to share it.

The Covid 19 pandemic was accompanied by a mass of false and misleading information and evolved into an overabundance of evidence-based but also false information (World Health Organization, 2020). This so-called “infodemic” brought to light the controversial nature of the topic of health. This was particularly evident in the context of health decisions that had to be made on the basis of health information, e.g., the decision to get vaccinated (Allen et al., 2023). This issue persists and represents a significant obstacle to the advancement of public health. One particularly important area of study in recent years has been the phenomenon of how false information beliefs can be combated through information literacy (De Gani et al., 2022). While many studies have explored how people encounter and process false information (Rapp & Braasch, 2014), relatively little research has been done on the information behavior of individuals after receiving false health information.

RESEARCH DESIGN

Aim of the paper
Understanding the ways in which individuals engage with false information, as well as the factors that contribute to its dissemination and impact, is essential for developing effective strategies to combat their spread. This paper investigates people's false information behavior in regard to their health with a focus on identifying patterns of behavior related to receiving potentially false information. The two research questions for this paper are the following:

RQ1 : Through which channels do people receive false health information?

RQ2 : Which information behavior patterns are used by individuals as response to the receiptment of false health information in physical and digital environments?

Method
The DESIVE project, which aims at understanding dis- and misinformation behavior, is a three-year project (2022-2024) funded by the German Federal Ministry of Education and Research. The project triangulates data from qualitative explorations through interviews, app diary entries and surveys (https://desive2.org/). As part of the project, 21 qualitative semi-structured interviews were conducted between September 2022 and January 2023. The study uses a grounded theory approach which makes use of the elements of theory-based sampling, constant-comparison-analysis and theory development (Glaser & Strauss, 1967). Participants were recruited based on project-related events and presentations. A strategic approach to recruitment is necessary to achieve diversification of the sample in terms of socioeconomic parameters, age and gender, which was achieved through regular iterative considerations between the authors of the paper. The sample consisted of 21 individuals (female = 13; male = 8) aged 20 to 76 (7 participants under 30, 9 participants between 30 and 50 and 5 older than 51), living in Germany. Participants in the study received a monetary incentive of EUR 30 for their participation in the study. The ethics board of the faculty of Humboldt-Universität zu Berlin gave formal approval of the study and all participants signed an informed consent. Interviews were held online via the video conferencing platform Zoom and lasted between 31 to 97 minutes, with an average length of 62 minutes. All interviews were conducted by two project members in German, quotes were translated to English after the analysis. The interview guide was pilot tested in four interviews and small changes were made afterwards.
During the interviews, the first step was the identification of participants' health information infrastructures. Information sources and exemplary scenarios of information interactions in the context of health and false health information were examined as well as the trust in all identified sources. Subsequently participants were asked about their personal health information behavior towards false health information. The interviews contained a visual interactive participatory element, comparable to the concept of information horizons (Sonnenwald et al., 2001). Miroboards were prepared in advance on miro.com by the interviewers, a completed example map is given in figure 1. Screensharing enabled all participants to see their personal health information infrastructures without the need to understand the platform and its functionalities. They only verbally influenced the creation process; all technical actions on Miro were done on the interviewers side. During the interviews the boards were filled in and constructed based on the statements of the participants (see figure 1). The generated maps provided a helpful reference point for the rest of the interviews and helped to guide the discussion towards more detailed and insightful questions. Every map is individual and looks different based on explanations and experiences of the participants.

![Figure 1. Personal Health Information Infrastructure of Participant P17 (Miroboard - Example).](image)

The interview data was transcribed in a two-stage approach. First all interviews were transcribed automatically using the software Amberscript. Afterwards all transcripts were verified and reviewed manually by the interviewers. For the analysis of the data a Grounded Theory Approach was conducted. Using Maxqda, the initial coding process was conducted inductively by two researchers, starting with in-vivo and open coding which in a next step were sorted and organized in a focused coding process (Charmaz, 2014). For the qualitative analysis, visual tools of Maxqda as for example the Code-Relation-Browser or the Code-Matrix-Browser were applied.

**RESULTS**

Our analysis of various health information infrastructures, such as institutional and interpersonal entities, enabled us to identify channels that facilitate the exchange of health information. Health information, in this context, includes receiving accurate, and potentially false health information. Health information behavior patterns in regards to false health information depending on information sources and its characteristics were identified and will be discussed below.

**False Health Information in Personal Health Information Infrastructures**

People receive health information from various sources by actively or passively seeking and encountering information or by communicating with others, e.g. family members or professionals, about health. The combination of all channels that serve as information sources for an individual constitute the personal information infrastructure. This study focuses solely on the individual’s health information infrastructure.

The findings of this study indicate that the sources and actors involved in personal health information infrastructures encompass individuals from social environments (e.g. family members and friends), the professional environment (e.g. work and education), (social) media and the Internet (e.g. certain websites). Further educational, health, or research institutions, health insurance companies, and public (health) authorities are part of their infrastructures. In addition, most participants stated that information exchange and communication with others about health-related issues play a central role in the acquisition of individual and socially relevant health knowledge. Participants sometimes refer to misleading health information (e.g. information is wrong in a specific context) while talking...
about their experiences with false health information. In the following, the term false health information is used equally for both misleading and potentially false health information. While two participants were not able to remember a situation in which they received false health information (P13, P6), all other 19 participants shared personal experiences. A collection of all sources and actors, from which participants received false health information is represented in table 1.

<table>
<thead>
<tr>
<th>Channel</th>
<th>False health information received through:</th>
<th>Mentions (N = 21)</th>
<th>Channel</th>
<th>No false health information was received (or recognized) through:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-personal</td>
<td>Friends</td>
<td>11</td>
<td>Inter-personal</td>
<td>Doctors/Health Professionals</td>
</tr>
<tr>
<td></td>
<td>Family</td>
<td>7</td>
<td></td>
<td>Oneself</td>
</tr>
<tr>
<td></td>
<td>Acquaintanceships (e.g. Neighbors, Sport buddies)</td>
<td>5</td>
<td></td>
<td>Pharmacist</td>
</tr>
<tr>
<td></td>
<td>Colleagues/Fellow Students</td>
<td>3</td>
<td>Media</td>
<td>Podcasts, TV-Shows (e.g. with Researchers)</td>
</tr>
<tr>
<td></td>
<td>Political Protest</td>
<td>2</td>
<td></td>
<td>Press (digital and analog)</td>
</tr>
<tr>
<td>Digital</td>
<td>Social Media/Instant Messenger</td>
<td>11</td>
<td>Institutional</td>
<td>Educational Institution (e.g. Library, University)</td>
</tr>
<tr>
<td></td>
<td>Internet (e.g. Forums, Search Engines)</td>
<td>5</td>
<td></td>
<td>Health Institution (e.g. Health insurance)</td>
</tr>
<tr>
<td>Media</td>
<td>Scientific Output (e.g. Articles, Books, Reports)</td>
<td>3</td>
<td></td>
<td>Foundations, Health Societies, Health Authority</td>
</tr>
<tr>
<td></td>
<td>Books, Flyer, Magazines</td>
<td>1</td>
<td></td>
<td>Work place</td>
</tr>
</tbody>
</table>

Table 1. Participants Health Information Channels Where False Health Information was Received (or not).

Although it was not planned as central component of this study, Covid-19 experiences (P1, P5, P7, P16, P17, P20) or related topics such as mandatory masks (P21), PCR-testing (P9) and vaccinations (P4, P8, P9, P10, P17) were primarily mentioned in combination with the receipt of misinformation. Further false information about diseases (P16, P11), vaccinations independent of Covid-19 (P14) and the use of natural remedies (P2, P20) or alternative health products (P20, P18) were shared.

Regarding individuals in their personal environment, several participants mentioned a lack of information literacy skills, which resulted in the dissemination of false health information (P5, P8, P12, P20). Moreover, the false health information that is shared is often based on a misinterpretation of scientific studies (P8, P20, P21) and lack of understanding (P5, P19, P20), causing it to be believed, not recognized and forwarded (P21).

**Information Behavior Patterns in Response to False Health Information**

After analyzing sources of information sharing and the reception of false health information, information behavior patterns in response to false health information were identified in physical and digital environments. Among other factors (e.g. trust, personal traits, relationship), the handling of the situation and the information behavior of participants seems to vary depending on the channel from which false health information is obtained. Similar behaviors occur in all identified environments, sometimes with small differentiations. An overview about identified patterns in response to receiving false health information is given in table 2.
Table 2. Information behavior patterns of participants (N = 21) in response to receiving false health information

<table>
<thead>
<tr>
<th>Interpersonal Context</th>
<th>IB pattern</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Environment (e.g. face to face)</strong></td>
<td>Information Seeking</td>
<td>e.g. seeking contextual information after receiving potentially false health information</td>
</tr>
<tr>
<td></td>
<td>Information sharing, Clarification, Discussion</td>
<td>e.g. sharing of validated information and counter arguments in discussions to clarify that and why the health information is wrong</td>
</tr>
<tr>
<td></td>
<td>Information avoidance</td>
<td>e.g. avoiding or changing the topic containing false health information within conversations</td>
</tr>
<tr>
<td></td>
<td>Information evaluation, Questioning</td>
<td>e.g. evaluating or verifying information by seeking information afterwards or questioning the sharing individual for sources and background knowledge and reasons</td>
</tr>
<tr>
<td></td>
<td>intentional non-IB</td>
<td>e.g. listening but subsequently not reacting to the false health information within conversations</td>
</tr>
<tr>
<td><strong>Digital Environment (e.g. social media, Internet)</strong></td>
<td>Information seeking</td>
<td>e.g. seeking context information after seeing or receiving potentially false health information</td>
</tr>
<tr>
<td></td>
<td>Information sharing, Discussion</td>
<td>e.g. sharing of validated information and counter arguments to clarify that and why the health information is wrong</td>
</tr>
<tr>
<td></td>
<td>Information avoidance</td>
<td>e.g. avoiding the reception of potentially false information by leaving conversations or blocking people on social media</td>
</tr>
<tr>
<td></td>
<td>Information evaluation</td>
<td>e.g. evaluating or verifying information by seeking further information</td>
</tr>
<tr>
<td></td>
<td>intentional non-IB</td>
<td>e.g. seeing but subsequently not reacting to the false health information for example online, in comments or in messages.</td>
</tr>
</tbody>
</table>

The information behavior patterns varied the most in the personal environment of the participants depending on the sharing person (e.g., family members, friends, acquaintances). Receiving false health information from acquaintances often leads to discussions (P7, P14, P17) or in interrupting the sharing person (P20). Towards colleagues at work intentional non-IB or avoidance is rather reported (P12, P19). Participants restrain their opinion (P19), or ignore the situation after unsuccessful clarification attempts in the past: “It's just like conspiracy theories. You just don't accept it anymore. You ignore it.” (P12). In response to false health information from family and friends, participants are more willing to evaluate the information by critically questioning sources and references (P17, P18) or seeking information afterwards (P1, P16, P17, P18, P19). Additionally, in personal conversations or discussions, individuals may share validated counterarguments (P1, P5, P8, P5, P20, P21), seek information (P1, P8, P16, P17), or offer opinions (P20) in order to clarify false health information. One participant mentioned supporting family and friends in their handling of false health information by explaining:

“Look, where did it come from? Who wrote this? What could be the intention of the person or persons to claim or not to claim this? What did they claim before? Things like that, to somehow classify this long-term.” (P5)

Continuing disagreements in personal conversation or discussions result in two behavior patterns towards family and friends: avoiding the topic because of conflicting opinions (P8, P21) or trying to understand the origin leading to the acceptance of different opinions (P4, P8). These different behaviors can be attributed to closeness and mutual trust (P4, P8) or the wish to stay in contact with family members (P8, P21). If opinions were too different in friendships
on the other hand, breaking off contact in response to receiving false health information was identified (P10, P21). This has been particularly relevant in relation to the Covid-19 pandemic:

“I thought it was remarkably different, because normally Person A has an opinion and person B has an opinion. And then you have different opinions and that's where it stays. But I had the feeling that with Corona it was somehow a question not only of one's attitude, how one wants to behave or of one's convictions, but that these convictions can have an influence on others. Much more concrete than if it is about whether the person now believes in God or not. So there are other areas where someone can believe something different than me or be convinced of something different than me. But it doesn't directly affect my health. So that was kind of new, I thought.” (P17)

Intentional non-IB and information avoidance were two information behavior patterns that we observed in response to false health information. Intentional non-IB means that participants decided not to react to the false information, for example, not discussing it, not explaining it, not agreeing or disagreeing with it. Unlike information avoidance, the person continues to listen to and does not avoid the topic or the person altogether. However, once the information is received or heard, the person consciously decides not to react to it, as explained by P10 in a conversation about alternative healing methods instead of cancer treatment:

"I just listened and didn't agree and didn't speak against it because I didn't think I needed that kind of discussion.” (P10)

Referring to digital environments (e.g. instant messengers, social media, internet), this behavior occurred concerning false information during the Covid-19 pandemic. In large group chats with various people from the same sports club (P8) and when encountering false health information on the Internet (P20) or social media (P4, P16, P17) participants decided to not behave in a certain way:

"But I don't necessarily see telling strangers over the Internet that they're talking nonsense as effective. It has, it can have an effect. But I think it's often more likely to cause ignorance.” (P20)

A summary of all identified reasons for situations, in which participants intentionally decided to not behave in response to false health information is given in table 3.

<table>
<thead>
<tr>
<th>Reason for intentional non-IB</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>mental health awareness</td>
<td>“But while we're on the subject of mental health, you also kind of have to allocate your resources yourself. [...] If I had the feeling that I had to [permanently argue against it], I would be overloaded.” (P20)</td>
</tr>
<tr>
<td>lack of perseverance</td>
<td>“Because yes, I do not have the breath for it.” (P11)</td>
</tr>
<tr>
<td></td>
<td>“[others do not argue with me] because they knew to confront me, that would take some time and they wouldn't do that to themselves because they didn't want to, I think.” (P4)</td>
</tr>
<tr>
<td>lack of purpose</td>
<td>“So many different opinions that it was also difficult to counteract if someone was quite radical, in one direction or the other.” (P9)</td>
</tr>
<tr>
<td></td>
<td>“So with those who I notice on the sidelines [that they are spreading false information]. I sometimes say something. But there are some who - where is no chance of getting anywhere.” (P20)</td>
</tr>
<tr>
<td></td>
<td>“Nope, not anymore, because I noticed that they are so resistant and represent their own opinion. It's just like conspiracy theories. You just don't accept it anymore. You ignore it.” (P12)</td>
</tr>
<tr>
<td></td>
<td>“And when people just argue that way, I say, there's not much I can do about it. Instead of saying: 'Look, if you get sick, it may be worse.' if the person has come through two years of Covid completely unscathed [...] yes, what else do you think? It becomes difficult. You can only decide for yourself what is important for you.” (P1)</td>
</tr>
</tbody>
</table>
DISCUSSION

The aim of this paper was to understand through which channels people receive false health information and which information behavior patterns exist towards this kind of information. Based on our results, the spread of false health information was predominantly identified in physical face-to-face conversations with family, friends and colleagues, as well as in digital environments such as (group) chats and social media. Although health information behavior is individual, patterns towards false health information were identified among the participants, which include for example information seeking, evaluating, sharing and avoiding. It became evident that comparable patterns occur in both physical and digital environments. For this reason, it is useful to emphasize the intertwined and standalone characteristics of both digital and physical environments as part of future research on false health information. Furthermore, the influence of patterns in both environments needs to be analyzed regarding their comparability. Due to factors such as the speed of propagation and the wide range of possible recipients, the extent of some patterns could be more severe in the digital environment. Typical health information behaviors defined by Johnson & Case (2012) consequently occur also towards false health information. Two information behaviors appear to be important drivers for the dissemination of false health information: information avoidance and intentional non-IB.

Zhao & Tsang (2022) indicated that the content and especially the extent of falsity of false information is a driver for its dissemination. This was only visible in very few cases in our study. Instead, the context and source from which false health information is encountered are crucial. Information behavior patterns towards false health information are significantly influenced by personal context factors such as relationships, personality traits, and trust. Close relationships, such as those with family and friends, and a mutual sense of trust tend to lead to constructive discussions, where individuals are more willing to accept contradictory opinions and seek to understand and clarify them. Moreover, a distinction between personal and impersonal discussion settings was evident. When false health information is shared by a stranger in an impersonal setting (such as a political protest) or a professional context (such as work or education), individuals are more likely to choose not to engage with it and may even resort to information avoidance. In the context of false health information, no information evaluation or validation occurs. The lack of negative feedback therefore does not minimize the dissemination of false health information. Consequently, information avoidance can be seen as a potential driver.

Unlike in other studies related to health, the information avoidance observed in this study is not a deliberate or unconscious defense mechanism against potentially harmful information (e.g. Sun et al., 2020, Soroya et al., 2021, Howell et al., 2020). Avoidance of false health information only occurs if the health information was identified as false and unwanted. As individuals are already aware that the information is false, it is not expected to cause any

**Table 3. Reasons for intentional non-IB in response to false health information.**

<table>
<thead>
<tr>
<th>emotional relationship</th>
<th>“Um. Yes difficult, because you have somehow completely different relationships and the relationship is also very important. And you don't want to put the relationship at risk or something.” (P8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>potential aggressiveness</td>
<td>“But then, towards the end, it became really aggressive. And then I said: 'Oh no, I don't want that now either.' So I'm not the hero who somehow confronts I don't know 30 angry people and says, you're all crazy, that does not help either.” (P10)</td>
</tr>
<tr>
<td>abstractness of arguments</td>
<td>“So it was really so much. Um. I forgot the word. Um. Yes. So very contrived and very, very absurd. I actually didn't react to that either, because there again I had the feeling that it was so abstract.” (P4)</td>
</tr>
</tbody>
</table>
harm as long as it is not shared for entertainment or sarcasm reasons (Metzger et al., 2021). Furthermore, this study shows that information avoidance cannot be attributed to commonly identified drivers such as uncertainty (e.g. Case et al., 2005; Sairanen & Savolainen, 2010), stigma and lack of trust in healthcare providers (Howell et al., 2020) or required, undesired actions (Sweeney et al., 2010; Dwyer et al., 2015; Song et al., 2021). Instead, information avoidance within this study can be equated with the need not to receive information that is considered incorrect and therefore does not correspond to one's worldview or opinion on the specific health topic. This type of information avoidance is referred to as dissonance information avoidance (Chater & Loewenstein, 2016, Golman et al., 2016). Similar to Afifi (2009) and Dai et al. (2020), information avoidance is not limited to information as entity but also to avoiding behaviors that result in the avoidance of receiving information (e.g. unfriending, blocking etc.) to regain control by curating ones’ own information infrastructure. Additionally, actively avoiding false health information seems to be linked to the avoidance of aversive emotions (Siebenhaar et al., 2020). Emotions therefore seem to be not only a driver for information seeking (Savolainen, 2014) but also for information avoidance. Another driver for the dissemination of false information is a related behavior pattern defined as intentional non-IB. In certain scenarios, individuals may deliberately opt not to react in response to false health information. This behavioral pattern tends to emerge in situations in which engaging in a discussion with the person disseminating inaccurate information would yield no benefit or meaning or could potentially harm one's mental well-being or damage the current relationship. In some cases potential aggressiveness of the sharing person(s) or lack of knowledge towards the discussed topic result in this behavior pattern. Intentional non-IB seems to be a filtering mechanism (Talja & Hansen, 2006), which results in filtering false health information without marking it or acting on it. Intentional non-IB also seems to be different from information avoidance. Contact, conversation, or receipt of information are not avoided (which can be both active and passive), instead, a conscious decision not to react or behave towards the information follows. In the context of false health information, it is consequently neither corrected nor supported but also not avoided. To the authors knowledge, this behavior pattern has not yet been studied in comparable information behavior research besides information non-seeking (Manheim, 2014) and information non-sharing (Huisman et al., 2020), and would be interesting to analyze in other contexts as well. It is worth exploring whether intentional non-IB can be considered a type of information resistance (Kitzie et al., 2021, Huttunen, 2022) or information resilience (Lloyd, 2014; Montague, 2022), because individuals do not always have to resist or handle discursive powers in situations where they consciously decide not to react to false health information. However, similarities to both concepts are apparent.

In contrast to Kim et al. (2020) and Sun et al. (2022), who identified information avoidance as potential transition to information seeking, in this study the health information behavior ends after information avoidance. The same applies to intentional health non-IB. Both behavior patterns mean that the person who shares false information does not receive a negative response to the information shared. Consequently, there is no evaluation and clarification of the false health information. If people with similar opinions subsequently receive this information, or people who cannot classify it, for example due to ignorance or uncertainty, the falsity of the information is not revealed. This results in the further dissemination of false health information, regardless of the intention of the person sharing. Accordingly, information avoidance, as well as intentional non-IB appears to be a critical driver for the dissemination of false health information. Link (2021) identified a similar connection between information avoidance and the dissemination of misinformation on Covid-19. In regard to the dissemination of false health information, this warrants attention in future research.

Although false information on health matters has received limited attention in information science, the Covid-19 pandemic has prompted an increase in research on the impact of false information on health (Nguyen et al., 2023). The Covid-19 pandemic, which began in 2020, has brought the issue of false health information to the forefront of public consciousness, making it relevant to all members of society. Although this study did not focus exclusively on Covid-19, it was frequently mentioned as an example for the receipt of false health information. However, other topics, such as chronic diseases, homeopathy, (alternative) pharmaceuticals, and nutrition were also mentioned. The study identified a relationship between the urgency, importance, and prevalence of false health information, and how individuals respond to such information in terms of their information behavior. If shared information has an impact on the society and could potentially lead to a serious or fatal impact (on someone's health), participants are more willing to behave towards this information in form of discussions or the sharing of validated counter arguments, as well as increased information evaluation and health information literacy activities. In particular, the possible influence of false information on one's own health or the health of others seems to determine how participants behave towards it. In this context the content of the false health information influences the behavior pattern towards it, similar to Zhao & Tsang (2022). If the influence is assessed as low, negative feedback on the false health information is less likely to occur, because individuals avoid or do not react to the information. Consequently, the false health information is not questioned, which, in addition to trust in sources (Boutron et al., 2019, Buchanan, 2020), potentially lacking information literacy (Karlova & Fisher, 2013, De Gani et al., 2022), similar beliefs and personal relevance (Buchanan, 2020, Allington et al., 2021) as well as misinterpretations or lack of knowledge, can
promote the spread of false health information. However, it should be noted that this hypothesis may not apply universally in all cases because, for example, during Covid-19, despite the social relevance and need for correct information and the potential dangerous impact, much false information was distributed. In this exceptional situation, however, other factors such as overload, information avoidance and distress also have to be considered, as Siebenhaar et al. (2020) indicates.

LIMITATIONS AND FUTURE RESEARCH
This study has limitations regarding its sample and research design. Except for four, all participants had a higher educational background. Although no significant differences in the behavior towards false health information and information literacy skills were identified, re-recruitment for follow-up studies are intended. Furthermore, the research design of qualitative in-depth interviews is not ideal for the analysis of the person’s false information sharing behavior. Instead, participants tend to report on the information sharing behavior of others and how they react to it. For this study, it has not resulted in negative implications but for future research this ought to be considered.

All participants were aware of the existence of false health information and most participants were able to report experiences. They also referred to information literacy skills, which helped them handle false information. Nevertheless, because of the participants' self-reports, it cannot be assumed that everything they perceived as false health information was false, and everything that they reported as accurate information was accurate. An experimental study that is built into the qualitative design could be used to further investigate the individual understanding of false health information.

CONCLUSION
This study examined how individuals perceive and respond to false health information. Qualitative semi-structured interviews with 21 participants revealed various patterns of health information behavior, and a strong relationship was observed between these patterns, the context in which false health information was encountered, and the source of the information. Factors that influence the health information behavior are the personal context such as relationships, personality traits and trust.

Most information behavior patterns (seeking, evaluating, discussing and sharing) seem to minimize the dissemination of false health information, if they are used to identify and clarify false health information. None of the participants mentioned sharing false health information themselves, which can be explained by the research design. However, based on the identified information patterns, two potential drivers for the spread of false health information were apparent. First, information avoidance and intentional non-IB seem to promote the dissemination of false health information, due to the absence of clarification and subsequent continuous potential spread. Second, the assessment of the urgency, personal and societal relevance, and potential impact of false health information was found to be a significant driver in its dissemination. However, this driver of dissemination seems to be linked to other phenomena such as information overload, information avoidance and distress. False health information can have serious consequences for individual and societal health outcomes, and addressing the drivers of dissemination is an essential step towards curbing its spread.

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Understanding Reactions in Human-Robot Encounters with Autonomous Quadruped Robots

Chan, Yao-Cheng  The University of Texas at Austin, School of Information, USA  |  ycchan@utexas.edu
Hauser, Elliott  The University of Texas at Austin, School of Information, USA  |  eah13@utexas.edu

ABSTRACT
Incidental human-robot encounters are becoming more common as robotic technologies proliferate, but there is little scientific understanding of human experience and reactions during these encounters. To contribute towards addressing this gap, this study applies Grounded Theory methodologies to study human reactions in Human-Robot Encounters with an autonomous quadruped robot. Based upon observation and interviews, we find that participants’ reactions to the robot can be explained by their attitudes of familiarity, certainty, and confidence during their encounter and by their understanding of the robot’s capabilities and role. Participants differed in how and whether they utilized opportunities to resolve their unfamiliarity, uncertainty, or lack of confidence, shedding light on the dynamics and experiential characteristics of Human-Robot Encounters. We provide an emerging theory that can be used to unravel the complexity of the field as well as assist hypothesis generation in future research in designing and deploying mobile autonomous service robots.

KEYWORDS
Human-Robot Encounter; Human-Robot Interaction; Quadruped Robot; Autonomous Robot; Grounded Theory

INTRODUCTION
With the proliferation of robotics technologies, especially in businesses using robots to facilitate operations (Rindfleisch et al., 2022), encounters with robots in everyday life environments are becoming more frequent. Despite all the benefits provided by robots, reported hostile reactions to robots and robot bullying indicates that there are underlying issues with robot deployments. For instance, in 2014, Smith and Zeller (2017) deployed a hitchhiking robot called hitchBOT to investigate human reactions to it. HitchBot successfully hitchhiked across the world in several trips, however, in 2015, it was found vandalized when it attempted to travel across the U.S. The vandalism against hitchBOT was an unfortunate event and posed a grand challenge to both robotics scientists and Human-Robot Interaction (HRI) researchers: How do humans handle robot encounters in everyday life environments?

To start answering this question, HRI researchers have begun to explore Human-Robot Encounters (HRE). As an emerging research topic of HRI, HRE studies the implicit and indirect interactions between humans and robots when both parties unintentionally encounter each other in everyday life environments. “Many people affected will in fact not be users of robots but will just ‘happen to be there’” (Rosenthal-von der Pütten et al., 2020, p.1) As HRI studies tend to focus on direct interactions, HRE broadens the scope of HRI research by incorporating other forms of interactions. For example, a college student who is walking on campus encounters a delivery robot walking toward her. In this case, HRE researchers may study how she perceives and reacts to the robot without her actually using it. The interaction between the spatiotemporal co-located student and the robot is subtle, indirect, unintentional, and yet socially profound. The student’s perceptions and reactions to the robot are likely to be influenced by factors such as the social cues presented by the robot, the physical environment surrounding them, and the student’s social judgment of the robot (Babel et al., 2022). Currently, many organizations adopt quadruped robots for deployment to utilize their enhanced mobility and the ability to carry objects. Their navigation and autonomy capabilities allow them to generate multiple human-robot encounters. However, past studies and news articles showed that the deployment of quadruped robots had received public criticism, and evoked fear and ethical concerns (Yunus & Doore, 2021), indicating there were challenges to wide and comprehensive robot deployment as well as the need for more HRE research.

Given the complexity and understudied nature of HRE research, this study applies Hoda’s Socio-technical Grounded Theory (2021) to explore how people react to encounters with Boston Dynamics Spot, a quadruped robot. Grounded Theory methodology is well-suited to study HRE because of HRE’s rich social nature, and the methodology can be used to analyze the data collected and generate a theory to explain HRE as a sociotechnical phenomenon. We apply participatory observations in a lab-based HRE study and conduct semi-structured interviews to collect in-depth data. Following Hoda’s guidelines (2021), the present study is preliminary and small-scale, and the data collected is not comprehensive enough to generate a mature theory. Therefore, this study focuses on providing an emerging theory that explains the data collected so far and can be used to generate hypotheses in future research. Our emerging theory proposes that human reactions to an autonomous quadruped robot in an HRE scenario are associated with humans’ familiarity, certainty, and confidence in encountering robots.
RELATED WORK
Following Hoda (2021), we conducted a lean literature review before the study, and a targeted literature review after data analyses (p. 14). In this section, we present the works that serve as the basis of our study.

The fast development and deployment of robotics systems in human society increase the chances of humans unintentionally encountering robots, therefore it is of paramount importance to understand this emerging phenomenon. Due to technology limitations, early works on HRE relied heavily on observations and wizard-of-oz setups. Additionally, these works focused more on what people think and behave prior to the actual and direct interactions, and then proposed recommendations to improve interaction quality in general. For instance, Bergstrom et al. (2008) conducted a field study, observed how people react to a humanoid robot in a mall, and classified the people into groups of Interested, Not Interested, Indecisive, and Hesitant based on their speed, orientation, and position. The authors further examined the effect of different types of robot behavior on perceived naturalness and concluded that the match between robot behavior and the type of people would allow them to perceive the robot as more natural. Even though the main focus of this study was not on HRE, it did emphasize the importance of understanding human behavior that was prior to direct interactions. In a recent work on Social Robotics, Avelino et al. (2021) explored the literature on social robots’ greeting abilities in encountering new users in a social context. The authors emphasized the importance of first impressions and the development of robot capabilities that would lead to a better experience for new users. The authors also pointed out that future research on Social Robotics should examine how non-verbal communication between robots and humans can lead to better encounter experiences. Both of the reported studies are not HRE research, but they contributed knowledge to different aspects of HRE.

HRE research is expanding but the dearth of it means that it is still understudied. To answer this challenge, Babel et al. (2022) adopted a box-like cleaning robot and deployed it in a busy train station. The authors recruited people who walked past the robot and asked them to answer a questionnaire. They also observed and interviewed the people. Their results showed that people had concerns about collisions between robots and pedestrians, job loss, and inconvenience caused by the robot’s lack of communication capabilities. This study provided empirical findings about human reactions to an autonomous robot in public. However, robot vacuums have been available to the public for several years, so people might be more familiar with cleaning robots in general. This leaves the question that if people would react to a more technologically advanced robot in the same way. In one of the most recent works on HRE, Moesgaard et al. (2022) conducted ethnographic research to study how people would react to a primitive mechanoid robot that did not follow social norms. Their results indicated that people not only utilized their prior knowledge of robots and robots’ behavior to evaluate them, but also drew upon membership categorization frameworks to make sense of them. The authors emphasized the notion of humans and robots will soon come to co-exist in this world, and HRI research should expand beyond the idea that humans are only direct users of robots, as more and more research has touched upon the indirect interactions between humans and robots. Furthermore, the authors argued that robotics system designers should not only focus on the capabilities of robots but also on how people feel about them, especially in public settings. This argument also implied that HRI researchers should take into account the rich social nature of HRI and HRE in future research. Another HRE work by Hardeman (2021) used a wizard-of-oz setup and conducted field research on 28 people who walked past a wheel delivery robot. The results were similar to Babel et al’s (2022) work where people showed concerns about collisions, privacy issues, and the lack of communication capabilities. The topic of this study was similar to our research; however, this study was exploratory in nature and also adopted a primitive robot. Nevertheless, their results seemed to show that people had neutral to positive reactions to the robot.

HRE research is still nascent. The reported works have studied how people perceive and react to robots that they accidentally encounter. However, those works investigated HRE by focusing on how people react to a robot in general, without taking into account the appearance and capabilities of the robots being used. In other words, it is still unclear whether their findings would apply to other types of robots as well as if there were any hidden factors. As presented by Babel et al. (2022), the authors investigated human-robot conflicts using humanoid, zoomorphic, and mechanoid robots, and found that human compliance and acceptance differed between the robots. We argue that the zoomorphic form of Boston Dynamics’ Spot may elicit different human cognitive and behavioral responses. Additionally, since the public sale of Spot in 2019, it has received mixed reviews from the public on major social media. A sentiment analysis of Twitter conducted by Moses and Ford showed (2021) that on the one hand, people were amazed by the technology, on the other hand, the dog-like robot’s connection to military use scared many people. Most people had not seen dog-like robots in real life and their perceptions of them mainly originated from the impressions of them from watching online videos, movies, and TV shows that showcased robot dogs. The authors called for more research on this topic. To the best of our knowledge, no research has studied how people react to an autonomous quadruped robot when they accidentally encounter one. Therefore, we aim to fill this gap by using Grounded Theory methodologies to explore human reactions to an autonomous quadruped robot and propose an emerging theory that can be adapted to generate hypotheses in future research.
METHODOLOGY
This research followed Hoda’s (2021) Socio-technical Grounded Theory. The site of our study was a lab-based HRE study that investigated human perceptions of a quadruped robot (Hauser et al., 2023). We conducted participatory observation while assisting in the data collection for the HRE study, and interviewed the participants to understand their experiences in the study. This work presents our analysis of the experiment and interview data, fieldnotes, observations, and a variety of other sources, such as the original experiment protocol and interview guide.

Detail of the Study Site
A total of 21 participants were recruited from a local university through an email list. Eight of them identified as male and 13 of them identified as female. Seven were undergraduate students and 14 were graduate students. The participants’ majors included Information Studies, Computer Science, Latin American Studies, Biochemistry, and Biomedicine Engineering.

The HRE study consisted of (1) a lab-based experiment, (2) a survey, (3) a free-form interaction session with the robot, and (4) an interview. The robot adopted in the experiment was the Boston Dynamics quadruped robot Spot. In the experiment, participants were asked to walk from one end of a simulated hallway to the other end (Figure 1). Meanwhile, the robot was programmed to autonomously walk from the opposite end to where the participants were standing. The participants and the robot would encounter each other roughly in the middle of the hallway. The robot was programmed to avoid the participants autonomously and then keep walking to the destination. The participants were not notified what would happen in the hallway and were only instructed to walk freely and pass the robot however they felt natural. There were two conditions in the experiment, namely Leashed, and Autonomous. For the Leashed condition, a research team member walked together with the robot, holding onto a leash that was tied to it (the robot still walked autonomously). For the Autonomous condition, the robot walked by itself without the leash or and presence of the research team member. The Leashed condition was designed to test whether the presence of a human and canine behavior visual cue would influence the participants' reactions (see Hauser et al., 2023 for more detail). After the experiment, the participants were asked to answer a survey regarding their perceptions of the robot. The free-form interaction session came after the survey. The participants were offered a chance to interact closely with the robot, take photos or videos of it, and ask any questions they might have to the research team. They were also offered opportunities to see the robot perform additional tricks such as sitting down and dancing. After this session, the participants were instructed to join the interview.

Figure 1. The simulated hallway, both the robot and participants walking in it.

Interview
The interview was semi-structured and consisted of seven core questions, including (1) the participant’s experience in the hallway, (2) the influence of the presence of humans, (3) the participant’s experience in the free-form interaction session, (4) the participant’s speculation of their reactions to the robot in non-laboratory settings, (5) improvements to the robot, (6) the participant’s familiarity and prior experience with robots, and (7) the participant’s speculations of the robot’s purpose in the study. The interview was supplemented with follow-up questions that were prompted by both the participant’s answers and the researcher's observations. The first round of interviews (12 participants) lasted around 20-25 minutes and included only the first six core questions. As data collection and analysis happen simultaneously in Grounded Theory studies, we identified a prototypical question “What is the
robot doing here” that was commonly raised in the first round of interviews. Therefore, we decided to add the 7th core question for the second round of interviews, which lasted around 25-40 minutes.

**Data Analysis and Source**

We adopted an integrated data collection and analysis process, which is characteristic of Grounded Theory methods. During the data collection process, the authors reviewed the interview data collected and conducted the initial analysis with open coding and constant comparison. The categories that emerged from the data prompted us to adapt the interview protocol as mentioned in the section above. The participant recruitment ended when we reached theoretical saturation. After the data collection was finished, we conducted iterative data analysis. We first coded participants’ reactions in different phases of the HRE study, and then we coded what influenced the participants’ reactions. The coding and constant comparisons were conducted iteratively until the theoretical categories emerged. Finally, we conducted memoing to document our interpretations of the theoretical categories which were the reactions in relation to familiarity, certainty, and confidence in encountering an autonomous quadruped robot.

Ongoing participatory observation in robotics research guided the author’s interpretation of these findings. The authors recorded and discussed their experiences in assisting with the administration of the HRE study protocol. These experiences prompted follow-up questions for the interviews and informed the interpretation of the interview data as well. Iterative writing, analysis of fieldnotes, and basic memos all guided integrated data collection and analysis.

**FINDINGS**

We first describe the participants’ reactions to the robot. After presenting and illustrating these, we focus on moments where participants described changes or shifts of reactions. Then we analyze the reactions and changes in terms of familiarity, certainty, or confidence, find patterns within participants along these facets, and propose and explain in detail our emerging theory: Human reactions in encountering an autonomous quadruped robot are influenced by their Familiarity, Certainty, and Confidence. (Figure 2). Finally, we describe the phases of the HRE study protocol in terms of the opportunities they present to the participants to increase their familiarity, certainty, and confidence in encountering an autonomous quadruped robot.

![Diagram](image.png)

**Figure 2.** Our emerging theory: Human reactions in encountering an autonomous quadruped robot are influenced by their Familiarity, Certainty, and Confidence.
Participants’ Reactions
This section briefly describes the participants’ reactions we saw in our data. In the following sections, we elaborate on what influenced participants’ reactions and why there were changes in reactions. All participants expressed that they were generally curious and excited about robots, so they wanted to learn more about robots by participating in this study. As for their first impressions of the robot, the participants reacted as surprised, scared, cautious, curious, and not surprised. There were two major inflection points when participants’ reactions changed, including (1) the moment when they realized the robot would avoid them in the hallway (i.e. the encounter), and (2) the free-form interaction session. These inflection points made participants who were initially scared or cautious feel relieved, surprised, more comfortable, or become curious and impressed, whereas participants who were initially curious or surprised stayed curious or became excited and impressed. After our coding and constant comparisons of all interview data, the changes in reactions appeared to be the results of changes in familiarity, certainty, and confidence in encountering the robot. During the inflection points, several opportunities were utilized by the participants that helped them gain more familiarity, certainty, and confidence in encountering the robot. These were accomplished by having a better understanding of the robot’s capabilities and role, as well as the increased mental proximity between the participants and the robot.

The Relationships Between Reactions, Familiarity, Certainty, and Confidence
This section details our emerging theory characterizing human-robot encounters in terms of participants’ familiarity, certainty, and confidence. We first describe what influenced the participants’ reactions and how the reactions relate to familiarity, certainty, and confidence. Participants’ initial reactions were influenced by their prior experiences with robots and their first impressions of the robot’s capabilities, including its appearance, walking, the sound of footsteps, and cameras. Many participants were unfamiliar with the robot, uncertain of what was going to happen, and were not confident enough that it would be perfectly safe to walk to the other end of the hallway. After the encounter, some reported becoming more certain and confident of their understanding of the robot’s purpose. In the free-form interaction session, they also increased their mental proximity to the robot by being able to touch it and get close to it. These opportunities helped the participants gain familiarity, certainty, and confidence in encountering the robot. The participants also reported that the presence of a human afforded them a sense of familiarity, and more certainty and confidence that the robot was safe.

Prior Experience with Robots
Participants’ prior experience with robots influenced their first impressions of the Spot platform. Every human has their own prior experiences, familiarity, or associations with robots. To some people, encountering a robot may be as normal as encountering a car. To others, a robot may appear as an out-of-this-world species. Even though encountering robots is still uncommon for most people nowadays, some participants reported that they had seen dog-like robots in movies or TV shows before. Yet interestingly, their reactions differed. Some participants had seen dog-like robots before and they were curious about the experiment. “I’ve seen such a form. So I was just reminded of them. And I was really curious to see what it does and what the experiment really is.” - P04. Other participants remembered that dog-like robots were like predators in movies so they would need more time to be more familiar with it. “Because I watch a lot of movies, where robots do come to life. It was walking like a dog or like a predator. So it did feel a little bit, it would take time getting used to.” - P12. One participant was cautious of the Spot platform because dog-life robots were weaponized in a TV show. “In Black Mirror, the robot is exactly like this dog. And there’s a sword that comes out of it. The sharp thing comes out of its body and it attacks you, so I was like really cautious if something is just going to pop out of it.” - P19.

Robot’s Capabilities - Appearance
To most of the participants, the HRE study was the first time they saw a Boston Dynamics Spot in real life. Without any information about the Spot platform given to them prior to the study, they were unfamiliar with the Spot platform and uncertain about what it can do or was going to do in the study. “I was like, asking myself questions about what’s gonna happen next.” - P10. Due to its dog-like appearance, some participants implicitly treated the robot as a wild animal. They seemed to expect that the robot would act like a certain animal and projected some stereotypical wild animal behaviors onto the robot. “kind of similar maybe to some other animals like a black panther, like those animals, because those animals usually have long legs and are good at running”, - P06. This projection made some participants cautious because of the possible outcomes of encountering a wild animal. “Probably because this [ robot] had limbs. That doesn’t have limbs [other delivery robots]. I know that cannot charge and cannot run like an animal behind me. But this doesn’t give me the same security.” - P07. To others, the connection between the robot and wild animals was even alarming as they thought the robot might hurt them when they got closer to it. “When it was walking towards me, it definitely looked like a dog. When it came closer, it wasn’t like fear but it was just a momentary shock. Like, what if it jumps on me?” - P12. The answers showed that the unfamiliarity with the robot and the uncertainty of its capabilities made some participants react negatively. On the other hand, participants who recognized Spot as a robot that looked like a creature were intrigued by its appearance.
“I would say the looks of it stood out to me, the way it looked modern and robot-like, and also, like a creature at the same time. So that is what intrigued me. And I found that interesting. Me being maybe more on the techie side, curious about technology, and like future technology and stuff. I'm more comfortable with it. Because I see the possibilities.” They seemed to be comfortable with Spot because they perceived Spot as a robot. This perception allowed them to associate Spot with technology and afforded them more confidence and certainty that Spot would behave like a robot. “Yeah, I mean, I was pretty confident walking by, I wasn't worried or anything like the robot or something would happen to me” - P01.

**Robot’s Capabilities - Walking**

Due to technological constraints, the Spot platform continuously stepped in a fixed rhythm when walking or turning in order to prevent falling over, producing a kind of marching gait. This was a major difference in gait compared to the relative smoothness and stillness of quadrupedal animal movements. This marching gait seemed to make participants less confident that it was safe when they were approaching the robot. “When it started walking like ‘Ta Da Ta Da’, I got a little startled. But then I had in my mind that it's going to come towards me. So I was, overall scared.” - P07. The robot’s ability to walk was frequently cited by participants in interviews. Some participants described the robot’s quadrupedal gait as unusual, particularly its mechanistic character. “I did feel like the walk, or the style of it walking was a bit mechanical. So when I first saw it coming, walking towards me, it took me a second to get used to that.” - P14. This unfamiliarity led to a feeling of surprise. “When it started moving, I was a little taken by like okay, this moves a little differently.” - P08. Some participants commented that even though they knew being near to the robot was safe, its unusual gait made them nervous simply because they were not used to it. “When it started walking, it kind of made me nervous, to be honest […] Like I knew that it was safe, but it’s not something that I’m used to.” - P15. The robot’s gait was cited multiple times as something that needed improvement, especially when participants were asked whether the robot would be suitable for deployment outside a laboratory environment. “After it walks a little bit naturally and makes less noise, then it would make sense, then it would easily blend in with the surroundings as well. Not necessar[ily that] it should look like a natural dog. But it will easily blend in” - P16. This answer implied that participants presumed most other people would be unfamiliar with quadrupedal robot gaits. There were also other participants who identified the robot’s gait as its major difference from the more familiar quadrupedal walk of a dog. “It looked to me like a dog. […] But the thing is, it was maintaining its pace, which dogs do not, generally mostly might not do. They might walk faster or slower. So I figured that it’s not a dog.” - P18. Such comments reveal both the novelty of robotic gaits and the association of quadruped robots with canines.

**Robot’s Capabilities - The Sound of Footsteps**

In the HRE study, the hardwood flooring made the robot’s footsteps loud. Several participants were initially surprised by the sound of the footsteps because they were simply louder than expected. “That thumping noise that it was making, that was also, again, because I was not expecting it to make that noise, so when it started, I was just taken aback.” - P08. The unexpected noise from the footsteps was even scary to another participant. “When I saw it, it was fine. But then it started walking it was really loud. That's the first thing I noticed. And I feel like if it was a little quieter, I wouldn't have been as nervous or scared around it.” p02. The sound was also a cue that seemed to make some participants perceive the robot as a wild animal. “I didn't know that it makes that noise that horse makes.” - P07. Despite being surprised by the sound, several participants soon realized that the reason why the footsteps were loud was because of the hardwood flooring of the hallway, and the sound might be normal had the robot walked on a cement floor. “The sound of it walking kind of struck me, but I kind of think the possible reason can be that it was a wooden floor. […] But if it is maybe a normal, cement road, or like, ground or a track, maybe it wouldn't sound that much.” - P17. The recognition of the effect of the physical environment helped the participants understand why the robot was making the sound, and the negative reaction was not as strong as others.

**Robot’s Capabilities - Camera**

Several participants noticed the cameras on top of the Spot platform. Some of them were curious about the camera’s utility. “I was asking more like technical questions about the camera and the laptop attached. I'm still curious about that. Like, was the robot able to sense that I walked up on this side of the hallway, and then it changed its path? Is that what happened?” - P02. Others were concerned about privacy issues. “If people on a street see that there’s a camera on this thing, and it’s recording them or seeing them, then they might feel like okay, this is an invasion of my privacy or something.” - P20. In general, privacy issues did not seem to be the main trigger for the participants to react negatively. Participants seemed to acknowledge that cameras were essential for autonomous robots, and our society was already full of cameras, such as smartphones and street cameras. In other words, the participants were already familiar with the idea of being exposed to cameras and that the robot’s cameras were not used to spy on them. “There will be scenarios that I might think that it is kind of recording, or it is watching or who is watching or whatever it is. But I do agree on the point that if there is a robot working, delivering stuff, I wouldn’t mind.” - P17.
Robot’s role - Purpose
During the interview, a prototypical question “What is the robot doing here” was frequently asked by the participants. This question prompted us to try to understand if knowing the robot’s purpose was important, and if there were any changes in the reactions after knowing that the robot would avoid them. Firstly, some participants were curious about what the robot was going to do. “It was the point of just passing through, and I didn’t know what was going to happen. So I was just curious about that what the interaction would be” - P04. Having little certainty about the robot’s actions was uncomfortable for some participants. “I was kind of thinking about who’s gonna make way for the other. Am I gonna crash into the robot or something? So that kind of made me feel a bit uncomfortable.” - P20. Upon reflection, participants replied that they would be less cautious had they known what the robot would do. “If I know that the robot is just to walk from that side to this side, which I already knew. And the robot might change its path to stay in its lane, then I could be a little less cautious. And also, I would say safe, because I know what it’s trying to do and what it can be, it might not do anything to me. It's just completing its work.” - P18. After knowing that the robot would change its lane and avoid the participants, some of them felt excited. “I just felt excited about seeing how it avoided me” - P05. Another participant seemed to become a lot more confident in encountering the robot. “It sensed my movement, and it changed its direction. After that, I became extremely normal. I was like, okay it's a good robot. After that, I have been completely warmed with it.” - P07. In addition, some participants also increased their familiarity with the robot and confidence in walking across it by associating it with typical pedestrians, and the robot was just tasked to do something. “I felt like it had a mission, the robot doesn’t care about me, it was tasked to move from point A to point B.” - P10. Some participants felt that it was important to know the purpose of autonomous robots because robots were developed by humans, so their actions were determined by the intentions of the developers. “Maybe it’s being controlled or it's been made, it's been programmed by humans, I would be curious to know what was the human thought process or like why did they think it's okay to let the robot out? ” - P14. Another reason why knowing robots’ purposes was important was that humans’ actions might depend on the robot’s purpose. “I feel like it's important to know, like, if it's an emergency, you can get out of his way. But if it's like running deliveries or whatever, then you don't have to be as conscious about it. As long as the purpose of the robot is always clearly stated, no one's gonna have a problem with it” - P21. This was also an indication that being more certain of robots’ purpose can have reciprocal benefits to both humans and robots. Overall, knowing what the robot would do was a resolution to many participants’ uncertainty about the encounter. “I now know that it's a robot, and what it does, like how it walks. So I was pretty much okay, knowing what this is.” - P08.

Robot’s role - Presence of Human
In the Leashed condition of the HRE study, there was a research team member walking alongside the robot with a dog leash tied to it. The presence of a human next to an autonomous quadruped robot resembled a typical human-dog dyad which increased the participants’ familiarity with encountering the robot. “I think because we're at a stage with robots, like they're so new. That seeing a person with a robot, you can recognize a person. There's this familiarity factor. Like I can recognize a person and if a person's okay with this robot, it must not be scary, or anything like that. Maybe that's why I wasn't extremely uncomfortable with it.” - P13. The higher familiarity with the human-robot dyad was also comforting to some participants. “Having a person holding the robot was very comforting” - P02. Some participants also commented that besides the familiarity factor, they can also judge if a robot was safe by assessing the human next to it. Additionally, if the robot caused something, the human could be held responsible. “I can see the human, and I can judge his intentions, and even if something is going wrong, I can hold him accountable”. - P19. Some participants commented that having a human present meant that the robot was under control, which offered some certainty and confidence that encountering the robot was safe. “Maybe more secure, that at least a human is having a hold of the robot. So if something happens, just in case, they have at least control over it.” - P17. Some participants assumed that robots would have an emergency button, and humans could shut it off if anything dangerous happens. “I will just assume that there was an off button, you can just put on the code and they'll shutdown, or you can just shut it down manually. So I didn't feel worried about that at all.” - P09. Another participant made an interesting comment that since robots do not have emotional control, then having a human controlling it will make people feel safer. “Since robots in our society are not normalized yet. I feel robots need to be controlled by humans with EQ, robots don't have EQ. So if it's going to do something dangerous to children, maybe in a park, humans need to have a button to shut it down.” - P07.

The Mental Proximity Between the Robot and the Participants
In the free-form interaction session, the robot was stationary at first and some participants felt the robot was friendlier compared to when it was walking. “When I was nearer to the robot, it was standing there quiet so that I felt like it's more friendly.” - P21. The sense of friendliness could be a result of knowing that the robot would avoid the participants and the lack of loud footsteps. Additionally, when the research team operated the robot to perform additional tricks, many of the participants felt fascinated by it and became more interested and curious about what else it can do. “I was surprised that it can lay down as well. Like, I think after the second interaction, it makes me
feel more curious and more positive on the robot because it can do a lot of tricks.” - P11. The interaction session was also an opportunity for the participants to get close to the robot and observe its machinery and technological parts. “After I took a closer look at all the components and everything, I was amazed how it was working perfectly with all the heat running through.” - P09. Many participants took the chance to interact with the robot directly, “I was like getting near it. And I wanted to see it sit and I want to take pictures of it.” - P07. The direct interaction, such as photo taking and touching, gave the participants more certainty that the robot was safe. “When I touched it, I felt more like safe with it in a way, it made it more real, I think it stops becoming something that like I can't reach or something that I shouldn't be able to touch, or like not interact with. It was more like Oh, you're here. I'm here. We're in the same space.” - P15. The increased mental proximity between the participants and the robot was a resolution to many participants' negative reactions to the robot earlier in the hallway. “During the second time, when seeing the stepping scene or how it turned or how it behaved, I don't feel that like scared.” - P05. Some participants also mentioned that they became more curious about the robot when they felt like they were closer to it. “I feel like closer to it, I was like oh, what else can you do? I want to know more about it. I think from far away, it looks scarier, like oh I don't know how big it is, or how fast can it move, but once I was like up close, I was like oh it's just a robot. I feel like I want to know more and more, like intrigued.” - P10.

In our study, only one participant (P03) stayed not surprised and not curious throughout the study. When asked why she was not surprised, she replied: “I mean, I've been around robots before, not a crazy large amount. But I've seen robots similar to that one walking or seeing pictures and media online, things like that.” This answer seemed to indicate that she was already quite familiar with the Spot platform and well-informed about its capabilities. Furthermore, when we tried to probe why she had the unsurprised reaction by asking if she knew what the robot was going to do in the experiment, she replied “I was expecting it to have some sort of reaction. But like, it did. I wasn't crazy surprised. I went Oh, okay.”. The answer seemed to imply that she believed robots were typically tasked to do something. This was evidenced by her later response: “I mean, I guess I was expecting it to do something as I walked by. Such as make sure it didn't run into me”. Similar beliefs were expressed by other participants. “The robot is supposed to be created by humans to do certain tasks.” - P15. The assumption that the robot's purpose was to support humans made P03 not surprised by the robot's actions. P03 also was the only one who decided to skip the free-form interaction session, because she felt like there were no more interesting things to see, and she disengaged herself from further interactions with the robot. “I didn't think much would change besides just me approaching it, and it would walk around like it did before.” - P03.

Opportunities Offered by the Study Protocol
Sensitizing on moments of change in reactions lets us view the HRE study as a set of opportunities for the participants to change or update their perceptions of the robot. In the HRE study, the participants had a change in reactions in two moments. The first moment was when the participants and the robot encountered each other. Passing the robot was an opportunity that gave the participants certainty that the robot would not run into them or physically harm them. In other words, the robot's action was a resolution to the participants' uncertainty about its purpose in the HRE experiment. The second moment was the free-form interaction session. This session allowed the participants to directly interact with the robot and ask any questions they might have. With direct interactions, several participants increased their mental proximity to the robot and their reactions and perceptions of the robot became more positive. The presence of humans was another opportunity that helped the participants speculate the robot's role in the HRE study. The resemblance of the human-dog dyad presented a sense of familiarity and that the robot was under control. These helped the participants gain certainty and confidence in encountering the robot. Other than the HRE study, the interview session provided opportunities for the participants to reflect on their experiences in the study. During the interview, several participants took the chance to ask questions they might still have. The answers they received helped them gain more familiarity with the robot.

DISCUSSION
Reaction, Familiarity, Certainty, and Confidence
Our emerging theory proposes that human reactions to encountering an autonomous quadruped robot in an HRE scenario are associated with familiarity, certainty, and confidence. Before the encounter in the experiment hallway, the participants were not aware of the robot’s purpose. Therefore, their reactions to the robot largely depended on their prior experience and familiarity with robots in general as well as their certainty and confidence in encountering the robot, which was influenced by their perceptions of the robot’s capabilities. In terms of the robot’s capabilities, we identified several categories, including appearance, walking, the sound of footsteps, and camera. After the encounter, participants were naturally made aware that the robot would avoid them in the hallway, hence the participants’ reactions changed to more positive. In other words, the participants gained more familiarity, certainty, or confidence in encountering the robot by having a better understanding of its purpose. In the free-form interaction session, the participants had more opportunities to directly interact with the robot. They took the chance to get close to it, touch it, or take photos of it. These opportunities increased their mental proximity with the robot and hence
gained familiarity, certainty, and confidence in it. The presence of a human next to the robot mimicked a typical human-dog dyad, which increased the participants’ familiarity with it. Additionally, the presence of a human seemed to imply that the robot was under control, therefore, it provided a sense of security, and the participants’ certainty and confidence increased, and they replied that they would feel better about it if there was a human next to it. Opportunities to increase familiarity, certainty, and confidence were keys to participants’ resolution or relief from their negative reactions and uncertainty, and lack of confidence in their ability to predict and understand the robot.

We anticipate that one may argue to replace familiarity, certainty, and confidence with trust, and we can empathize with this argument. Trust has been proven to influence human-robot interactions where appropriate trust is key to successful collaborations between humans and robots (Khavas et al., 2020). Research has also investigated how to maximize trust through the design of transparency in robot systems (Matthews et al., 2020). Our study does not adopt trust as the main influence on reactions because trust is multi-dimensional. A review and meta-analysis study of trust in HRI conducted by Hancock et al. (2021) identified six categories of trust antecedents. In addition to the complexity of trust, it is typically measured using scales (Yagoda & Gillan, 2012). We do agree that trust has the potential to explain some of the human reactions in our data. However, no participants mentioned their trust in the robot in the interview, and the complexity of defining trust prohibited us from claiming trust as the driving factor in our data.

Implications for Future Research
The lab-based HRE study protocols presented here resemble real-world HREs but are implementable in a controlled setting. Although any lab-based study will suffer from reduced ecological validity compared to in situ research, our results benefited from our protocol’s higher controllability. As HRE is still nascent, our lab-based approach helped us explore select facets of HRE phenomena. Using the Grounded Theory method, we identified familiarity, certainty, and confidence as key factors influencing participants’ reactions to the robot encounters. These can inform hypothesis generation for future work on HRE with both quadruped and other robot platform types.

These findings might also inform innovation in the development of specialized HRE survey instruments. It is likely that familiarity, certainty, and confidence are not measured by currently available HRI survey instruments such as the Godspeed Questionnaire (Bartneck et al., 2009) and the Negative Attitude Toward Robots Scale (Nomura et al., 2006). The effects of the presence of humans and robot purpose, which surfaced from the interview and our observations, are also likely not adequately measured by existing HRI survey instruments. These effects will most likely continue to play a role in how humans handle robot encounters, and future HRI research may consider mixed methodologies to encompass the social nature and usability of robot deployments (Seibt et al., 2021). Triangulating interview data with quantified survey data can equip researchers with an integrated perspective to interpret the results and better understand how humans can co-exist with robots.

We provide an exploratory but nuanced account of the sources and dynamics of participant fear during encounters with quadruped robots. Fear of robots was pervasive but not universal among our participants, in line with survey-based results of the general U.S. Population (Liang & Lee, 2017). The Spot platform’s appearance, movement, and sound were all potential sources of the experience of fear during the encounter. Media portrayal of robots being used as weapons in both fictional and journalistic coverage was also referenced by participants when discussing their fears. Our study protocol offered opportunities to help the participants increase their familiarity, certainty, and confidence in the robot, which mitigated the negative emotions and reactions of participants who utilized these opportunities. This suggests that studies of fear during robot encounters should consider utilizing opportunities to touch, be near, and ask questions about robots at some appropriate point in their experimental designs. Furthermore, our findings suggest that prolonged exposure or chances of direct interactions with robots are key to improving the quality of human-robot interactions. We join calls for more longitudinal studies of human-robot encounters (Hart et al., 2022); these are urgently needed to clarify the dynamics between participant experience and familiarity with robots in particular as autonomous mobile service robots continue to proliferate in public spaces.

A major finding in our study was that knowing the robot’s purpose mitigated participants’ negative emotions and reactions. We use this to argue that HRI research into bystanders’ perceptions of robot purpose should complement existing work on the intelligibility of robots and tasks or objectives in human-robot teaming scenarios. This is not only for the success of robot deployments but also for the underlying ethical concerns (Wirtz et al., 2018). Robot personality is also a potential research direction for HRE studies. Research on robot personality has shown that humans tend to project personality onto robots (Fussell et al., 2008) as well as recognize a robot’s personality through its designs (Chien et al., 2022). Our interview data also demonstrated that some participants projected a robot personality onto the robot, such as the “friendly” mentioned above. HRE studies using humanoid robots, service robots, or customer-facing robots may benefit from considering the effect of robot personality on their robot deployments (Whittaker et al., 2021), or examine how robot personality can influence people’s familiarity, certainty, and confidence in encountering robots.
Limitations
We identified some challenges in our study. Firstly, the social nature, complexity, and unpredictability of HRE imply that there are many factors influencing how humans perceive and react to robots. Several of the identified factors in our study are context-dependent, such as the sound of the footsteps, the presence of humans, and the free-form interaction session. Our study only examined one aspect of HRE which was encountering a quadruped robot while walking across a hallway. Additionally, our study protocol provided opportunities to resolve some of the participants’ questions or doubts. These opportunities may not be applicable to in-the-wild HRE studies, as most people may just walk past the robots without explanations provided. From our data, it is unclear how people would perceive robots if their questions were not resolved. Therefore, our findings do not entail all aspects of HRE and can only partially explain how humans react to robots when encountering them.

Secondly, our interview protocol also focused more on how the participants reacted or felt about the robot as well as how they formed their reactions and feelings. This protocol allowed us to investigate more specifically the design aspects of the Spot platform. However, this protocol did not offer the opportunity to understand how the robot can be deployed in different contexts, or how the robot can be tasked with different roles. Future research may attempt to take into account the robots’ tasks and investigate how human reactions may be influenced.

Finally, studies have shown that humans form mental models of robots based on their appearance (Fink, 2012). The Uncanny Valley theory (Mori, 1970) describes the effect of the consistency between robots’ appearance and behaviors. The theory has also been validated by numerous studies (Ciechanowski et al., 2019; Kim et al., 2019). Since our study focused on a relatively advanced quadruped robot, our findings may not reflect how humans react to other types of robots. Therefore, future research should adapt our findings if using different types of robots. Additionally, one aspect of our study protocol presented a human-robot dyad that resembled a human-dog dyad. This resemblance increased some participants’ familiarity with the robot and mitigated some of their concerns. However, this might have contradicted the idea of robots being autonomous. As commented by one of the participants, having a human next to a robot might not always be ideal. “It wouldn't make sense because the robot is supposed to be created by humans to do certain tasks. And if a human has to be present all the time, it doesn't make sense, right? So if the robot should be autonomous, it should be able to do everything on its own.” - P12. More research is needed to investigate the presence of humans next to autonomous robots.

CONCLUSION
The development of autonomous quadruped robots allows organizations and businesses to deploy robots to facilitate business operations. The deployment of robots will generate multiple human-robot encounters. However, how humans handle robot encounters in everyday life environments is still understudied. This work fills this gap by adopting participatory observation in a lab-based HRE study and applying Grounded Theory methodologies for data collection and analysis. The novel study protocol allowed us to explore human reactions to an autonomous quadruped robot, Boston Dynamics Spot, in a lab-based scenario that preserved the relevant aspects of real-world encounters. Our major contribution is an emerging theory that explains the relationship between human reactions, familiarity, certainty, and confidence in encountering an autonomous quadruped robot.

Encountering an autonomous quadruped robot such as the Spot platform was still an unusual experience for most participants. When they first saw the robot in the HRE study, they relied on their prior experience to speculate about the robot’s capabilities for judgments. With one exception, participants’ first impressions were some combination of curious, surprised, cautious, or scared. After the encounter, participants had a better understanding of the robot’s purpose in the HRE study, and hence some of their doubts or questions were answered. In the free-form interaction session, the participants had a chance to directly interact with the robot. Those who did so reported that this opportunity helped them realize that the robot was safe and was something they could touch or use. As a result, their mental proximity to the robot increased. The encounter and the interaction session were two opportunities offered by our study protocol to resolve the participants’ unfamiliarity, uncertainty, and lack of confidence in encountering. We suggest other HRE studies consider adding such opportunities as appropriate for their research goals.

This work can serve as the theoretical basis for future research in mobile autonomous service robot design and deployment. Our emerging theory that reactions are associated with familiarity, certainty, and confidence sheds light on the dynamic and experiential characteristics of HRE. Future studies can adapt these findings and our emerging theory to generate, develop, and refine hypotheses, and revise or develop specialized HRE survey instruments.

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Engaging Participants in Online Interviews: Lessons Learned from Implementing a Participatory Visual Approach in Two Explorative Health Information Behavior Studies

Dewitz, Leyla

Berlin School of Library and Information Science, Humboldt-Universität zu Berlin, Germany | leyla.dewitz@hu-berlin.de

ABSTRACT
This article provides a theoretical background on participatory approaches in (health) information behavior studies. Furthermore, it introduces and discusses the implementation of a visual participatory approach applied in two explorative health information behavior studies, each conducted online via Zoom and with the virtual whiteboard Miro. One study examined the health information behavior and digital well-being of individuals with social anxiety ($n=22$), while the other explored health information behavior in the context of false information and scientificity ($n=21$). The approach aimed to actively engage participants within the interview setting through creative and visual elaboration and representation of health information interactions using the virtual whiteboard Miro. Findings show that using visual materials during face-to-face interviews facilitated the communication about sensitive health content and supported to capture key statements in situ, promoting the externalization of tacit knowledge during the interviews. Despite the content differences of the two studies, the unifying aspect examined in this article is how the implementation of the visual participatory approaches could enhance interview settings and lead to gathering rich data. This article fills a gap for methodological considerations of participatory techniques within (health) information behavior studies.

KEYWORDS
Health Information Behavior, participatory research, qualitative methods

INTRODUCTION
Qualitative methods can provide a deeper understanding of human behavior and thus can be used to interpret human practices in a variety of contexts, including people's (health) information behaviors (Lambert & Loiselle, 2007; Bates, 2004). Health information behavior studies – and in particular qualitative, in-person interviews – pose potential difficulties for both the participant and researcher. The researcher’s challenge is to create and establish a setting within a question-and-answer situation that enables participants to freely disclose sensitive and highly personal information to the unfamiliar researcher, who generally does not disclose sensitive content about themselves (Clarke, 2006). In order to enhance the interview setting in regard to trust and rapport between the participant and the researcher, the use of participatory methods can be a valuable approach. This article aims to contribute to the field of health information behavior by presenting participatory methods as an approach to engage participants within research by moving beyond researching participants to conducting research collaboratively with them. Participatory approaches focus on individuals’ lived experiences, including their thoughts and emotions, social perceptions, behaviors, and interactions. Participatory studies emphasize collaboration and (co-)creation of knowledge between participants and researchers by recognizing that individuals and communities have unique and relevant experiences and perspectives (Meyer et al., 2020). By involving participants in the research process, researchers can gain a more nuanced and context-specific understanding of the issues studied. Critics of such participation state that it can sometimes be used superficially, without truly engaging study participants. For example, Hart (1992, 2008) has offered valuable assessments of the various stages of participation (see ladder of participation), including tokenism. There are many perspectives on what participatory research is or could be (see Northway, 2010), but one of its key contributions is summarized clearly by Cornwall & Jewkes (1995): “the key difference between participatory and conventional methodologies lies in the location of power in the research process” (p.1667). In other words, participatory research responds to conventional attitudes towards – and raises ethical questions about – the role of the researcher, attempting to overcome such conventional power dynamics to whatever extent possible by encouraging researchers to stand back and give a voice to participants, who are de facto experts on their own knowledge. Whereas participatory research is seen as an approach to addressing power dynamics in the research process, it is important to state that such dynamics may persist in participatory research despite efforts to create equal partnerships between researchers and participants. For example, researchers may still hold more power in decision-making and in analyzing and interpreting data (Wallerstein et al., 2019).

This article presents both a theoretical framework and a practical proposal for incorporating participatory approaches into qualitative interviews, in order to contribute to the wider discussion of methodological variety in qualitative information behavior research. It provides an overview of the state of the art regarding participatory methods.
interview formats, focusing on (health) information behavior research. Two hands-on examples serve as case studies to show how, on the one hand, visual participatory approaches can be used within or adapted to interview studies. On the other hand, these examples are intended to clarify when visual participatory approaches could be appropriate or helpful within interviews and which specific challenges they could counteract or entail. Towards those two aims, this study introduces these visual participatory approaches within the two case studies by describing the procedure, the implementation, and the lessons learned by applying them. The first study examined the health information behavior and digital well-being of individuals with social anxiety (n=22). The second explored the health information behavior and perception of scientificity in the context of false information among adults (n=21). Both interview guides consisted of various visual participatory elements created in the virtual whiteboard Miro. The visual elements were also intended to help visualize the verbal interaction through and facilitate the interactive discussion of visual materials.

The structure of this article is designed to provide a comprehensive overview of participatory approaches within health information behavior studies. The literature review serves as an introduction to (health) information behavior and participatory research, providing a frame of reference for the key aspects of the subject matter. This section also includes examples of previous (health) information behavior studies that have employed participatory methods within their research design. The method section presents a more detailed account of such approaches by elaborating the study design of the two health information behavior studies described in this article, employing a digital visual approach. The discussion explores the theoretical considerations that were incorporated into these studies and how they align with the examples presented in the literature review. The following section highlights the lessons learned from these two case studies, presenting key considerations for and benefits of participatory approaches. Finally, the last section summarizes the findings, providing an overall conclusion.

**LITERATURE REVIEW**

**Health information behavior**

Information behavior in general characterizes the multitude and complexity of how humans engage with and respond to information (Greifeneder & Schlebbe, 2023). It captures information interactions in relation to sources and channels, including active as well as passive information seeking and use (Wilson, 2022; Bates, 2017). To study this provides a basis to gain knowledge on how to enhance information access in a rapidly changing information landscape (Spink & Cole, 2006). (Health) information behavior research draws on multiple theories, models, and methods to understand the complex and dynamic ways in which people interact with information (Johnson & Case, 2012). It refers to the various ways in which people seek, acquire, share, evaluate, experience, use, or even avoid health information (Lambert & Loiselle, 2007; Dewitz, 2022). Accordingly, it includes both active and passive behaviors (Kelly et al., 2014) and is sometimes associated with the need to make life decisions based on health information (Soroya et al., 2021). The acquisition of health information sources and practices can be both interpersonal and institutional: people search for information online, seek advice from friends and family and peers, consult health care providers (Smith, 2014), and use various new and old media to obtain health information (Riaz et al., 2021). These behaviors can be influenced by a variety of factors, including personal (e.g., personal characteristics, health status, education and health information literacy, socioeconomic circumstances), context (e.g., cultural and social norms) and device-specific (e.g., access or lack of access to technology and technology modalities) (Dewitz, 2022). Besides the many examples of quantitative approaches in interdisciplinary health information behavior research (for an overview see Gilbert et al., 2021), a broad variety of studies also apply qualitative methods when focusing on health information behavior (Oh et al., 2016; Lambert & Loiselle, 2007).

Interviews are widely used and effective at revealing a deeper understanding of everyday information interactions (see Bates, 2004) and for in-depth examinations of various health information behaviors (Greyson & Johnson, 2016). Qualitative health information behavior studies focus on (vulnerable) social groups with specific health needs, such as LGBTQI+ individuals (e.g., Kitzie et al., 2020), the elderly (e.g., Huisman et al., 2020), (young) parents (e.g., Greyson, 2017), people affected by cancer or other chronic or physical illnesses (e.g., Bressel, 2022; Costello, 2016), and people with a psychological disorder (e.g., Aref-Adib et al., 2016). In times of the Covid-19 pandemic, health information behavior studies also shed light on multiple health information interactions of laypeople (e.g., Soroya et al., 2021), changes in (health) information behavior (see Montesi (2021) for a comprehensive overview) and false information regarding health (Savolainen, 2022).

**Participatory research**

Participatory research is an approach that actively engages study participants or the community throughout all stages of the research process, ranging from jointly designing a study to reporting and sharing the results (Northway, 2010). It is rooted in emancipatory beliefs and values and takes the approach of conducting research with participants rather than on them (French & Swain, 2004). It often adopts a critical stance toward society by giving voice to marginalized and vulnerable groups in particular and advocating for applied research, solving problems through research while seeking to reshape conventional research practices, power dynamics, and the generation and...
use of knowledge (Cornwall & Jewkes, 1995). For a general overview on participatory research frameworks, orientations, and examples of study approaches, see Vaughn & Jacquez (2020). Participatory interview methods actively involve participants in the research process, giving them a greater degree of control and influence over research questions, methods, and outcomes (Salmon, 2007). Building rapport with participants is an important part of the qualitative interview process, especially in participatory research (Atkinson, 2005).

One way to lighten up a question-and-answer situation in an interview is to use participatory or creative methods, for example jointly producing visual artifacts (Wilkerson et al., 2014). According to Rainford (2020), such creative elements can yield positive outcomes by promoting reflexivity and facilitating more engaging discussions. Moreover, these methods allow for a more nuanced exploration of complex issues, moving beyond simplistic binary thinking, given that visual artifacts can unlock less linear, more free-flowing thinking that is not necessarily constrained by speech. In fact, creative exploration during an interview can serve as a valuable starting point for developing thoughts about personal experiences (Gauntlett & Holzwarth, 2006; Literat, 2013). Several participatory studies have employed art-based methods or other visualization techniques as a means of facilitating engagement and interaction within interview settings (e.g., Hwang et al., 2022). By using methods that involve creating visual representations rather than solely relying on verbal communication, researchers can gain deeper insights into the practices and behaviors of participants (Bagnoli, 2009). This shifts the dynamic of the interview from a static question-and-answer situation to a creative activity of making or producing something together and discussing it (Gauntlett & Holzwarth, 2006). In addition, the implementation of entire participatory design formats in HCI health research has demonstrated effectiveness in facilitating the externalization of tacit knowledge, opinions, backgrounds, and needs (Langley et al., 2018), particularly in sensitive subject areas like mental health (Flechtner et al., 2023). In the latter years of the Covid 19 pandemic, digital tools were used to conduct or implement interviews. For example, the digital whiteboard Miro became frequently used within online interviews or design workshops to enhance brainstorming, ideation, and mapping – ensuring creative and flexible engagement through visual elements (Slingerland et al., 2022; Cerna & Müller, 2021; Wong-Villacres et al., 2020). Creative methods used in physical in-person interviews can thus be transferred into a digital format. Miro’s most basic form enables the use of virtual sticky note notes, embedding videos, pinning documents or presentations to the board, inserting illustrations or images, adding drawings, and attaching annotations and comments, making it possible to tailor the units to the specific needs of the study design and use them in real time.

(Health) information behavior studies and participatory approaches

Participatory approaches are gaining popularity in the field of health research (Abma et al., 2019; Cargo & Mercer, 2008). However, in the information science domain of health information behavior research, only a limited number of studies have employed participatory approaches (e.g. Genius, 2010; Freund et al., 2016; Greyson et al., 2017, Greyson, 2013). Therefore, this section presents both information behavior studies and health information behavior studies using participatory approaches.

The series of methods, tools, techniques, and theories constituting participatory approaches can be applied to information behavior studies (see Meyer et al., 2020 for a comprehensive scoping review on participatory design and information behavior). Already there is a growing body of literature in information behavior research employing participatory elements in interviews (Sonnewald et al., 2001; Hartel, 2014; Dewitz, 2021a,b; Schlebbe, 2022; Greyson et al., 2017; Greyson, 2013; Meyers et al., 2007; Barriage, 2021). Several qualitative studies in information behavior research have adopted participatory approaches as a means to promote active conversation (e.g., Dewitz, 2021a; Given et al., 2011). These studies have focused particularly on groups considered vulnerable, including refugees (e.g., Fisher et al., 2016; Dewitz, 2021a, b), children (e.g., Schlebbe, 2022), and adolescents (e.g., Meyers et al., 2007). It is possible that individuals from certain social groups may find it difficult to share their experiences and needs with others due to the sensitive nature of the content. Therefore, participatory approaches could help to facilitate communication and self-expression and allow participants to convey complex emotions and experiences otherwise difficult to express using traditional interview methods alone (Dewitz & Schlebbe, 2022). Additionally, individuals belonging to vulnerable groups may face barriers in accessing or recalling past experiences for various reasons (Dewitz, 2021a). It is important to note that if these experiences involve sensitive content, conducting studies using participatory methods without the guidance and approval of psychologists or an ethical board is not recommended (Flechtner et al., 2023). Information behavior research in general has emphasized the effectiveness of participatory approaches in exploring participants' experiences, needs, and other behavioral interactions with information. This involves moving away from traditional research practices that solely focus on studying participants, towards conducting research with them instead (Meyers et al., 2007). By prioritizing opportunities for participants to express their opinions, accommodating diverse abilities and interests, allowing for participant choice, and covering different communication styles (from visuals to vocal), researchers can enhance their knowledge of how people interact with information to gain a richer and more nuanced understanding of participants' experiences (Barriage, 2021; Greyson et al., 2017, Greyson, 2013). In a study conducted by Barriage (2021), the information
practices and experiences of 5-to-7-year-old children were examined. The study investigated the information needs and activities of young children, as well as the challenges they faced, the support they received, and the emotions they felt while engaging with information. The study employed a participatory approach in different stages. One stage involved a book discussion, while another stage involved uploading pictures of everyday live interactions using the PixStori app. Another stage involved a conversation about the photos taken. Schlebbe (2022) used a participatory element as part of the mosaic approach to encourage children to visualize their "dream tablet" by asking them to draw wishes of what they would like to do with their tablet to gain a deeper understanding of the participants' information wants regarding mobile technology. Greyson et al. (2017) used a participatory, arts-based method in an interview study with young parents aged 15–24 years to gain deeper insights into (health) information practices. The study shows an innovative and interactive drawing-based interview technique, which can be easily adapted within qualitative interviews, guiding participants in depicting their personal social information worlds. A few questions helped participants draw their information worlds, for example illustrating how and where they looked for information when they had a health problem. For Greyson et al. (2017), such visual and creative methods have great potential to enhance research into everyday information practices and the information behavior of marginalized groups in particular. In another study, with refugee adolescents, regarding information behavior and smartphone use before, during, and after their flight to Germany, Dewitz (2021a,b) used maps in physical face-to-face interviews and app icon cards that the participants adjusted to a world map (flight route). This interactive participative interview element served as a low-threshold and a playful way to lighten up the static question-answer structure, actively engaging the participants in an age-appropriate manner. This corresponds with Agosto & Hughes-Hassell’s (2006) claim that participants are eager to participate in research that permits them to express their ideas and opinions.

Overall, these studies suggest that incorporating participatory elements into (health) information behavior studies can enhance the quality and richness of the data obtained and can help to promote a greater degree of engagement and empowerment among participants. However, it is important to carefully consider the ethical and practical implications of using participatory methods and to ensure that participants are adequately informed about their rights and supported throughout the research process.

METHOD
This paper presents (digital) visual participatory elements that can be adapted to (health) information behavior interview studies to gain a deeper understanding of participants' interactions with health information and to actively involve the participants in the research. Methodologically, the article is based on an extensive literature review of the central aspects of participatory approaches generally and in regard to (health) information behavior studies. It further presents two practical examples of exploratory interview studies in which (digital) visual participatory elements were employed. Central aspects between the theoretical and the practical part of the article are further compared and discussed. This article aims to methodologically introduce a visual participatory research approach for health information behavior studies that can be employed within qualitative (online) interviews to engage participants actively in the research process.

Research design of the two health information behavior studies
Despite the clear benefits of interactive participatory elements in (health) information behavior studies, researchers must consider the sensitivities and challenges involved in applying them. For this reason, this section presents a visual approach to participatory research in order to exemplify how to engage participants in (health) information behavior studies.

Two studies using hands-on examples were (co-)conducted by the author using visual participatory elements within two qualitative interviews. One study (I) examined the health information behavior and digital well-being of individuals with social anxiety (n=22), while the other study (II) explored adults’ health information behavior and perception on scientificity in the context of false information (n=21). The interviews were conducted online via the video conferencing platform Zoom. Both studies are based on qualitative research approaches (study I: thematic analysis; study II: grounded theory) and therefore involve semi-structured in-depth interview guides as their data collection method. Because both studies will soon be published, a methodological analysis based on the empirical material is not presented here. Therefore, the following sections will rather describe the design and implementation of the visual participatory approaches of the two studies using the virtual whiteboard Miro. This aims at summarizing the potential of visual participatory elements within qualitative online interviews and elaborate on the benefits and challenges that such approaches entail.

The visual participatory approach was implemented to introduce a low-threshold and playful way to diversify and introduce more lightheartedness to the otherwise static question-answer structure and introduce greater interaction between participants and the researcher. In addition, it was intended to motivate the participants to articulate their needs, experiences, and ideas and to stimulate their memories, making it easier for them to remember past
experiences and to draw on explicit and tacit knowledge. Using visual approaches to discuss abstract concepts such as 'health information behavior' and 'digital well-being' helps to simplify and convey them in accessible and comprehensible language. This is essential for facilitating discussions about these topics, which participants encounter in their daily lives but may not have explicitly considered before. This approach allows for the avoidance of potentially confusing terminology and instead translates these concepts into relatable actions and visual representations, promoting the construction of bridges of knowledge.

As these two hands-on examples show only a simple form of a participatory approach, it is important to note that participatory research as a whole is and can be much more than the inclusion of visual interactive-participative elements within interview studies. The case studies represented here are an initial attempt to approach participative research as a whole is and can be much more than the inclusion of visual interactive-participative elements within interview studies. The case studies represented here are an initial attempt to approach participative methods and will be further developed by the author.

Miro as tool for data collection in both studies
In both studies, the digital whiteboard Miro – which enables the visualization of specific interactions and material – was used to implement the visual interactive elements. For both studies, a clear design was chosen within the elements in order not to overwhelm or distract participants (see Figures 1 to 5). The Miro boards were devised by delineating specific areas for user input. In both studies, the researcher elected to manage the Miro board and received guidance from the participants. This approach avoided overwhelming participants with digital methods or forced activity. The researcher shared the screen on Zoom and was responsible for incorporating the participants' inputs into the Miro board. Miro was chosen due to its versatility and ability to easily adapt to the purpose of both studies. It was particularly useful for visualizing various contexts of interaction with technology and mapping personal health information infrastructures, as well as for classifying different images or app use. The Miro board was set up to allow participants to select relevant elements related to each task and move them into place with the researcher’s help. Participants were encouraged to verbally express how the researcher should navigate, for example, the app icons and rating buttons (see Figures 1, 2, 5).

Study I: Health information behavior and digital well-being of people with social anxiety
Study design
The study examined the health information behavior and digital well-being of individuals with social anxiety (n=22). Miro was used during the online interviews to collect and map the apps frequently used by participants, which were subsequently evaluated by participants in terms of how they impact their subjective (digital) well-being. A second Miro board was introduced to allow the participants to visualize their (mental) health information infrastructure (inspired by concepts such as information horizons and information worlds), for example by gathering and bringing in connection health information sources and health information needs. All interviews sought to understand the relationship between the digital well-being and health information behavior of people affected by social anxiety disorder (SAD). For this reason, a method was sought that would encourage participants to open up about their technology use, habits, and behavioral interactions in relation to health information.

Participants and sample
Two pretests were conducted, first with a psychologist to sensitize the researcher and to evaluate the feasibility of the interview guideline and the visual interactive elements from a psychological and ethical perspective. The second pretest was conducted with a person affected by social anxiety to provide the researcher with feedback on the question design, the feasibility of the interactive elements and any noticeable mental load felt during the interview. Feedback from both pretests was incorporated, which primarily included formulating the tasks more precisely for clarity. The study included 22 participants suffering from SAD, consisting of 15 women and 7 men (self-reported gender), aged between 18 and 65. All participants were informed about their rights prior to the interview and signed an informed consent form according to GDPR standards. After the interview, participants in study I were asked if they would be interested in reusing their created Miro boards themselves. Some participants later made use of them either to discuss the content with their psychotherapists or for personal use.

Challenge in this research and why it is a chance to adopt a participatory approach
SAD is characterized by an excessive fear of negative evaluation and scrutiny by others in social situations, which often results in severe stress and avoidance of social situations altogether. This presents a challenge for conducting (online) interviews with individuals suffering from SAD, as they may have high inhibition thresholds for social interactions. Participatory approaches can be appropriate for such needs because they introduce a more equal power dynamic and provide more flexibility in the involvement of participants, adapting conditions to reduce the social pressures on individuals such as those with SAD. In addition, a visual participatory approach supports individuals in expressing thoughts through nonverbal interactions, perhaps more easily than when they are in the focus of a conventional face-to-face interview.
Study procedure – the visual participatory elements within the interview

A semi-structured interview guideline was used to provide questions that were comparable across all participants but also able to respond flexibly to the needs and specific content, as well as to the interview flow. The questions within the semi-structured interview guide covered various topics, including personal information, the use of different technologies (such as smartphones and tablets), and the assessment of how and in which situations the use of technology benefited or negatively affected everyday life regarding health and digital well-being. It was important to find a way for participants to open up about their technology use, reflect on it, and draw on tacit and implicit knowledge about their behaviors. For example, a method that allows them to articulate feelings and remember situations in the past, such as a time when they had used communication technology during an instance of social anxiety. The three visual participatory elements consisted of the following three aspects: (1) identifying apps used by participants (Figure 1); (2) assessing the apps in terms of how they make participants feel (“makes me feel good”, “makes me feel partly good/not good,” or “makes me feel bad”); and (3) conducting a personal (mental) health information infrastructure, covering used sources and needs, as well as potential relationships between these two. All Miro boards were prepared using moving elements (e.g., app icons, blank cards, and sticky notes) and constant elements (e.g., the app collection [figure 1] or potential information sources / channels [figure 3]). The constant elements were implemented to provide participants with a memory aid or a useful starting point for their own ideas and impulses.

Figure 1. Miro board 1 with (from left to right) blank sticky notes, app collection, smartphone/tablet for assigning the apps used, trash can for the apps implemented but not used.

After an introduction to the interview and various questions regarding the use of technology and devices, the first Miro board was presented to the participants through screen sharing in Zoom. In the first task (Fig. 1), participants were asked to fill the smartphone or tablet with apps they use in their everyday lives. Participants were encouraged to instruct the researcher to adjust the smartphone or tablet. Apps that had not been used for a long time were assigned to the trash can. The blank sticky notes (figure 1, left) were used to add apps that had not been included in the app collection.

Figure 2. In Miro board 2 participants were encouraged to specify or classify feelings associated with the specific apps used by having them allocate those apps into categories (from left to right: "makes me feel good", "makes me feel partly good/not good", "makes me feel bad").

The next step was to assign the apps to learn more about interactions, situations or contexts, and associated feelings or emotions related to the specific apps or app use. The challenge of having to choose one of these categories (“makes me feel good”, “makes me feel partly good/not good”, “makes me feel bad”) stimulated conversation and reflection. The participants were encouraged to speak their thoughts aloud and explain why the categorization had been made. Furthermore, this interactive element encouraged participants to engage actively and deepen the conversation by motivating them to reflect on their behavior and interactions to discuss actual experiences related to
their subjective digital well-being. The overall aim of this interactive element was not to force the participants to classify the icons accurately, but to stimulate or provoke engagement with the topic of feelings and app use through exposure.

Figure 3. In Miro board 3 participants were encouraged to share information needs (questions) and information sources / channels that they have used in the past or use in present.

Miro board 3 aimed to assist participants in visually mapping information sources and channels that they had used or were currently using for (mental) health questions. In this way, information needs could be identified by gathering questions that participants had asked or were asking in relation to their (mental) health. Both aspects of information interaction (used information sources and information needs) were interwoven and compiled simultaneously to allocate relationships to the specific entities. It was important that the researcher introduced targeted questions to sustain the conversation. Ultimately, connections could be identified and drawn between sources and needs, and thus a personal (mental) health information infrastructure emerged (see supplementary material, figure 6, under the following link: https://doi.org/10.5281/zenodo.8124360).

Study II: Health information behavior towards false information and perception of scientificity

Study design
The second study investigated the health information behavior and the perception of scientificity in the context of false information among adult individuals living in Germany (n=21). Miro was used as a tool to help visualize participants' health information infrastructure and to evaluate the scientific appearance of specific resources in situ during the online interview, such as screenshots of different (scientific) health information sources.

Participants and sample
A pretest was conducted with four individuals to evaluate the feasibility of the interview guideline and the visual interactive approach within the interview. After the pretests, minor adjustments were made regarding the question design. The focus of the pretest was to find out whether the research design encouraged participants to talk about actual experiences with false information, which was positively confirmed by the pretests. The study included 21 participants, consisting of 12 women and 8 men, aged between 20 and 75. Recruitment criteria merely consisted of residence in Germany and being of age. All participants were informed about their rights prior to the interview and signed an informed consent form according to GDPR standards.

Challenge in this research and why it is a chance to adopt a participatory approach
Regarding recruitment criteria, no participants with vulnerabilities were sought specifically, although it is possible that selected participants did present vulnerabilities such as chronic illnesses. To anticipate such sensitive health topics emerging during a health information behavior study, the researcher, the setting, the interview guide, and the participatory approach in general had to be aligned to this. Moreover, false information is a delicate, controversial topic involving social judgments. Such a serious topic therefore benefited from visual participatory elements in the interview to make it more easily accessible and discussable. Inquiring about participants' information behavior regarding health, including potentially inaccurate or false information could have prompted participants to provide socially desirable responses. To mitigate such potential biases and increase the ease of communication during the interview, the integration of participatory visual elements within the interviews facilitated a natural and comfortable sharing of opinions.

Study procedure – the visual participatory elements within the interview
A semi-structured interview guideline was used in the study to ask questions that were comparable across all participants but also able to respond flexibly to their needs and specific content as well as to the interview flow. The questions within the semi-structured interview guide covered various topics, including personal information, the role of health in everyday life, and experiences with and reactions to received (potentially) false information. It was important to find a way for the participants to open up about their personal health information interactions and habits, reflect on them, and draw on explicit and tacit knowledge about themselves and others: articulating feelings and remembering situations in the past, such as those in which they came in contact with (potentially) false health information. The two visual participatory interview elements were as follows: (1) conducting a personal health information infrastructure covering used sources and needs, with a subsequent question of whether participants had
ever received false information from any of these actors or sources and (2) assessing the scientificity of different health information sources by assigning colored buttons (“scientific”, “not scientific,” or “partly scientific”) to stimulate discussion about the scientificity of health information resources and criteria for the subjective assessment of scientificity. All Miro boards were prepared using moving elements (e.g., source/actor elements [figure 4], sticky notes, and evaluation buttons [figure 4, 5]) and constant elements (e.g., screenshots from scientific/non-scientific health sources [figure 5]). The constant elements were to serve as memory aids for the participants and as a good starting point to share knowledge, helping to visually guide participants to deepen the conversation through reflection. The aim of the study was to learn more about which sources or actors participants used to inform themselves about health topics (figure 5). Since these sources of information can potentially spread false information, Miro board 4 was used to introduce and lead the topic in regards to receiving false information from any kind of actor. In order to identify used sources and actors, as well as related situations and their potential connection to each other, it was necessary to visualize this complex content to help participants remember situations and experiences and also to reflect situations during the mapping process. The Miro board was coordinated by the researcher in order not to cause additional stress to the participants. During the process, the researcher asked questions to accompany the mapping process and to maintain the conversation.

Figure 4. Miro board 4 aimed to map participants’ personal health information infrastructures with potential sources to choose from (in gray) and blank cards (sticky notes) to add sources used (left). The red rings (left) helped to mark the main sources and arrows (not shown here) to visualize relationships between sources/actors.

A second Miro board was introduced to determine how participants assess the scientificity of a health source, by showing various screenshots of scientific/not scientific health information sources. The aim was to gain deeper insights into participants’ thought processes, feelings, and ambiguities or uncertainties when assessing different health sources for scientificity. Accordingly, different examples — ranging from YouTube videos to a scientific article, book cover, or advertisement — were presented to participants via Miro and served as a basis for discussion (figure 5). The various screenshots were viewed individually for clearer focus and easier reading of texts and descriptions of screenshots. The participants were asked to adjust differently colored buttons ("scientific" in pink, “non-scientific” in blue, and “partially scientific” in orange tones) to each image and elaborate on why that source was perceived as scientific or not. Rating the screenshots was not intended primarily to evaluate the scientificity of the health information actor/source as a test of participants’ knowledge, but rather to encourage discussion and engage participants in sharing beliefs, in situ, about which attributes resources required to be perceived as scientific. The Miro board was coordinated by the researcher in order not to cause participants additional stress. At the end of the task, the view was expanded to all screenshots, and participants were asked if they were satisfied with the decision or whether they would like to add or change anything.

Figure 5. Miro board 5 was used for assessing the scientificity of different health information sources by assigning colored buttons (“scientific”, “not scientific,” or “partly scientific”) to stimulate discussion about scientificity of health information resources and criteria for the subjective assessment of scientificity.
**Overall Methodological considerations for both studies**

Though they were inspired by approaches within participatory studies – especially with regard to visual participatory elements within interviews (e.g., Dewitz, 2021a,b; Sonnewald et al., 2001; Greyson et al., 2017) – the individual elements in the (co-)conducted studies were freely developed according to the research questions (see supplementary material, table 1, under the following link: https://doi.org/10.5281/zenodo.8124360) and tested on multiple pretests to ensure that the methodological considerations were applicable. All visual participatory elements were introduced to enrich the interviews in various ways. The first was to improve the interview setting in terms of the relationship between the researcher and the participant by trying to shift the “expert function” to the participants by letting the researcher only locate what is instructed by the participant (e.g., subjective app evaluation regarding perceived well-being in technology interaction). This also avoided overwhelming the participants with potentially unfamiliar digital tools or making them feel observed or tested. In addition, a research design was sought that offered the possibility of loosening up the interview situation from static question-answer to a dynamic narrative flow. In both studies, the participatory method elicited personal health information infrastructures by identifying information sources and related information needs in a playful manner. A second way the visual participatory approach enriched the interviews was by externalizing knowledge with visual starting points for introducing conversations about sensitive topics, and further deepening those conversations. The overall methodological considerations for both studies aimed to encourage participants to recall and vocalize their thoughts by visualizing, making, or developing something collaboratively. These simple methods guided participants’ creative impulses to elaborate and acquire explicit but also tacit and hidden knowledge, through visual impressions that made knowledge more communicable, explainable, or even accessible for the participants. The aim was to build memory bridges from explicit knowledge to tacit knowledge about the participants themselves, about behavior or interactions, and about knowledge gained through in-situ reflection in the interview. One methodological challenge was not to overwhelm participants. Although the visual elements were a bridge to start conversations, there was a risk of participants perceiving them as tasks to test knowledge (figure 5). Accordingly, visual participative elements needed to be well planned, pretested, and introduced accessibly and precisely. Further, it is essential to be transparent about the research process e.g. the goal of tasks presented. For more information, access the supplementary material, table 1, (https://doi.org/10.5281/zenodo.8124360) in which the specific study designs, methodological requirements, and implementation considerations for the visual participatory elements in both studies are documented.

**DISCUSSION**

For establishing an ethically appropriate setting in interviews that enables participants to freely disclose and reveal highly personal and sensitive health information methodological considerations play a key role (Clarke, 2006). As both studies involved ethically sensitive subject matter, it was necessary to employ a methodologically appropriate procedure. Participatory approaches put the needs and perceptions of participants first, gathering data with rather than on them (French & Swain, 2004), acknowledging that individuals have unique experiences and perspectives (Meyer et al., 2020). In addition, participatory approaches focus on individuals’ lived experiences, including their thoughts and emotions, social perceptions, behaviors, and interactions (Meyer et al., 2020), which aligns with the foci of (health) information behavior research (e.g., Lambert & Loiselle, 2007; Johnson & Case, 2012; Meyers et al., 2007). Therefore, adapting a participatory approach was seen as a research-enhancing method to adapt in the presented studies. Both studies aimed to implement a low-threshold participatory approach for a more nuanced and context-specific understanding of participants’ views and experiences regarding health information. This required reflecting on every step of each participatory element to adjust it appropriately, for example in pretests with a psychotherapist (study I). As the conducted studies presented only simple participatory approaches, it is debatable whether or not the visual participatory elements are truly participatory research according to the standards set by Hart (1992, 2008) and Northway (2010). According to Cornwall & Jewkes (1995), research becomes truly participatory when power is reallocated. Accordingly, the studies conducted for this article aimed to give voice to participants as experts of their own knowledge and to give the researcher a more observing role. While the power dynamics could not be entirely reversed here, an attempt was made to address the most predominant of them. Nevertheless, the extent to which these studies were participatory was limited by not having involved participants in each step of the research design, (research questions, methods, and outcomes) which would have satisfied these after Salmon (2007). It also lacked the possibility, emphasized by Cornwall & Jewkes (1995), of identifying and solving problems in applied and subsequent practices. In addition, besides the visual participatory approaches presented here, no further attempts were made to build rapport between the researcher and the participants to the extent recommended for participatory research by Atkinson (2005). It was possible to create a trusting environment in which the participants opened up about their everyday life and lived experiences. However, the fact that the visual results in the Miro boards were made available to the participants from study I for further work can be seen as a benefit. According to Rainford (2020), Wilkerson et al., (2014) and Greyson et al. (2017), creative methods and visual participatory approaches effectively lighten up the question-answer situation and facilitate engagement and interaction within interview settings. They also shift the paradigm from a static question-answer structure to a more
creative activity of making or developing something jointly together (Flechtner et al., 2023). According to Dewitz (2021a, b), interactive practices – such as mapping or adjusting commonly used apps – provide a low-threshold starting point to identify information interactions and app use. This served as a basis to implement a certain approach in the study about health information and digital well-being of people suffering with SAD (figure 1), as it promoted reflexivity and facilitated discussion. In addition, the process of mapping and visualizing health information infrastructures – including sources and actors, needs, and situations of information exchange or sharing – opened a way, according to Rainford (2020), to a more nuanced exploration of complex issues. The visualizations of health information infrastructures in both studies helped to move beyond binary thinking to find a way of externalizing tacit knowledge (figures 2, 5), opinions (e.g., in the evaluation tasks of both studies [figures 2, 5]), backgrounds (figures 2), and needs (figures 2, 3, 4), which Gauntlett & Holzwarth (2006) and Flechtner et al. (2023) stated. In addition, as in Dewitz (2021a), the visualizations accompanying the interview process encouraged participants to convey complex emotions, experiences, and opinions, which is a crucial aspect of participatory approaches according to Agosto & Hughes-Hassell (2006). As in Greyson (2013), Greyson et al. (2017) and Dewitz (2021a, 2021b), visual participatory approaches can also help depict participants’ personal information infrastructures in everyday life interaction in physical and digital settings. The studies conducted for this article were inspired by such participatory approaches: despite the deviation in participants and research designs from those approaches, these studies shared the general aim of identifying information behavior patterns and engaging participants.

LESSONS LEARNED
The presented case studies implemented visual elements to engage vulnerable participants and sensitively address health-related topics, fostering an environment that encourages open sharing and recall of health information behaviors. The lessons learned involve various aspects focused on the conducted case studies. Generally speaking, one drawback of the participatory approaches within the two presented case studies is that they did not fully meet the criteria for participatory research designs. A truly participatory study would involve broader involvement of participants in various research aspects, ranging from the study's conception to its implementation and analysis. To enhance participation in the case studies presented, the following adjustments could be made, which would also benefit future study designs: Participants should be asked (e.g., through an anonymous survey) about their experience with the visual participatory approach after the interview. For example, it would be worth discussing whether the last task (Figure 5) could be modified to avoid potential perception as a knowledge test. The results of the presented case studies have not yet been applied to solutions that directly benefit the participants. However, it can be seen as a benefit of the first study that participants made use of the Miro boards after the interview, either to discuss content with their psychotherapists or for personal use. All in all, sustaining conversations beyond the scope of traditional face-to-face interviews benefited the depth of the conversation and contributed to gathering rich data. Nevertheless, there is still work to be done to establish researcher-participant relationships that allow for an even more trust-based interaction and also consider the research interests of the participants.

CONCLUSION
The purpose of this article was to provide theoretical outline and practical insights into participatory approaches within health information behavior studies to contribute to a methodological discussion. The descriptive analysis of two health information behavior studies found great potential in implementing visual interactive elements to engage vulnerable participants and sensitively address health-related topics, fostering an environment that encourages open sharing and recall of health information behaviors. The methodological considerations presented were found to be effective for exploring (health) information interactions in an ethically sensitive way, ultimately seeking to involve participants in a more inclusive manner. The approach aimed to actively engage participants within the interview setting through creative and visual elaboration and representation of health information interactions using the virtual whiteboard Miro. Interactive elements embedded in the interview helped to encourage participants to vocalize their thoughts while assessing visual materials. This procedure proved beneficial in making cognitive processes more explicit. In conclusion, using visual materials during the face-to-face interviews facilitated the communication about sensitive health content and supported to capture key statements in situ, promoting the externalization of tacit knowledge during the interviews and lead to gathering rich data. In future work, the analysis of the visual artifacts in conjunction with the interview material, will provide even greater insight into the potential of the method. In addition, the in-depth analysis of the data collected during both studies will be used to further improve the method.

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Mixed Methods Framework for Understanding Visual Frames in Social Movements

Dozal, Laura W.  
University of Arizona, USA | lwerthmann@arizona.edu

ABSTRACT
Attempting to understand visual frame perspectives in social movement posts online is important to develop an account of how social movements communicate and for what purpose. This paper builds a Mixed-Methods Matrix framework that combines computational applications with visual methodologies to discover frames of meaning making in a large image collection. Frame analysis and Critical Visual Methodology are reviewed and used in the framework to work in tandem with quantitative research methods. The quantitative methods consist of network analysis applications and network structure analysis. Visual sentiment analysis is explored using methods of computer vision. The methods framework is presented in the form of a matrix that enables researchers to identify applications for looking at social movements online through theoretical and computational approaches. The broader implication for the framework is to help researchers understand how online image collections can show meaning through perspective.

KEYWORDS
Social Movements, Mixed-Methods, Visual Interpretation, Network Analysis, Computer Vision

INTRODUCTION
The Project is a literature review that builds a framework for applying mixed methods for understanding visual frames. The main idea of this review is to select various methods that can extract specific elements of information from images that pertain to social movements. These elements facilitate frames of perception that can create different meanings based on a particular visual interpretation. Frames of perception help create meaning out of particular social experiences that might call for subjective interpretation (Gaffman, 1972). For example, an experience such as a protest can be interpreted through various frames including support of or opposition to an ideology of a social movement; a public policy issue; or a violent action. Although framing has been discussed and described across various disciplines, Mary Bock (2020) describes framing as “a metaphor for contextualisation”. Frames have also been described as a central idea or narrative that can provide meaning to particular events (Gamson, Modigliani 1987, as cited in Rodriguez, Dimitrova, 2016); and can provide context and organization for messages that affect understanding (Rodriguez, Dimitrova, 2016). For the purposes of this review, visual frames can be defined as devices of an image that convey meaning through aspects of association, composition, and social technical elements. Their associational qualities are based on reference and metaphor (Bock, 2020), compositional properties can be indexed or differentiated by other images (Rodriguez, Dimitrova, 2016), and social and technological contexts can aid in explicit understandings of reality.

Forms of visual interpretation used in this review come from Gilian Rose’s (2016) model that reviews methods of visual analysis which include the site of production, the image itself, circulation, and audiencing (Figure 1). Production as a form of visual interpretation contributes to the effects of visual frames based on the technologies used to make that image, the access to those technologies, and the affordances provided by technologies (Rose, 2016). The perception of an image based on its production value can be essential to how a frame is understood, for example the camera used in the 1920s had different technological affordances than a camera in the 1950s, and a camera now. These cameras implement a particular perception of the composition of an image, a record of that point in time, or a falsification of reality (Doisneau, 1991, as cited in Rose, 2016). The Image Itself as a form of visual interpretation can be considered a commodity based on its objective and emotional qualities (Rose, 2016). These qualities can be intentionally or unintentionally perceived through the space and structure of visual effects found in the image (Rose, 2016). Circulation as a form of visual interpretation represents the movement between the production site of an image as well as the site of audiencing (Rose, 2016). Both places can be different in time and environment, but the features of movement between these sites is determined by an image’s circulation (Rose, 2016). For example, the provenance (record of ownership of an art piece) can help curators infer aspects about the circulation of a visual art piece, or the algorithm on a specific social media platform can help shape how an image, for example of daily life or a protest event, is shared. In this review circulation is understood as the technological and social modalities of movement between the image’s production and its audiences. Audiencing of an image is where an interested viewer understands the meaning of an image and accepts or rejects them based on the circumstances of the viewing (Fiske, 1994, as cited in Rose, 2016). The types of technological displays, identifiable elements of an image, and social identities of a viewer have the ability to elicit a particular audience perception (Rose, 2016). For purposes of this research, access to an image, its composition, and social contexts in which it is viewed are all aspects of how a viewer perceives an image and creates an audience.

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The interdisciplinary approach to understanding visual frames of social movement images through computational methods has the potential to communicate information on the actions, messages, and causes surrounding a movement by understanding how images are circulated throughout online networks. Although visual framing has been researched across multiple disciplines (Bock, 2020), and frame theory is widely used to review meaning and intentions by social movement researchers, visual frames of social movement are still an under-researched topic, particularly for online images. As online images continue to grow in volume with a velocity that is always growing, and a variety that comes from various authors, they contribute to the big data phenomenon that brings new computational methods of analysis to established theoretical concepts (Gandomi, Haider, 2015). Visual frames have been identified as challenging and have been implemented by various methods that lack methodological basis (Rodriguez, 2020). This research intends to observe some of these methods and identify newer approaches that relate to an interdisciplinary approach of social movement research and data science for identifying visual frames in images online.

**VISUAL FRAMING AND SOCIAL MOVEMENTS: THEORY OVERVIEW**

**Social Movement Frames**

Frames help people make meaning from a situation by helping them organize an experience and perceive aspects of the information (Buechler, 2016). Visual frames can be defined as devices of an image that convey meaning through aspects of association, composition, and socio-technical elements. The influence of visual representations from social movements online has been paramount in spreading awareness for different causes (Meikle, 2015, Michaelson, 2015), but what is their influence towards building a community? As images, videos, and memes about a social cause have become more common for circulating information, these newer types of engagement are understood as activity within the social movement (Earl 2003, Turner, 2013). Roberta Garner (1997) defines social communication campaigns, petitions, and the like (Earl, 2011). As an approach to understand social movement actions and participation, framing is a useful way to appeal to a specific audience and consider existing grievances and cultural issues. In an attempt to explain social experiences, Goffman (1972) strengthened the concept of framing by describing frames as using subjective views to understand specific “slices” of an empirical world (Davis, 1975). Framing was introduced to the field of social movement research as a social constructivist approach for meaning making and meaning interpretation. In social movements, framing puts forward cultural components that review the
social construction of meaning by paying attention to grievances, motivation, recruitment, and identity in the context of collective action (Buechler, 2016). Social movement framing helps to conceptualize the work of mobilizing grievances and relies on an interpretive process that pulls from current events and culture.

Framing research developments include qualitative and quantitative methods for researching recruitment and participation, framing disputes, discursive fields, and communication efforts. With regards to using frames in social movement recruitment and participation processes, David Snow, et al 1980, apply a systematic review to three sets of data collected from previous case studies, recruitment documentation, and questionnaires to better understand process details, as opposed to the previously analyzed psychological and motivational levels of analysis. The data come from various types of movement organization structures, and the findings show that recruitment efforts are based around structural proximity, availability, and affective interaction (Snow, 1980). Community outreach structure was also found to be an important factor for recruitment strategies and growth. Further research would do well by applying this systematic approach at scale, and with digital technologies in mind. One example of framing in a digital recruitment process introduces the notion of distributed citizenship, where users define their part of their online identities as citizenship of groups online which assumes a creative political relation within networks to one’s contemporaries, specifically with social media (Meikle, 2016). Examples of early distributed citizenship are interactivities of do-it-yourself (DIY) cultural-political online communities that show a need for a type of “real” digital citizenship. Although this essay provides examples of distributed citizenship, there is no concrete methodology to prove the need or existence of it. Data collection might benefit from digital communication technologies by enabling a wider range of data collection processes to relevant participants in close proximity and those at a distance.

Research on using framing theory for communication efforts considers digital technologies for social movements. Earl et. al. (2016) review literature in political communication and social movement studies and suggest that the two fields be integrated for a better understanding of audience reception and context of social movement messages. Specific topics that would benefit from this collaboration include “information overload, selective attention, perceptions of bias, and the possibilities that entertainment-related communications open up, among others” (Earl, et. al 2016). This study helped show different aspects of messaging in social movements, specifically in recruiting for protest participation, but only goes in-depth on the medium of the message i.e. digital vs face to face, instead of the content.

Visual representation of social movements online provides information on the actions, messages and causes supporting the movement, with an intention of raising awareness and building support. In some cases, challenging an oppressor or state is part of the message (Earl, 2011). An online visual representation of a social movement is ephemeral and contingent on performance and actions, similar to descriptions of street art (Irvine, 2012). Online images can record actions and traces of the movement’s message, which have persuasive and recognizable elements of collective action that can be reflective of visual frames. This review of social movement image analysis understands that types of connections within the group can help to identify visual frames in social movement images online. Visual frames in social movements have been a foundational methodology in the field of research that implements notions of meaning making and goal setting for movements and their members. Framing as devices to convey meaning through elements of association, composition, and social and technical components, can create outlets for different methods of visual interpretation.

Social movement framing can be conceived in digital technologies by understanding the content used. The literature on communication and recruitment efforts discusses the affordances of digital technologies (Gregory, 2018), text data including documents and online communications (Bail, 2012; Earl, 2014), and models that can be applied to understand the frames being reviewed (Freelon, 2018; Tufekci, 2014, 2017). Specifically, if we review how images and video content are implemented in collective action of social movements, and include aspects of discourse and composition, there is potential to identify elements of frames being used. These frames can be understood as forms of visual representation of a social movement’s meaning construction and goal alignment, they can also review framing efforts at a more granular level.

**Visual Interpretation Modalities**
Rose’s four sites of visual interpretation modalities are used in this research as a framework for using frames to interpret images that portray actions, events, and messaging from social movements online.

- **Production** as a form of visual interpretation contributes to the effects of visual frames based on the technologies used to make that image, the access to those technologies, and the affordances provided by technologies (Rose, 2016).
- **Circulation** as a form of visual interpretation is understood as the technological and social modalities of movement between the image’s production and its audiences. Both places can be different in time and
environment, but the features of movement between these sites is determined by an image’s circulation (Rose, 2016).

- The Image Itself as a form of visual interpretation can be considered a commodity based on its objective and emotional qualities (Rose, 2016). These qualities can be intentionally or unintentionally perceived through the space and structure of visual effects found in the image (Rose, 2016).
- Audiencing of an image is when an interested viewer understands the meaning of an image and accepts or rejects them based on the circumstances of the viewing (Fiske, 1994, as cited in Rose, 2016). The types of technological displays, identifiable elements of an image, and social identities of a viewer have the ability to elicit a particular audience perception (Rose, 2016).

Visual Interpretation Approaches

Visual representation of online social movements can be understood through concepts of visual culture, visibility, and notions of ephemerality used to represent social practices and locate deviations from the quotidian. According to Margaret Dikovitskaya (2021) visual culture is “a research area and a curricular initiative that regards the visual image as the focal point in the processes through which meaning is made in a cultural context”. By specifically focusing on visual discourse in framing research, Rodriguez and Dimitrova (2016) identify levels of visual framing from different types of media content and its audience’s perception through a literature review. Their literature review focuses on the gaps in identifying frames in news discourse, and how the visual aspect of frames is more powerful than text because of a “lack of cognitive load” (Rodriguez, Dimitrova, 2016). They research how visual frames have been used in the past and how they can be analyzed in the future by developing a model of systematic frames including denotative, stylistic-semiotic, connotative, and ideological representations (Rodriguez, Dimitrova, 2016). The amount of information provided by a visual in one instance is colossal, especially with concrete framing elements. Although less thinking is needed to understand a visual with intentional messaging, if concrete references towards visual interpretation are lacking it can be harmful to the process of making meaning through visual interpretations. The authors touch on this subject and describe it as having specific referential implications for intentional messaging by specific parties (Rodriguez, Dimitrova, 2016). Mary Bock (2020) goes deeper into concrete theoretical applications of visual framing by proposing a model that uses specialized visual approaches opposed to language approaches. Block’s analysis applies a literature review that covers 165 articles, conference papers, dissertations, books etc to understand the creators of a visual frame, the material practices behind framing, and how the image works as a form of ideology (Block, 2020). Essentially, Block’s model covers production as a site of meaning making and falls short of including aspects of circulation and audiencing. Other research on visual frames spans across the four sites of meaning making by analyzing various types of framing approaches. Framing applications cover a wide range of topics that affect specific types of visual analysis, specifically pertaining to issues pushed by social movements. These applications can be viewed through aspects of the four visual interpretation modalities as sites of meaning making.

NETWORK ANALYSIS AND GROUP STRUCTURE: THEORY OVERVIEW

With regards to the visual interpretation model, identifying patterns of ties and group structure of images connected through online social movement actions can be paramount in finding visual frames regarding circulation and production. Circulation can influence group structure as movement of an image throughout a group has the potential to be part of a significant social, cultural, and political process (Rose, 2016). While using circulation to analyze patterns of ties, identifying the strength of nodes and their relationships to other nodes can be helpful in finding information circulation hubs that enable a larger or smaller spread of visual frames (Goldenberg, Han, Lehmann, Hong, 2009, Granovetter, 1973). The affordances and infrastructure of the social media platform enable specific forms of production practices that evoke various digital implications of re-sharing. These infrastructures for image production practices are helpful to identify common patterns of ties and structure within groups. For example, liking and resharing features are part of the algorithmic rules that can guide group formation and node relationships.

Group Formation

A group in a network is identified by the presence of ties within a network, both direct and indirect, as well as identifying full connections between individuals within a group, and complete isolation across groups (Hoffman, 2021). A group can be as small as two nodes with one connection, or as large as a million nodes with millions of connections, and at the most basic level, every node is reachable through a path by every other node (Hoffman, 2021). Mario Diani (2003) introduces the idea of a social movement being a specific type of social network based on specific types of relations formed within and between movements which can range from coalitions, solidarity campaigns, political organizations, and even countermovement (Diani, 2003). This idea is expressed through implementation of group identification, structure, and formation within social movement networks. Backstrom et al. (2006) attempt to understand the structural features and formation of groups within online communities, and how these groups change over time. Although the study was done before the heightened interaction of social media affordances, the study looks at links between users and finds that particular individuals and structural connections.
enable growth of an online community (Backstrom, 2006). This article is important for implementing a methodology that measures movement of a group within a network and for understanding how that movement is aligned with changes in the overall network structure (Backstrom, 2006).

Group formation and structure can infer potential sites of production and how access to social media platforms and the affordances provided by them can give insight on how information is spread based on how nodes might have more or less power over network connections. As a method for group formation and identifying group structure, stochastic blockmodels can be used in the Mixed-Methods Matrix framework. Stochastic Blockmodels can be applied to analyze the community structure of networks, which in turn can enable underlying implication of the overall social structure (Brieger, 2004; Cole, 2019). In this case, instead of finding nodes who share the same set of ties, stochastic blockmodels find nodes that share similar positions within their groups (Hoffman, 2021).

**Diffusion Practices**

One of the more influential theories of diffusion practices is the diffusion of innovation, or ideas and how they are adopted by specific individuals and communities. The concept is best explained by understanding that there are levels to how an idea might spread from early adopters, a majority and laggards (Rogers, 2013). Communities can be connected from a hierarchical mode, “top-down”, or proximal mode, where nodes connect to others that are spatially or culturally relevant, and maintain similar sharing behavior (Soul, 2004). Nodes can be connected using direct or indirect ties. Direct and indirect ties are important in exploring particular outcomes of information diffusion, for example, direct ties can facilitate ideological frames and protest tactics to be shared between different social movement communities while indirect ties are important to help spread a cultural understanding of values and ideas between similar nodes that might not have direct contact (Soul, 2004). These concepts can be applied to help understand how visual frames are spread throughout social movement networks.

An attempt to identify the position of a node and its structure in a network can be explored through positionality which is the analysis that looks at similar patterns of relations to see nodes that might occupy similar positions and perform similar functions in the network (Hoffman, 2021). This positional analysis is helpful for identifying nodes with the potential to circulate information to a larger or smaller network. Such nodes, or even subgroups of nodes, are called hubs and rest on their central positioning and acquaintance connections (weak ties) to spread information in an efficient and effective manner (Granovetter, 1973; Onnela et al., 2007; Wasserman, Faust, 1994).

**Deep learning overview**

Particular qualities of an image, both physically and symbolically, have the ability to shape meaning. One way to understand the components of an image is to look more closely at its compositionality and understand the semiological effects it might have on building visual frames. Deep learning, or neural networks can do this for a large image dataset. Deep learning tasks mainly consist of algorithmic methods for mapping an input vector to an output vector using layers of mathematical transformation that help process parameters and apply weights to the data (Goodfellow et al, 2016).

One of the more common deep learning applications for image methods is the Convolutional Neural Network (CNN or ConvNet) algorithm. A CNN processes input data with grid-like topology including images that have a 2-D grid of pixels (Goodfellow et al, 2016). The model then discretizes the data at regular intervals to assign learnable weights as importance to differentiable aspects of the image (Goodfellow et al, 2016, Saha, 2018). These weights help differentiate parts of the image and with enough training the process can learn specific filter types for classification. These filters represent features that can be adapted through training, effectively learning a set of features appropriate for the task, in our case, a set of features that represent the image. Essentially, the CNN model learns a collection of filters, each of which adjust its weights to highlight local relationships that can occur anywhere in the image. The collection of these filters are combined with a nonlinear function where many layers of the filters can be composed (Morrison, 2021). The CNN model is most used throughout the following research review and is applied in combination with other types of classification and feature extraction and word embedding models. These models are then put through a classification model, most of the articles in this review use a support vector machine (SVM) as a sentiment classification model (Kumar et al, 2020; Kumar, Jena, 2021; Oritis et al, 2021; Sajjad, Muhammad, et al, 2018). A support vector machine learns to assign labels to data based on what it learned in the training set (Nobel, 2016). As more labels are applied, the model learns how to tag the data and applied classification tags with more confidence (Gandhi, 2018).
Visual Sentiment Analysis
Sentiment analysis can be used to computationally categorize messages and attitudes based on the text. It is supposed to decide the sentiment of a text scored on a positive or negative effect based on a chosen sentiment corpus used in a model. Emotions and affect can be represented by signs and qualities of an image (Rose, 2016). For the purposes of this paper, the multimodality of the image as well as any textual elements attached to it can both be used for sentiment applications.

VISUAL INTERPRETATION MATRIX FRAMEWORK
The application of the combined methods for visual interpretation can identify the influence visual frames might have on a group based on the affordances of visual creation provided by a platform, as well as access to that platform. It also can aid in identifying types of frames that frequently circulate specific network structures. A review of methods incorporating the image itself and audiencing as forms of meaning making can aid in the compositional aspect of an image and how it can be perceived. The combination of methods is implemented into the visual interpretation matrix (Figure 3) which shows the computational applications that coincide with the sites of visual interpretation modalities. Each cell holds the application that describes the method which enables meaning making. The site of production can be a host for initial group formation while using stochastic blockmodels. The site of circulation can be interpreted through diffusion practices consisting of Exponential Random Graph Models (ERGM) and positional analysis. A suggested application to review the image itself is through image analysis with computer vision, more specifically using neural networks. The site of the audience can be reviewed through both diffusion practices of community structure network analysis and natural language processing methods in sentiment analysis.

Information Diffusion and Group Formation
Network and frame analyses are included in the core concepts of social movement research, but to date, few studies combine the two. The collaboration of both network analysis and visual framing can help to understand aspects of group formation tendencies based on the visual content being circulated online.

Visual frames at the sites of circulation and production can be looked at through the lens of diffusion practices and group formation. Diffusion practices deal with how information spreads throughout communities and have been theorized based on how types of information spread, for example innovations (Rogers, 2003). Group formation looks at processes of how communities come together to develop over time (Backstrom et al, 2006); this concept can be applied to online and offline communities. These concepts are used in network analysis methods and can be applied to online and offline content. Network analysis focuses on the patterns of ties between nodes or individuals (Hoffman, 2021), and is useful to understand social movement communities. Network analysis for social movements can also help understand patterns of visual framing within the content being shared in and across communities.
These patterns can be viewed in the context of qualitative and quantitative applications of diffusion practices and group formation.

**Figure 3: Proposed Mixed-Methods Matrix**

**Connecting Sites of Production to Group Formation**
Understanding the intricacies of structure and group formation can be key to identifying the particularities of groups within a network and might help the spread of information and framing effects for meaning making. By using group formation methods to explore the site of production, many researchers have attempted to combine stochastic blockmodels with other models to understand various positionalities and relational structure for different types of data. These approaches have been reviewed as extensions to community structure estimation methods (Nicola et al, 2021). For example, Cole and Williamson (2019) used count-based topic modeling and the stochastic blockmodel to understand relations within and across latent communities by reviewing the information being sent between nodes and groups. Another approach has been to review how stochastic blockmodels work with extensions of graph clustering. A literature review and comparison of types of graphs, clustering, and inference approaches, as well as number of group applications is investigated in a systematic and cross-sectional way, finds that the Stochastic blockmodel incorporating a Markov Chain Monte Carlo with a hierarchical structure showed positive developments for applications on graphs (Lee, Wilkinson, 2019). Markov Chain Monte Carlo applications are used to understand the probability distribution of a population by sampling from the distribution (Geyer, 1992), in this case the nodes were connected in a hierarchical structure instead of by proximity connections.

**Connecting Site of Circulation to Diffusion Practices**
Understanding the intricacies of structure and group formation can be key to identifying the particularities of groups within a network and might help the spread of information and framing effects for meaning making. Using methods of positionality in a network as diffusion models can enhance visual modalities of circulation. To review the information being spread within groups across networks, Yongjun Shin (2020) looks at how tripartite semantic networks can be used to understand message frames. A tripartite network reviews how three different types of groups can be connected by levels or proximity (Farraro, Doreian, 1984). By looking at differences in message framing over time, Shin (2020) applied the tripartite semantic network analysis to show small and significant differences in framing mechanisms based on network structure. Although the article does not focus specifically on visual frames, the implication of a tripartite analysis on understanding group formation and structure is an important addition to understanding circulation frames of images in a network.

Exponential Random Graph Models (ERGM) can be considered to identify diffusion practices of information throughout a network because they can control for many factors, not just node attributes. ERGMs use the observed network as a sample network to be seen as one instantiation of a set of possible networks with similar features as (weighted) parameters, including direct and indirect ties and node attributes, and maximizes the probability of the
observed network over other (usually thousands) similar generated networks (Cranmer et al., 2017; Hoffman, 2021; Luke, 2015). ERGM models can also be used to understand social roles within groups and how they facilitate information by focusing on the more prominent nodes specifically with ego-ERGM which helps model potentially latent dynamics of distinct roles and can help predict if an organization in question takes on a particular leadership role (Box-Steffensmeier et al., 2018). Extensions to ERMGs have recently been introduced to understand multiple relationships and interaction within groups, specifically groups with more than one type of relation or interaction, also understood as multilayer networks (Krivitsky et al., 2020). Group formation and group structure can infer potential sites of circulation and how access to social media platforms and the affordances provided by them can give insight on how information is spread based on how nodes might have more or less power over network connections.

**Computational Applications for Sites of Audiencing and the Image**

Visual frames for social movements online are derived not only from components of the image, but also how the viewer understands the meaning of an image. Compositional and social modalities derived from particular qualities of an image, aid in understanding the meaning making process through the image itself. Visual frames can add attention through audiencing in the form of convergence, where a paradigm shift is reflected through changes from medium specific content to content that can be consumed across multiple forms of digital tools (Jenkins, 2008, as cited in Rose, 2016). For example, heatmaps of the spread of Covid-19 have converged as a form of understanding levels of infection and have been seen not only on various social media platforms, but also in newsrooms, research outlets, and websites (Pan et al., 2020). The heatmaps were a result of consistent use by the audience and reflected how the data analysis application of visual cues enable a clearer understanding for the general public.

Network and frame analyses are included in the core concepts of social movement research, but to date, few studies combine the two. The collaboration of both network analysis and visual framing can help to understand aspects of group formation tendencies based on the visual content being circulated online. The application of the combined methods for visual interpretation can identify the influence visual frames might have on a group based on the affordances of visual creation provided by a platform, as well as access to that platform. It also can aid in identifying particular types of frames that frequently circulate specific network structures. A review of applications incorporating the image itself and audiencing as forms of meaning making can aid in the compositional aspect of an image and how it can be perceived. These methods can be understood through sentiment analysis and Deep Learning approaches.

**Connecting Sites of Audiencing and the Image to Deep Learning**

To supplement textual sentiment analysis of protests, a visual CNN model that recognizes protesters’ activity and attributes to estimate levels of perceived violence is implemented on data collected from online images of protests (Won, Joo, Steinert-Threlkeld, 2017). The research results in high accuracy measures of sentiment review as well as a protest image dataset of geotagged tweets to analyze visual attributes and sentiments (Won, Joo, Steinert-Threlkeld, 2017). Although the visual analysis captures general depictions of image characteristics to understand the overall sentiment of protests events, implications of privacy issues might arise, especially because of the geotagged data. Conversely, understanding the level of perceived violence at events of collective action has the potential to support the group and their outer networks in understanding the levels of danger in an event.

Deep learning methods have also been used in attempts to recognize collective action, disaster images, and other topics in the social sciences. Disaster images have a huge circulation on social media during and after the time of the event. The diversity of images that cover the disasters is helpful to build a benchmark corpus of categorical images for a deep visual sentiment analyzer (Zohaib Hassan et al., 2020). Other research reviews visual content for political science through automated methods of analysis, computer vision and deep learning, can contribute to new research questions and methodology to the field of political science (Joo, Steinert-Threlkeld, 2018). These advancements are helpful in applications of social movement analysis, as the field is connected to research in political science (Earl, 2000), and might have the potential to support visual frame analysis in the future.

**MIXED-METHODS MATRIX USE: INTERDISCIPLINARY IMPLICATIONS**

These applications are suggestions and examples for how to use the Mixed-Methods Matrix, which can be used in whatever creative manner a researcher deems appropriate. The Mixed-Methods Matrix attempts to provide successful mixed method applications for identifying visual frames, first for social movement images, and for other domain specific image datasets. Implementing mixed methods through visual interpretation approaches to find visual frames of social movement images can enable information extraction, classification, and interpretation through quantitative analysis. It can also provide a theoretical framework of perception as meaning making through visual frames. The Mixed-Methods Matrix contributes to the creation of a methods framework to better understand the implications of computational approaches in visual theory. Theorizing the application of these approaches can
inform actual experimentation on large amounts of data to see if outcomes exhibit a visual frame based on the visual interpretation methods.

Attempting to understand visual frames in social movement posts is necessary to develop a model of how social movements communicate online and for what purposes. Tools like the Mixed-Methods Matrix can be used to identify types of information spread online. Plenty of research has been done on digital technologies in social movements (Earl, Kimport, 2011; Tufecki, 2014) and how movements deal with problems that are seemingly similar to historical obstacles in the past (Earl, 2014); but communication, recruitment, and campaign processes online has implemented new approaches to collective action on and offline. As more of our lives move to online communication and we become more adapt to large amounts of data, the ability to understand how to become part of a movement, stop a violent event, or spread awareness is pertinent, especially when false information is now a normal part of online communication (Zanettou et al, 2017). Applying an extra filter of framing to how we perceive the meaning of messages can enable a viewer with added information on how to interpret an image online.

CONCLUSION
Visual frames in social movements have been a foundational methodology in the field. Framing can be used in various ways to reinforce established research methods including visual analysis through network analysis and deep learning. To understand frames of visual analysis, four modalities for interpreting visual materials are applied as a framework to understand how computational application might work to identify visual frames. The four sites include production, the image itself, the site of circulation, and sites seen by audiences (Rose, 2016). The applications of visual analysis are applied to social network methods including Exponential Random Graph Models, or ERGM to observe a network as a sample over a set of simulated possible networks to understand the structure of a network that enables information diffusion. Where stochastic blockmodels can be applied to analyze group formation to understand social structure. The review of these analyses is intended to understand how images connect to each other based on the content, viewers, and creators. Deep learning analysis methods consist of visual sentiment analysis using feature extraction and word embeddings using semiotics elements based in signs.

Future research on the ethical implications of using visual methods in collective action or social movement research is necessary for protecting the privacy and safety of social movement members. Especially since visual and location information is vital to the ethical implications of collective action events that might become dangerous. Also, future considerations of online censorship regarding visual content analysis is important for understanding how frames are built around specific types of compositionality. The methods and computational applications here do not cover aspects of the ethics of visual content, but the topic is appropriate for those attempting to replicate the Mixed-Methods Matrix.

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Enriching Library Holdings for English Language Learners: Applying Traditional Readability Formulas and Modern Cohesion Methods to Film

Durward, Matthew
University of Canterbury, New Zealand | mdu74@uclive.ac.nz
Organisciak, Peter
University of Denver, USA | Peter.Organisciak@du.edu

ABSTRACT
This study evaluates the effectiveness of various readability measures when assessing the difficulty of film materials for English Language Learners (ELLs). Library materials catering to ELLs are frequently limited to formal instruction texts and fiction materials. This study explores the feasibility of less laborious, computational text assessment methods to better understand library holdings from the perspective of ELL appropriateness. The investigation applies traditional formulaic readability measures and modern cohesion methods to film subtitle data. While text difficulty assessment with readability measures has been widely studied, there is a need to investigate which measures are most suitable for film application. In addition to evaluating existing readability measures, a more robust composite score is also presented, combining aspects of traditional readability formulas and modern cohesion methods. The experiments were conducted on real-world datasets and tested on film data marked for difficulty by ELLs.

KEYWORDS
readability, language learning, film difficulty, recommendation

INTRODUCTION
Over the past decade, there is growing desire for libraries that serve the increasingly diverse population of English Language Learners (ELL) within their respective communities (Foster, 2018). Public library environments are safe havens for users of different ELL backgrounds. Recent migrants benefit from these institutions as being a place to gain English instruction and support resource acquisition (Wexelbaum, 2016). However, the COVID-19 pandemic has highlighted a greater need for digital services and support beyond in-person interactions. The limitations on in-person communication can elicit an additional challenge for library professionals and users alike when providing material guidance, such as readers’ advisory (Lockley et al., 2021).

Existing methods of recommending resources for English Language Learners (ELLs) generally consist of either pre-compiled lists that assign difficulty by professional judgment (Moorhouse, 2020; Vardell et al., 2006) or materials that are specifically produced for ELLs that use levelling criteria to indicate difficulty and planned progression (Chou, 2022; Vuzo, 2023). These methods have been widely used in the field and have been shown to be effective in providing appropriate resources for ELLs; although it is essential to note that they should be used in conjunction with other strategies and considerations to ensure that ELLs have access to the most appropriate resources. Despite this, it is also important to acknowledge that these methods have limitations.

While current methods for constructing content recommendations for ELLs are valuable, they are hindered by quantity and medium: which means these materials only represent a fraction of a library’s holdings and are also confined to text materials. Further, they are restricted to specific written text registers such as narrative texts like novels or expository texts like formal instruction; this offers limited flexibility in choice on the user’s end. This begs the question of how the full extent of a library’s collection can be better utilized through the lens of ELL appropriateness. By doing so, libraries can bridge the gap between generalized recommendations to more audience-specific and personalized advisory lists.

One approach to expand content recommendations for ELLs in libraries is to implement readability measures that assess the complexity of other English-language texts. Readability, while not universally embraced as a phenomenon, is the perception of ease when reading a text by an individual (DuBay, 2004). There are numerous methods of assessing readability, but they can generally be thought of in two ways. First, traditional readability formulas such as Flesch Reading Ease (R. Flesch, 1948) and the Flesch-Kincaid formula (Kincaid et al., 1975), operate under the surface level features like word, sentence, and syllable counts. Second, modern cohesion methods like the Coh-Metrix L2 Readability Index (RDL2) (McNamara et al., 2014) that go a step beyond traditional formulas and are trained on deeper natural language processing (NLP) features.

Readability measures are sometimes used to match users to text materials. For example, the Flesch Reading Ease (R. Flesch, 1948) was designed to assist in matching users with schoolbooks, whereas the Linsear Write Formula (O’Hayre, 1966) was suggested to aid in the assessment of government technical manuals. Although these formulas were developed for written text, there has been evidence dating back near to the inception of popular formulas like...
the Flesch Reading Ease, denoting how these formulas might be even more suitable for spoken media over the written medium (R. F. Flesch, 1951). The use of readability measures as an assessment for films specifically for ELLs is sparse. New research into the area of matching low-literacy users with films based on caption data has demonstrated promising results (Pantula & Kuppusamy, 2020).

A recurring concern in research on the use of films as an ELL resource has been on identifying relevant resource selections that are both correctly paired with ELL comprehension level and engaging (King, 2002; Tuncay, 2014). Readability measures can facilitate matching users with resources that align with their proficiency while preserving their ability to choose content from a breadth of topics and genres. Beyond the content that readability measures can assess, other factors relating to listening comprehension can be acknowledged and assessed when evaluating films for ELLs. These factors expressed by Gilakjani and Sabouri (2016) primarily relate to listening comprehension and include features associated with the length and speed of speech production in addition to the accent or dialect expressed in the film.

There is potential to improve information access and aid resource acquisition for ELLs by enriching the metadata of existing library collections. Readability measures can facilitate the assessment of a film’s perceived difficulty, and this information can be incorporated into existing library metadata records.

An advantage of applying existing readability formulas and measures to film for ELLs is that these methods are computationally tractable and, compared to expert-recommended materials, they allow for broader coverage at much lower cost. However, the tradeoff is that assessment variables are largely limited to surface-level features that may not provide a thorough enough examination of the material. To understand the value of different existing measures for film, we investigate and compare a series of different measures.

Beyond readability and text cohesion measures, other film-specific information can further enhance the assessment of text difficulty in films. For example, Pantula and Kuppusamy (2020) found that incorporating a temporal dimension, specifically through the use of an Average Time per Frame (ATPF) variable, effectively assesses difficulty through subtitle data. In this study, we incorporate the average number of words per second derived from the film’s associated .SRT text file to account for a temporal dimension.

This study investigates the effectiveness of traditional readability formulas and modern measures in assessing the difficulty level of film materials for English Language Learners. Specifically, the research questions for this study are as follows:

**RQ1:** How do different readability formulas correlate when applied to film text, and how do these correlations relate to film's critical ratings and genres?

**RQ2:** Can readability measures and associated features, such as sentence length, word frequency, and vocabulary difficulty (among others), be used for tagging film appropriateness for ELLs?

While the readability formulas and cohesion measures have been studied with respect to text, it is valuable in the context of libraries to understand how these calculations relate to text derived from film. By investigating relationships between formulas and subtitles, we can better understand which specific variables appear to be influential factors for target ELL audiences.

**RELATED WORK**

**Readability Measures for ELLs**

Readability formulas were implemented as a mechanism to help assess the difficulty of textual materials and assist practitioners in appropriate selections that correspond with a learner’s comprehension level. Research in the areas of appropriate material pairing (Peregoy & Boyle, 2016; Qodir et al., 2016; Wu, 2014) have indicated the importance of connecting learners with balanced resources that promote progress for language development without being overly challenging. This difficulty can result in discouraged student participation or failing to not actively engage participants.

Readability measures, such as traditional formulas, possess limitations and are often met with criticism surrounding their validity. These issues predominately relate to the confines of the surface level features being calculated (Klare, 1976). The consensus from advocates of these formulas is expressed in their ease of implementation and interpretation: meaning they can be generated with relative ease, and they provide a score that can be easily understood by a user. However, they are limited in scope with regards to deeper factors associated with ELLs, those being features of context or text cohesion (Zamanian & Heydari, 2012).

Progressive research into readability measures designed for ELLs has been demonstrated with the advent of more sophisticated tools harnessing NLP techniques to investigate deeper features of associated text difficulty for ELLs.
Recent studies comparing traditional formulas with modern methods have indicated that measures like the RDL2 are more accurate predictors of perceived text difficulty for ELLs (Crossley et al., 2011; Nahatame, 2021).

**Film as a Resource for ELLs**

Film as a linguistic pedagogical resource resonates with the notions of the cognitive theory of multimedia learning (CTML) (Mayer, 2014), dual-coding theory (DCT) (Paivio, 1971), and bilingual dual-coding theory (Paivio & Desrochers, 1980). Multimedia-based approaches to learning for ELLs utilize various cognitive stimulation forms which work together to render more effective learning retention. The effectiveness of this strategy has been demonstrated to have a positive effect, particularly with listening comprehension in ELLs, as the associated visuals of actor portrayals and circumstantial cues of a film “can provide context and non-linguistic input to activate topon-down processing” (Vandergrift, 2007, p. 200).

Beyond gaining exposure to phonological components of language usage, films also provide awareness into language expression that is culturally dependent, a salient example being colloquialisms. Researchers Abolfazli Khonbi & Sadeghi (2017) found film to be the best non-interactive mode of teaching idioms to ELLs with only interactive role-playing demonstrating better results.

An advantage of utilizing film to promote ELL development is that these resources offer a high degree of flexibility for both educators and users in their ability to be manipulated via user controls (i.e., the ability to pause, stop, play, and rewind a film) and their inclusion or exclusion of subtitles and captions. Researchers Albiladi et al. (2018) have suggested that these resources can alleviate specific pressures associated with formal instruction while providing an authentic representation of linguistic expression that promotes cultural awareness which would otherwise be challenging to perceive in traditional educational media, such as in textbooks.

**Using Subtitles and Captions to Assess Difficulty for ELLs**

Traditional readability formulas and modern cohesion methods alike have been devised for the assessment of text mediums such as books, with limited studies into their implementation of video subtitles. Though, research is expanding in this field. Some advancements have been made into models designed for aligning film to low-literacy users based on features of sentence and word ambiguity, indicating a high degree of difficulty prediction accuracy (Pantula & Kuppusamy, 2020). Further, recent developments by Alghamdi et al. (2022) indicate promising results applying NLP regression techniques that utilize acoustic, lexical, and syntactic features. They demonstrate results that outperform the Flesch Reading Ease for the assessment of lecture video subtitles.

Whereas research is limited in using automated techniques to evaluate perceived difficulty of films for ELLs derived from subtitles, the broader scope of applying subtitles for ELL development is well researched often with varying results. Vanderplank’s (2010) review coalesces the notion that subtitles generally are a net positive for ELLs, although considerations may be warranted as to what type of subtitle (i.e., reversed, bimodal, or standard) is most suitable for a particular ELL. In their review of authentic video materials for ELLs, researchers Baicharoen and Boonyaprapak (2018) found subtitles to have a significant impact on ELL listening comprehension, while further acknowledging that flexibility of choice as when to use subtitles should be case dependent based on the objective of the learner or educator.

The most appropriate approach for utilizing captions or subtitles with ELLs is best determined based on the specific needs of the user. Therefore, for the purpose of this exploration, subtitles are solely used as a method for assessing associated difficulty of the language represented within a film. Using readability measures on subtitle data aligned with their respective films offers one method of assessing the difficulty of a particular resource. Though, there are additional elements accompanying films that may be beneficial to ELLs, such as the inclusion of metadata relating to the pacing or rate of dialogue expressed in a film.

**READABILITY MEASURES**

**Traditional Readability Formulas**

The many existing measures and respective variables for determining the difficulty of text can be broadly categorized into two categories: those that assess syntactic complexity and those that assess lexical complexity. Some common variables or features that are often used in the calculation of traditional readability formulas include:

- **Syntactic features**: such as the number of words per sentence or the total number of sentences, which are used to indicate the level of grammatical complexity.

- **Lexical Features**: such as the number of characters per word and the number of syllables, which are used as a substitute measurement for lexical density, or frequency counts of vocabulary associated with 'difficult' words. These measures are used to indicate the level of vocabulary complexity.

For this investigation, seven traditional formulas are selected:
**Flesch Reading Ease (FRE)** – This metric scores the difficulty of a textual material on a scale from 0 (Most difficult) to 100 (least difficult) and is based on the dynamics of the average sentence length and the average number of syllables per word within the text:

\[
206.835 - 1.015 \left( \frac{\text{total words}}{\text{total sentences}} \right) - 84.6 \left( \frac{\text{total syllables}}{\text{total words}} \right)
\]  

(1)

**Flesch-Kincaid Grade Level (FK)** – Based on the same principles as the Flesch Reading Ease score, this metric uses the same variables of words, sentences and syllables. This calculation slightly deviates from the FRE and performs a simple metric relating to an expected U.S. grade level:

\[
0.39 \left( \frac{\text{total words}}{\text{total sentences}} \right) + 11.8 \left( \frac{\text{total syllables}}{\text{total words}} \right) - 15.59
\]  

(2)

**Gunning Fog Scale Level (GF)** – This metric employs the variables of words, sentences, and complex words (those with 3 or more syllables) and is calculated as in equation 3, rendering a hierarchical result where higher values denote more difficult reading materials:

\[
0.4 \left( \frac{\text{total words}}{\text{total sentences}} \right) + 100 \left( \frac{\text{complex words}}{\text{total words}} \right)
\]  

(3)

**SMOG Grade (SMOG)** – This measure only focuses on two variables: the number of polysyllables and the number of sentences. Higher scores indicate a more difficult text:

\[
1.0430 \sqrt{\frac{\text{all polysyllabic words} * \frac{30}{\text{number of sentences}} + 3.1291}{\text{number of sentences}}}
\]  

(4)

**Automated Readability Index (ARI)** – This measure computes the ratio of the characters per word and words to sentences. Higher scores denote more difficult texts.

\[
4.71 \left( \frac{\text{characters}}{\text{words}} \right) + 0.5 \left( \frac{\text{words}}{\text{sentences}} \right) - 21.43
\]  

(5)

**New Dale-Chall Score** – This measure includes the variables of words and sentences, similar to the above formulas. However, it differs by incorporating a list of 3000 familiar words (i.e., understood by 80% of fourth-grade students). Higher scores denote more difficult texts:

\[
0.1579 \left( \frac{\text{difficult words}}{\text{words}} \right) * 100 + 0.0496 \left( \frac{\text{words}}{\text{sentences}} \right)
\]  

(6)

**Linsear Write Formula** – This formula, designed by the U.S. Air Force, was designed to assess the readability of technical manuals. Higher scores denote more difficult texts.

\[
\frac{(\text{easy words}+1) + (\text{hard words}+3)}{\text{number of sentences}}
\]  

(7)

Where easy words are denoted as two syllables or less and hard words are three syllables or more.

**Specific Measures for Assessing Readability for ELLs**

**Complexity Score**

*Common European Framework of Reference (CEFR) (Europarat, 2020)* – This automated formula is based off the CEFR language proficiency standard. These models utilize artificial intelligence to help calculate the perceived difficulty of individual words within a text. The percentage of difficult words are then calculated, and a cumulative score is generated to correspond to an individual’s proficiency level. Difficulty scores correspond with the CEFR framework ranking difficulty from easiest (i.e., A1) levels to most difficult (i.e., C) levels. The complexity score considers the proportion of words as represented in categories ranging from A1-C.

**Coh-Metrix**

*Coh-Metrix L2 Readability (RDL2) score* (McNamara et al., 2014) – The most computationally sophisticated formula included for this list construction, the Coh-Metrix v.3.0 analyzes 10 indices to establish a Coh-Metrix L2 readability score. The variables being calculated are listed as: content word overlap, adjacent sentences, proportional, mean (CRFCWO1); sentence syntax similarity, all combinations, across paragraphs, mean (SYNSTRUT); and CELEX Log minimum frequency for content words, mean (WRDFRQmc).

\[
-45 + (52.230 * \text{CRFCWO1}) + (61.306 * \text{SYNSTRUT}) + (22.205 * \text{WRDFRQmc})
\]  

(8)
An examination of the various traditional readability formulas and methods specific to English Language Learners (ELLs) reveals the relationships between measures, as illustrated in Table 1. It is evident that there is a substantial overlap of shared variables among traditional formulas.

<table>
<thead>
<tr>
<th>Readability Measure</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRE</td>
<td>Total words, sentences, syllables</td>
</tr>
<tr>
<td>FK</td>
<td>Total words, sentences, syllables</td>
</tr>
<tr>
<td>GF</td>
<td>Total words, sentences, complex words</td>
</tr>
<tr>
<td>SMOG</td>
<td>Sentences, all polysyllabic words</td>
</tr>
<tr>
<td>ARI</td>
<td>Characters, words, sentences</td>
</tr>
<tr>
<td>DC</td>
<td>Total words, difficult words, sentences</td>
</tr>
<tr>
<td>LW</td>
<td>Easy words, hard words, sentences</td>
</tr>
<tr>
<td>CEFR</td>
<td>Proportion of A1-C CEFR words</td>
</tr>
<tr>
<td>RDL2</td>
<td>CRFCWO1, SYNSTRUT, WRDFRQmc</td>
</tr>
</tbody>
</table>

Table 1. Listed readability measures that are tested and their associated variables.

This paper offers an analysis into how readability measures can be adapted to process film materials through existing associated subtitle .SRT data and demonstrate a proposed solution in increasing library holdings for ELLs.

**DATA**

For this analysis a diverse set of films were selected with respect to genre and representative of popular titles that are likely to be in demand by library users and are more likely to exist in a library's collection. To achieve this, subtitles for IMDB's top 250 English films through the year 2016 were processed (Users, n.d.). The subtitle data for the collected 250 films were sourced from OpenSubtitles.org in the .SRT format. Submissions to OpenSubtitles are user-based, and films have numerous associated .SRT files. To ensure the most accurate .SRT file was selected for analysis, manual extraction was chosen over the use of an API. As OpenSubtitles operates by user submissions, the quality of .SRT files can fluctuate in accuracy. The following criteria were used to select files, in order of priority: Sub Translator > Trusted > Administrator > Platinum Member > Gold Member > Silver Member > Bronze member > VIP member > Sub Leacher > anonymous. This procedure signifies that a file contributed by a Sub Translator was selected over an anonymous submission.

The construction and evaluation of our testing dataset resembles the approach used by Chen et al. (2020), yet it's tailored to our research context. We utilized a subset of the dataset provided by Pantula and Kuppasamy (2020), specifically focusing on films produced in spoken English with English subtitles. This subset includes binary readability ratings ('readable' labeled as 1 and 'highly readable' labeled as 2), converted from a 10-point Likert scale, with annotations gathered from university students in India, all non-native English speakers.

The original dataset by Pantula and Kuppasamy (2020) aimed to assess readability for a diverse set of low-literacy users, including individuals still developing their English proficiency, those with learning disabilities, and senior citizens. Our study, however, primarily concentrated on the English Language Learners (ELL) subgroup, consisting of university students with adequate L1 proficiency but for whom English is a second language. They evaluated films featuring spoken English dialogue and English subtitles, thereby providing valuable insights into this specific subset within the broader ELL spectrum.

The student evaluators considered various factors identified by Pantula and Kuppasamy (2020) that could influence readability, such as the reading rate versus speaking rate, pausing gaps while reading, and difficulties in interpreting captions' meaning. They also considered the timing of closed captions' appearance and disappearance in videos, which can impact user comprehension and reading speed.

**METHODS**

To determine the appropriateness of films for English Language Learners (ELLs), a comprehensive approach was adopted that included the application of a mix of traditional readability formulas, measures designed for ELLs, and a film-specific measure. A composite score was generated by combining the most effective features of readability found in the tested measures. The aim of this study is to compare the effectiveness of multiple readability formulas and modern measures in assessing film difficulty for ELLs, while also investigating the influence of additional factors in determining appropriateness for ELL viewers.
Traditional readability formulas are extracted using Python (Van Rossum & Fred, 2009) with custom scripts and the `Textstat` module (Aggarwal, n.d.) to generate values for equations 1-7. The complex score associated with the CEFR was generated through the CEFR checker web interface (McDowell & Settles, 2019). The Coh-Metrix L2 Readability Index (RDL2) was generated through the Coh-Metrix 3.0 web tool (McNamara et al., 2014).

The readability measures used here are traditionally associated with text complexity. To complement them, features specifically relating to video were devised for inclusion, namely the average number of words per second and word count over time. Here, words per second provides a generalization of the pacing of a film’s dialogue. This was accomplished with Python following procedures outlined by Onofrey (2019) which utilized the incorporated timestamp data aligned in the .SRT files.

To illustrate how accounting for the speed of dialogue of a film may benefit users and educators, a selection of five films differing in genre and production year are selected, including: *The Kid* (1921), *Aliens* (1986), *Baby Driver* (2017), *The Apartment* (1960), *His Girl Friday* (1940). Figure 1. demonstrates how a film like *His Girl Friday*, with over 3 words per second could elicit extraneous processing overload on an ELL of a lower proficiency. Similarly, Figure 2. provides an overall picture of the number of words expressed in a film over time.

Alongside testing specific existing readability measures, we aimed to investigate the particular features used in calculating these measures. With the emergence of new automated readability assessment methods and machine learning approaches, research suggests that blending these with traditional formulas can effectively assess difficulty levels (Liu et al., 2021). To this end, we implemented a stepwise feature selection using an ordinary least squares (OLS) regression model. This helped identify the most pertinent features and measures that could predict the target ELL score variable, based on the ratings given by English Language Learner students in the testing dataset. This iterative process eliminates the feature with the highest p-value, continuing until all remaining features have p-values below the chosen 0.05 threshold—indicating statistical significance.

The stepwise linear regression analysis identified nine readability features and measures that significantly contribute to predicting the target ELL score and to gauge film appropriateness for ELLs. These selected features include the number of sentences, words per sentence, Flesch Reading Ease, Flesch-Kincaid, Dale-Chall, Gunning Fog, Linsear Write, and the CEFR proportion of B1 words and B2 words. Each of these features has shown a statistically significant relationship with the target ELL score, indicating their importance in assessing film appropriateness for ELLs. The OLS regression model was fitted with the selected features, and the associated coefficients were obtained. These coefficients represent the estimated effect of each feature on the target ELL score while considering the other features in the model. A higher coefficient value suggests a stronger influence of the corresponding feature on the ELL score. By examining the coefficients, we can determine the relative importance of each feature in predicting the target ELL score and understanding their individual contributions to film appropriateness for ELLs.

The R-squared value obtained from the OLS regression model was 0.5791, indicating that approximately 57.91% of the variance in the target ELL score can be predicted from the selected features. This suggests that the chosen readability measures and features have a moderate explanatory power in predicting film appropriateness for ELLs. However, it is important to acknowledge that there may still be other factors not captured by these features that contribute to the remaining variance in the target ELL score. Further research and exploration are warranted to investigate these additional factors and enhance the predictive ability of the model.

From this, a composite score for the films was generated using the selected features associated coefficients in equation 9:
The use of sentence count as a variable for determining the difficulty of text has been extensively studied in the field of readability. This variable is commonly employed in traditional readability formulas, such as the Flesch Reading Ease and the Flesch-Kincaid formula, as a means of gauging derived features, such as the average number of words per sentence, in order to generate difficulty metrics. As such, this variable is consistently represented in all traditional readability formulas tested in this study. Furthermore, the continued relevance of this variable has been demonstrated in more sophisticated extracted features used in modern classification models for film, as evidenced by its application in assessing average sentence ambiguity in the work of Pantula and Kuppusamy (2020).

Both the Dale-Chall score and the proportion of CEFR B-level words represent measures of vocabulary difficulty in this study. The Dale-Chall score includes a variable based on the proportion of words that fall outside of the 3000 most commonly used English words, as identified by Dale and Chall (1948). In contrast, the B-level vocabulary metrics specifically focuses on the proportion of moderate-level vocabulary according to CEFR standards. While these measures are similar, they ultimately assess different aspects of vocabulary difficulty. By including both variables, we are able to achieve a more robust application of vocabulary difficulty as experienced by the tested ELLs. This aligns with previous research by Masrai (2019), which suggests that it is the combination and circumstance of high-, mid-, and low-frequency based levels of orthographic vocabulary knowledge as influential factors for L2 reading comprehension. In this sense, the Dale-Chall acts as a surrogate for the low-frequency words, while the B-level measurements are concerned with the higher and mid-frequency vocabulary distribution. The remaining features of the composite score, including the Flesch Reading Ease, Flesch-Kincaid, Gunning Fog, and Linsear Write, operate under the guise of a different form of lexical difficulty assessment by incorporating syllable count as a variable. In this sense, these measures are capturing a different component of expected word level difficulty compared to the Dale-Chall measure and B-level words.

The developed composite score used to evaluate the readability of film was applied to the dataset of the IMDB Top 250 English films. The results, presented in Table 2, demonstrate the top five films that were determined to be the most readable according to the composite score when in comparison to the other tested readability measures. In addition, Table 3 illustrates the films that were identified as the least readable, providing a comprehensive understanding of the relationship between the tested measures.

\[
\text{Composite Score} = 0.00067 \times \# \text{ of Sentences} \\
+ 20.39 \times \text{words per sentence} \\
- 12.29 \times \text{Flesch Reading Ease} \\
- 87.28 \times \text{Flesch-Kincaid} \\
- 0.50 \times \text{Dale-Chall} \\
- 0.79 \times \text{Gunning Fog} \\
+ 3.14 \times \text{Linsear Write} \\
- 22.78 \times B1 \text{ word} \\
- 11.54 \times B2 \text{ word}
\]  

(9)

**Table 2. Calculated readability measures and composite score for the top 5 most readable film text.**

<table>
<thead>
<tr>
<th>Film Title</th>
<th>FRE</th>
<th>GF</th>
<th>FK</th>
<th>SMOG</th>
<th>DC</th>
<th>ARI</th>
<th>LW</th>
<th>RDL2</th>
<th>Complex</th>
<th>AWS</th>
<th>Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Song of the Sea</td>
<td>100</td>
<td>2.8</td>
<td>.21</td>
<td>2.6</td>
<td>5.66</td>
<td>-1.2</td>
<td>1.7</td>
<td>27.02</td>
<td>1098</td>
<td>.77</td>
<td>31.03</td>
</tr>
<tr>
<td>The Hustler</td>
<td>100</td>
<td>2.7</td>
<td>.43</td>
<td>2.6</td>
<td>5.09</td>
<td>-1.7</td>
<td>1.6</td>
<td>27.01</td>
<td>812</td>
<td>.72</td>
<td>13.6</td>
</tr>
<tr>
<td>The Revenant</td>
<td>100</td>
<td>2.8</td>
<td>.46</td>
<td>2.7</td>
<td>5.52</td>
<td>-1</td>
<td>1.6</td>
<td>27.84</td>
<td>937</td>
<td>.63</td>
<td>8.62</td>
</tr>
<tr>
<td>The General</td>
<td>82.31</td>
<td>5.2</td>
<td>3.8</td>
<td>5.1</td>
<td>6.07</td>
<td>1.5</td>
<td>4.1</td>
<td>16</td>
<td>1199</td>
<td>.11</td>
<td>4.8</td>
</tr>
<tr>
<td>Rio Bravo</td>
<td>100</td>
<td>3.2</td>
<td>.73</td>
<td>3</td>
<td>5.17</td>
<td>-.6</td>
<td>2.1</td>
<td>29.37</td>
<td>730</td>
<td>1.74</td>
<td>4.37</td>
</tr>
<tr>
<td>Reservoir Dogs</td>
<td>95.7</td>
<td>3.9</td>
<td>1.73</td>
<td>3.3</td>
<td>6.34</td>
<td>-.2</td>
<td>2.5</td>
<td>27.6</td>
<td>1044</td>
<td>2.24</td>
<td>-.24</td>
</tr>
<tr>
<td>Monty Python &amp; the Holy Grail</td>
<td>94.07</td>
<td>3.9</td>
<td>1.46</td>
<td>3.6</td>
<td>6.06</td>
<td>-.1</td>
<td>1.8</td>
<td>20.9</td>
<td>1548</td>
<td>1.39</td>
<td>-.48</td>
</tr>
</tbody>
</table>
The King’s Speech  98.45  3.9  1.12  3.3  11.85  -4.1  2.6  13.142  4376  1.38  -.57
Witness for the Prosecution  87.32  5.1  2.86  4.2  6.36  .8  2.6  21.08  1179  2.19  -.72
American History X  94.98  3.9  1.30  6.0  6.15  3.5  .1  26.14  965  1.59  -3.95

Table 3. Calculated readability measures and composite score for the bottom 5 least readable film text.

ANALYSIS
Research Question 1
To answer Research Question 1 we can direct our attention to Table 4 where results indicated strong to very strong correlations greater or equal to \( r (248) = 0.8, p<0.01 \), for the traditional readability formulas: Flesch Reading Ease, Gunning Fog, and Flesch-Kincaid, and ARI (Automated Reading Index). This can be attributed to the high degree of overlap between the specific variables found within these formulas. In many cases, such as the relationship between the Flesch Reading Ease and the Flesch-Kincaid grade level, a very similar calculation is performed. However, they differ in the regression analysis used to generate their respective formulas. Moderate to strong correlations were observed for the Linsear Write formula between \( r (248) = 0.6, p<0.01 \) and \( r (248) = 0.8, p<0.01 \) with traditional readability formulas: Flesch Reading Ease, Gunning Fog, Flesch-Kincaid, SMOG (Simple Measure of Gobbledygook), and ARI. A strong positive correlation \( r (248) = 0.84, p<0.01 \) was observed between Dale-Chall and the CEFR Complex Score. This can be attributed to the emphasis on variables engineered to assess difficult words. While Dale-Chall focuses on the percentage of words outside the most common 3000 words in English, the complex score focuses on the relative proportion of A1-C level words in a text excerpt.

<table>
<thead>
<tr>
<th>Readability Measure</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Mean Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. FRE</td>
<td>92.48</td>
<td>4.6</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.56</td>
</tr>
<tr>
<td>2. GF</td>
<td>4.4</td>
<td>0.9</td>
<td>.93**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.34</td>
</tr>
<tr>
<td>3. FK</td>
<td>1.7</td>
<td>0.8</td>
<td>.97**</td>
<td>.96**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.34</td>
</tr>
<tr>
<td>4. SMOG</td>
<td>6.2</td>
<td>0.6</td>
<td>.93**</td>
<td>.93**</td>
<td>.94**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.33</td>
</tr>
<tr>
<td>5. DC</td>
<td>6.1</td>
<td>0.6</td>
<td>.40**</td>
<td>.39**</td>
<td>.38**</td>
<td>.38**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.20</td>
</tr>
<tr>
<td>6. ARI</td>
<td>0.1</td>
<td>1</td>
<td>.88**</td>
<td>.87**</td>
<td>.9**</td>
<td>.90**</td>
<td>.22**</td>
<td></td>
<td></td>
<td></td>
<td>.29</td>
</tr>
<tr>
<td>7. LW</td>
<td>2.1</td>
<td>0.6</td>
<td>.67**</td>
<td>.80**</td>
<td>.81**</td>
<td>.69**</td>
<td>.24**</td>
<td>.69**</td>
<td></td>
<td></td>
<td>.28</td>
</tr>
<tr>
<td>8. RDL2</td>
<td>24.3</td>
<td>3.1</td>
<td>.54</td>
<td>.51**</td>
<td>.56**</td>
<td>.51**</td>
<td>.48**</td>
<td>.46**</td>
<td>.47**</td>
<td></td>
<td>-.37</td>
</tr>
<tr>
<td>9. Complex</td>
<td>1153.6</td>
<td>313.1</td>
<td>.25**</td>
<td>.23**</td>
<td>.24**</td>
<td>.22**</td>
<td>.84**</td>
<td>.07</td>
<td>.15*</td>
<td>.53**</td>
<td>.12</td>
</tr>
</tbody>
</table>

Table 4. Correlation coefficients \( r \) for readability measures and mean inter-item correlation.

Notably the combination of percent difficult words of the Dale-Chall score and the moderately challenging B1 and B2 words proved informative for the generated composite score. This likely can be attributed to B level words providing a more in-depth understanding of the specific vocabulary found within a text. Moderate correlations are present for the Coh-Metrix RDL2 between \( r (248) = 0.5, p<0.01 \) and \( r (248) = 0.7, p<0.01 \) and readability measures: Flesch-Reading Ease, Gunning Fog, Flesch-Kincaid, Dale-Chall. To gain a better understanding of the relationship between measures, we opted for a mean correlation analysis of all measures signified in the last column of Table 4. Interestingly the two strongest correlations are the Flesch Reading Ease \( r=-.56 \) and the Coh-Metrix RDL2 \( r=-.37 \). It is important to note that the negative indicator here is only representative of the structure of these formulas where lower scores indicate increased difficulty, in contrast to the remaining measures. Further the complex score demonstrated the lowest mean correlation \( r=.12 \).

One of the potential benefits of applying readability scores to film recommendation for ELL is the breadth of films: it still allows for a participant to choose from a wide range of film types. To consider this benefit, we looked at the relationship between readability measures and critical consensus as well as genre. First, we measured the correlation between readability measures and a 100-point score from critical review aggregator Metacritic. The correlation was very weak, with an absolute \( r<=.06 \) for all measures except the CEFR Complex Score \( r=.15 \), suggesting that
readability scores do not discriminate between. Additionally, we evaluated the relationship between a readability measure (Coh-Metrix RDL2) and genre labels collected from Wikidata. Genre accounts for only 7.3% of the variation in the measure (F=1.889, p=.02).

**Research Question 2**
In order to address research question 2, a pointwise biserial correlation analysis was conducted to investigate the relationship between various readability measures and scores assigned by English Language Learners. Details of the analysis are shown in Table 5.

<table>
<thead>
<tr>
<th>Readability Measure</th>
<th>$r_{pb}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flesch Reading Ease</td>
<td>-.17</td>
</tr>
<tr>
<td>Gunning Fog</td>
<td>.13</td>
</tr>
<tr>
<td>Flesch Kincaid</td>
<td>.14</td>
</tr>
<tr>
<td>SMOG</td>
<td>.15</td>
</tr>
<tr>
<td>Dale-Chall</td>
<td>.04</td>
</tr>
<tr>
<td>ARI</td>
<td>.06</td>
</tr>
<tr>
<td>Linsear Write</td>
<td>.07</td>
</tr>
<tr>
<td>RDL2</td>
<td>.22</td>
</tr>
<tr>
<td>Complex</td>
<td>-.01</td>
</tr>
<tr>
<td>AWS</td>
<td>.06</td>
</tr>
<tr>
<td>Composite Score</td>
<td>.76*</td>
</tr>
</tbody>
</table>

Table 5. Pointwise biserial correlation of ELL-rated film scores with existing readability measures and generated composite score. *p<.001

The results of the pointwise biserial correlation between the readability measures and English Language Learners' scores found in Table 5 suggest weak to moderate relationships. The Flesch Reading Ease, SMOG, and RDL2 measures showed correlation coefficients of -0.17, 0.15, and 0.22, respectively. The composite score calculated showed the strongest relationship, with a moderate to strong correlation coefficient of $r_{pb} = 0.76$ ($p < 0.001$). It's important to note that the small sample size of 36 may have limited the power to detect significant relationships. Despite this, the results suggest that the composite score may be a useful tool for predicting the difficulty of film subtitles for English Language Learners. The findings indicate that while the individual variables associated with the readability measures have some influence on the difficulty level of film media, certain measures are more suitable than others for this particular type of media. Interestingly, the average words per second, used to reflect the relative dialogue speed of the film, showed the least correlation with audience level scores, tying with the ARI score at $r_{pb} = 0.06$. Perhaps this relates to the parameters applied to participants for the construction of the testing dataset. Further research is needed to confirm these findings and to establish the most appropriate measure of readability for film media.

**DISCUSSION**
This initial exploration provides valuable insight into the relationship between various readability measures and their application when assessing film difficulty for English Language Learners (ELLs). The results of the study indicate that there is a strong internal consistency between traditional readability formulas which can be attributed to the feature overlap in their respective calculations. Additionally, the results show a strong relationship between the CEFR Complex score and the Dale-Chall readability formula. This can be ascribed to the fact that both calculations place a specific emphasis on vocabulary difficulty. Furthermore, the results showed that none of the individual measurements tested yielded highly definitive results in determining the difficulty of films for English Language Learners (ELLs). However, the combination of raw variables from traditional formulas and the integration of modern measures as features was found to be more effective in assessing the difficulty for ELLs.

This research is an important step in understanding how readability measures can be used to assess film difficulty for ELLs and provides a foundation for future research in this area. The opportunity to adopt automated methods of assessing content difficulty with readability measures for ELLs is an achievable and a feasible option for libraries. Although, defining the best method or measure to implement for library holding metadata is something that needs to be further considered. It is relevant to note that traditional and modern measures are constrained in both the features that are being assessed and the target population being served. For example, traditional formulas were largely
This study aimed to explore the use of readability measures on film text data to enhance library resources for educators and ultimately may be a more appropriate solution for enriching library metadata for ELLs. A comparative analysis was conducted to examine the relationship between different readability measures. To examine the correlation between readability measures and perceived difficulty for ELLs, a composite score was developed by incorporating relevant variables. Results from a pointwise biserial correlation analysis indicate that a combination of variables from traditional formulas and modern measures specifically designed for ELLs demonstrated the strongest correlation with perceived ELL difficulty. Furthermore, the study offers suggestions for improving the assessment of ELL difficulty by incorporating personalized components, such as user-specific aspirations relating to English variety and register.

CONCLUSION
This study aimed to explore the use of readability measures on film text data to enhance library resources for English Language Learners (ELLs). A comparative analysis was conducted to examine the relationship between different readability measures. To examine the correlation between readability measures and perceived difficulty for ELLs, a composite score was developed by incorporating relevant variables. Results from a pointwise biserial correlation analysis indicate that a combination of variables from traditional formulas and modern measures specifically designed for ELLs demonstrated the strongest correlation with perceived ELL difficulty. Furthermore, the study offers suggestions for improving the assessment of ELL difficulty by incorporating personalized components, such as user-specific aspirations relating to English variety and register.

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Mutual Sustainability among Communities and Their Knowledge Infrastructures

Fenlon, Katrina  
University of Maryland, USA | kfenlon@umd.edu
Reza, Alia  
University of Maryland, USA | areza@umd.edu
Grimmer, Jessica  
University of Maryland, USA | jgrimmer@umd.edu
Wagner, Travis  
University of Illinois at Urbana-Champaign | wagnert@illinois.edu

ABSTRACT
Digital, community-based knowledge infrastructures confront complex, systemic challenges to their sustainability over time. From digital community archives to computationally amenable corpora, databases, or data models created by and serving research communities, these sites of grassroots knowledge production tend to be maintained without long-term institutional commitments. Yet, they hold unique cultural evidence of enormous value. Prior work on the sustainability of digital humanities scholarship has surfaced numerous factors in project sustainability, including technical, organizational, and financial concerns. The roles of communities themselves in sustaining community-based knowledge infrastructures, however, are under-studied. This qualitative, multi-case study of digital humanities projects and digital community archives addresses community-centered approaches to understanding and implementing sustainability for digital knowledge infrastructures. This study finds that communities of various kinds—from public communities to networks of research practice—conceive of the sustainability of their digital projects as inextricably linked to the sustainability of communities themselves. We offer an exploration of factors in the mutual relationship of sustainability between communities and their knowledge infrastructures, including how they support the wellbeing of individuals and cohesion among communities, and how they promote activism and advocacy efforts within broader publics and disciplinary cultures.

KEYWORDS
Digital archives; digital humanities; sustainability; digital preservation

INTRODUCTION
Community-based, digital knowledge infrastructures—including digital community archives and many digital humanities projects—are notoriously difficult to sustain over time (Zavala et al., 2017; Smithies et al., 2019; Edmond & Morselli, 2020; Drucker, 2021; Maron & Pickle, 2014). They tend to be maintained by small teams of volunteers and rely on short-term funding and fragile technical infrastructures (Fenlon, 2020). Digital humanities projects that are based in academic or cultural institutions—but which involve grassroots digital curation efforts or collaborations with trans-institutional communities of research and practice—confront similar sustainability challenges to digital community archives belonging to groups unified by shared identity, memory, or place. These are all sites of digital, cultural knowledge production, and they exist on a spectrum of shifting community and institutional support. They are community-centered, in the sense that they are intended to serve the immediate research needs or values of the public and academic teams and wider groups that collaboratively build, maintain, and use them. They tend to operate outside of, or otherwise defy, the paradigm of institutional stewardship that protects the mainstream cultural record in libraries, archives, and museums.

At the same time, community-based, digital knowledge infrastructures often collect and maintain invaluable evidence—and innovative interpretive or secondary work—focused on peoples, histories, languages, and cultural phenomena that may not be well documented or accurately represented in mainstream memory institutions. Digital community archives and digital humanities projects often represent the histories and cultures of marginalized groups, with the goal of rebalancing the equity and inclusivity of the cultural record in such a way that keeps stories and knowledge under the control and power of community ownership. These factors make digital, community-based projects simultaneously invaluable as sites of grassroots knowledge production, and at the same time highly vulnerable to loss.

Our research considers the urgent question of how to improve sustainability for digital, community-based projects in ways that are truly community-centered. Community-centered sustainability approaches take community ownership and power meaningfully into account, and do not rely exclusively on the conventional approach of handing off ownership of primary sources or digital artifacts to institutional preservation, but instead seek to maintain digital projects and their outcomes over the long term as living, vital, community-owned resources (Fenlon et al., 2021; Fenlon & Muñoz, 2019).

Through a comparative, multi-case study of four digital humanities projects of different kinds, we have addressed the question of how different communities understand and implement sustainability for their digital collections. Our qualitative case studies included a total of 44 semi-structured interviews, along with participant-observation and...
analysis of documentary evidence, to characterize how communities contribute to the sustainability of their own digital knowledge infrastructures. We restrict our analysis in this paper to a subset of three out of our four cases, due to space limitations, and therefore include a total of 34 interviews in the reported analysis. The digital resources at the center of each case study include a digital archive, a machine-actionable corpus of texts, and a community-maintained data model. Each of these resources are created by relatively small core teams, but these teams and the resources themselves are surrounded, supported, used, and sustained by wider communities as well, which range from local communities to networks of collaborative research or groups joined around shared digital methodologies. Through this research, we have identified a framework of factors in the community-centered sustainability of digital humanities projects, including digital community archives (Fenlon et al., 2022).

This paper reports on select findings of this study, specifically related to one factor: the mutual relationship between the sustainability of digital knowledge infrastructures and the sustainability of the communities that create and maintain them. How do digital, community-based projects contribute to the wellbeing and endurance of communities themselves? In prior work, which reported a preliminary analysis of a single case study, we observed how one digital community archive serves its community by enhancing social ties as a hub for collaborative effort, and by helping to catalyze activism and advocacy efforts for the community (Fenlon et al., 2021)—outcomes which resonate with the broader literature on community archives as activist spaces, which also support community wellbeing (Treloyn and Emberly, 2013; Cifor et al., 2018; Caswell et al., 2018; Stevens et al., 2010; Flinn et al., 2009). This paper builds on our previous work by examining a fuller set of case studies.

Our central finding is that our communities conceive of the sustainability of their digital projects as inextricably linked to the sustainability of communities themselves. The wellbeing of communities is understood to have a mutual or reciprocal relationship with the digital knowledge infrastructures the communities create and maintain—each serving the endurance of the other in nuanced and context-specific ways. In this paper, we explore those nuances, including how community-based digital knowledge infrastructures support career advancement for participants in communities, help to diversify disciplines and engage broader communities in projects, maintain social cohesion among communities, contribute to improving disciplinary cultures, and promote activism and advocacy efforts.

**PRIOR WORK**

Community-based digital cultural knowledge infrastructures are notoriously difficult to sustain (Fenlon, 2020; Zavala et al., 2017; Smithies et al., 2019; Edmond & Morselli, 2020; Drucker, 2021; Maron & Pickle, 2014). Many digital humanities projects and digital community archives meet this description, which adapts Edwards’ (2010) definition of knowledge infrastructures as “networks of people, artifacts, and institutions that generate, share, and maintain specific knowledge” (p. 17), to focus on the community-based production and maintenance of cultural knowledge in digital forms. Such efforts tend to rely on short-term models of funding as well as bespoke technical architectures, which are prone to breakage. They operate under resource constraints and tend to rely heavily on volunteer labor. Even where projects or their members carry some level of institutional affiliation, as is the case for many DH projects that originate in the academy, those affiliations rarely bring along an institutional commitment to a project or any promise of support over time. Indeed, many academics, including humanities faculty and librarians, work on DH projects in the margins of their time or without significant opportunity for credit or reward for their labor (Pilsch & Ross, 2022; Risam & Edwards, 2018). The curatorial work behind the scenes of DH projects, before they reach the point of publication, is often described as “invisible labor” (e.g., Graban et al., 2013; Klein, 2020), drawing on a concept stemming from feminist labor studies to characterize certain genres of digital work that do not garner recognition or valorization because they take place largely out of sight—of administrators, of funders, of evaluators, or of the marketplace (e.g., Klein, 2020). The invisibility and lack of recognition and reward for DH work within the academy continues to be amplified when projects are public-facing or community-based (Burton et al., 2021), despite what seems to be a paradigmatic turn in this direction in recent years. Outside of academic and cultural institutions, within digital community archives, some of these issues can be compounded: there are, of course, fewer mechanisms for extrinsic compensation or reward, fewer opportunities for using shared infrastructure, and less access to the technical expertise needed to effectively develop and maintain digital projects (Newman, 2011; Froese-Stoddard, 2014; Lian & Oliver, 2018).

In digital curation and digital humanities broadly, there is little consensus on what sustainability means or entails (Eschenfelder, 2016; Drucker, 2021). This is, in part, because sustainability is a complex concept, which has been redefined in every scholarly context and discipline that deploys it, and which is highly subjective and difficult to operationalize (Bell & Morse, 2008). In this paper we define sustainability as the endurability of digital projects as changeable, community-based resources in active use, and responsively serving community needs. From this perspective, the concept of sustainability is distinguished from that of digital preservation by its emphasis on maintaining living, evolving digital resources within their native contexts, rather than archiving static representations within dedicated systems of stewardship. Despite some overlap in pragmatic approaches to
sustainability and digital preservation—particularly when we consider the sustainability of primarily digital artifacts and objects—the digital humanities literature acknowledges the distinctions between these concepts (e.g., Miller & Taylor-Poleskey, 2020; Kilbride, 2015).

Research on improving sustainability for community-based digital projects has become a priority over the past few years as DH practitioners, funders, administrators, and other stakeholders explore remodeling systems of labor and credit, identify alternative funding models for community archives (e.g., Jules, 2019), and explore the constraints and possibilities of shared infrastructures. Yet, the problem remains largely intractable, in part for lack of recognition of certain key factors in DH and community archives sustainability. The prior empirical work on sustainability in the DH literature focuses predominantly on two core facets of sustainability for digital scholarship:

- The long-term viability of technical artifacts and infrastructures: Approaches to this focus on digital preservation and curation practices (e.g., Goddard & Seeman, 2019; Miller & Taylor-Poleskey, 2020; Kilbride, 2015; Poole, 2015), building shared technical infrastructures (e.g., Blanke et al., 2017; Dombrowski, 2014), and partnering with curation institutions to preserve projects (e.g., Sweeney et al., 2017; Vandegrift & Varner, 2013; Clement et al., 2013; and Pool & Garwood, 2020).

- The financial and management aspects of sustaining organizations, units, and projects: Approaches to these focus on business models and strategies for management, staffing, and governance (e.g., Zorich, 2008; Maron et al., 2009; Steurmer & Abu-Tayeh, 2016; Pratono et al., 2020), and building institutional partnership networks (e.g., Almas, 2017; Spiro et al., 2017).

While this rich literature has made significant headway on a subset of the facets that contribute to the sustainability of community-based digital knowledge infrastructures, it tends to obscure or overlook the critical roles of communities themselves, which are more nebulous entities that transcend teams and organizations. A smaller body of work has explored the impact of communities and community-based strategies in DH sustainability (e.g., Smithies et al., 2019; Langmead et al., 2018; Warwick et al., 2008). In particular, Edmond and Morselli (2020) offer a similar division of the prior DH literature in this area into two main categories of metaphors guiding sustainability planning: (a) sustainability as data preservation and the technical robustness of tools, versus (b) sustainability as the maintenance of organizations or institutions. They offer an additional category: sustainability as a user issue, which resonates with our conception of community-centered sustainability. Work in this vein considers how community needs factor into sustainability planning (e.g., Edmond Morselli, 2020; Smithies et al., 2019; Langmead et al., 2018; Warwick et al., 2008); how communities can form supportive networks (e.g., Edmond, 2013; Blanke et al., 2017); and community-building practices (e.g., Skinner, 2018; Arthur, 2014; Clement et al., 2013). This last body work often focuses on user communities, rather than assuming a broader perspective on potentially invested and allied groups. There is a distinct need for empirical research on community-centered sustainability approaches for DH and digital community archives. Community-centered approaches prioritize community needs and values in how they define and approach sustainability, rather than the pragmatic needs or workflows of organizations and institutions under the contemporary paradigm of library stewardship. In addition, a community-focused conceptualization of sustainability focuses on the roles that different groups play in sustaining digital projects and collections, as a complement to the necessary factors of financial, technical, and organizational pillars of support.

CASES

This paper reports on a subset of a multi-case study of four digital humanities projects. However, in this paper we restrict our analysis to the following three cases, in light of space constraints. While all are being developed by specific groups as new knowledge infrastructures, to meet their particular research needs, they differ in key dimensions that are relevant to sustainability—such as in topicality or domain, size and scope, stage of development, institutional support, and funding history. These cases were also selected to leverage proximity and prior connections between the PI and case study projects, as this is a time-constrained study and our participant-observation methods relied on relationships of connection and trust between partners and the research team, building which requires significant time and effort. Here we briefly characterize the core teams and communities involved in each case. The types of communities are different in each case, and projects are “community-centered” to varying degrees. A fuller description of the communities in each case and the relationships among them is available in Fenlon et al., 2022.

Lakeland Digital Archive

The Lakeland Digital Archive is the community archive of a 130-year-old African American community in College Park, Maryland, adjacent to the University of Maryland (UMD) near Washington, D.C. Lakeland thrived for decades before the process of urban renewal demolished much of its landscape and displaced two-thirds of residents from their homes. For more than a decade, Lakelanders—including historical and current residents and their descendants—have worked to collect and preserve the community’s story, to document its contributions to regional history, and to advance the interests of the surviving community and present-day Lakeland residents. The Lakeland
Community Heritage Project (LCHP), a small, volunteer-run organization, has partnered with UMD faculty and the Maryland Institute for Technology in the Humanities (MITH) to prototype a new, digital community archive. The beta version of the archive, now online, holds 4,000+ digital objects. LCHP’s efforts have given rise to a restorative justice initiative, and the City of College Park’s Restorative Justice Steering Committee is exploring reparations for the Lakeland community in light of the harms done during urban renewal, making College Park one of the first cities in the country to take action on reparations specifically related to the legacies of urban renewal (Bernard, 2021). Relevant and invested communities include not only Lakeland but other historically connected, regional communities, the UMD community, and peer community archives.

**Music Encoding Initiative**

The Music Encoding Initiative (MEI) is an effort led by a combination of scholars, volunteers, and practitioners working within the field of musical research. MEI utilizes open-source technologies to encode musical documents into a machine-readable structure, to support digital representations and analysis. Invested groups include librarians, historians, theorists, and developers. One of MEI’s major products includes the MEI schema, which provides a core set of rules for recording physical and intellectual characteristics of music notation documents expressed in XML. In addition to the MEI Schema, the initiative provides the MEI Guidelines, which explain the MEI model and its suggested best practices. The MEI community’s governing body, comprising an elected board and technical team, oversee maintenance of MEI's GitHub repository and release updates. In addition, several interest groups focusing on specific areas of development, such as pedagogy, metadata, and musical notation, drive most of the activity and continuous development of the standard. Despite being a relatively small group of volunteers from the academic musical community, consisting of scholars and librarians, they serve as a hub for a broader community of users, conference attendees, and participants in the community’s online forums, including a listserv and Slack space.

**Open Islamicate Texts Initiative and KITAB project**

The Open Islamicate Texts Initiative (OpenITI) is a cross-institutional endeavor to create a machine-actionable corpus of premodern Islamicate texts and tools for textual analysis for Arabic, New Persian, Ottoman Turkish, Urdu, and other Islamicate languages. The closely related Knowledge, Information Technology, & the Arabic Book (KITAB) project aims to provide scholars with new tools for textual analysis. These projects form part of a cluster of interrelated strands of research involving a constellation of overlapping collaborators. These initiatives also invite participation and contribution from scholars across history and other humanities subdisciplines, as well as natural language processing. Relevant groups and communities include individuals providing textual data, developers interested in optical character recognition and handwritten text recognition techniques, historians studying Islamicate texts, teachers looking to utilize texts in their work, and potentially more general readers of Arabic and Persian texts.

**METHODS**

This case was designed as a multiple-case study (Yin, 2018) of four digital humanities projects, with the objective of characterizing the relationship between communities and the sustainability of digital humanities projects, including digital community archives. In this paper, we report selected findings from only three of the four case studies, as including all four would exceed our space constraints. The use of a multiple-case study as our method supports the dual goals of (a) replication of findings about factors that lend to community-centered sustainability, and (b) cross-case analysis of expected contrasts in how different communities conceptualize sustainability and implement sustainability strategies. Our data collection and analysis protocols were guided by two main theoretical propositions, derived from a review of prior work on sustainability in the digital humanities and community archives literatures: (a) Digital humanities projects are surrounded and supported by communities of different shapes, scopes, and sizes, which play various, vitally important roles in sustaining those projects; and (b) The meaning and entailments of sustainability vary significantly depending on context.

The unit of analysis in each case was a digital humanities project, including its associated core team and wider communities. Data collection and analysis encompassed semi-structured interviews, participant observation, and analysis of documentary evidence associated with each case, including digital resources produced by the projects, various channels of communication for the team(s) and communities surrounding each project, the websites and grant narratives associated with each, technical documentation, etc. Data collection and analysis for all cases were conducted from the fall 2019 through spring 2022. Table 1 provides an overview of the sources of evidence used in each case. Cases varied in size and scope, and in the depth of our participant-observation work.
This paper reports on results of a subset of 34 interviews conducted across three cases. This is a subset of our full data collection, which includes 44 interviews across four cases; but reporting on the fuller analysis is out of scope for this paper. Following IRB approval and consenting processes, we conducted semi-structured interviews with a majority of core team members involved in each case, as well as representatives from wider invested communities. Each interview lasted approximately an hour and was done either via Zoom video call or in person (until the beginning of the COVID-19 pandemic, at which point all interviews and most participant-observation work happened via Zoom video calls). Interviews were transcribed using Otter.ai transcription software, and manually edited for accuracy, before we subjected them to qualitative content analysis (Zhang & Wildemuth, 2016) to identify relevant themes in each interview with supporting quotations. To support this analysis, we used Atlas.ti qualitative coding software. Our codebook was created in part deductively, based on the theoretical propositions with which we began, but many of our codes derived inductively from analysis of the data itself, arising from new and unexpected insights from participants or themes and patterns in their interviews. As we conducted analysis we adjusted and refined the codebook to reflect our growing understanding of the patterns and themes we were seeing across cases, and re-coded iteratively as needed. At least two coders independently coded every interview. The coders then met to discuss their codings and to achieve consensus on the codings, to achieve total interrater agreement (rather than meeting a statistical threshold of interrater reliability) (Zhang & Wildemuth, 2016). We first analyzed data from each case independently, and then sought to draw cross-case conclusions. We offered case study partners the opportunity to review our preliminary findings and refined our analysis based on their feedback. Case study partners are also invited to review all publications associated with this work.

The communities represented in our cases, of course, are not monolithic. There was no firm consensus among community members about what sustainability means or entails for their digital projects, so in the findings below we aim to reflect the diversity of their responses and perspectives. We use alphanumeric participant identifiers to distinguish participants when quoting them, wherein the first letter of the identifier refers to the relevant case study (LXX for Lakeland participants, MXX for MEI participants, and IXX for OpenITI/KITAB participants).

**Limitations**

Our level of engagement with each case study varied due to contextual factors—how busy our case study partners were, how well the timing of our research coincided with their own timelines, the physical locations of our partners and whether there were clear inroads for investigator participation in each project. Variation in the level of engagement across cases is to be expected, and we have worked to reflect on how our varying levels of engagement affected our interpretation through our memoing processes. We also rely on evaluation by our case study partners to help confirm our understanding of each case.

While they exhibit many important and useful differences for the purposes of understanding the roles of communities of varying disciplines, shapes, sizes, and with varying intellectual and social objectives, our cases

<table>
<thead>
<tr>
<th>Case</th>
<th>Data sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lakeland Digital Archive</strong></td>
<td>• 12 interviews participants, representing the project team and members of wider community  &lt;br&gt; • Participant-observation in regular project meetings (in-person and virtual), digitization events, conferences and public outreach events, class projects for 2+ years  &lt;br&gt; • Documentation: Team Slack channel, Website, beta version of digital archive, Airtable base, documentary, publications, news articles, etc.</td>
</tr>
<tr>
<td><strong>Music Encoding Initiative</strong></td>
<td>• 16 interview participants, representing members of governing board, technical team, working groups, and wider community  &lt;br&gt; • Participant-observation in MEI conferences, working group meetings, virtual discussions  &lt;br&gt; • Documentation: MEI organization Slack space, Website, community documentation, project descriptions and relevant publications</td>
</tr>
<tr>
<td><strong>OpenITI/KITAB projects</strong></td>
<td>• 6 interview participants, representing core project team  &lt;br&gt; • Participant-observation in two-day workshop and team working meeting in 2020, conference roundtable, observation of conference talks  &lt;br&gt; • Documentation: Grant proposal narratives, website, GitHub space, public project documentation, relevant publications</td>
</tr>
</tbody>
</table>

**Table 1. Data sources across three cases**
proved to be homogenous in certain ways that limit our capacity for analytic generalization (Yin, 2018). Our cases do not include any projects without prior funding, or any projects that are completely independent of institutional affiliations. (In fact, three out of four of our cases have significant attachments to the University of Maryland, as described above). While further cases to probe these facets—of funding history and institutional affiliation—are out of scope for this study, we hope to come back to these important facets in future work.

**FINDINGS**

While we found significant variation among the kinds of communities involved in each case and their levels of investment, in every case participants perceived their core teams and their emergent knowledge infrastructures to be serving a broader set of groups of shared interest, who are either actively or potentially involved in each project and its sustainability over time. Figure 1 offers an abstract view of how communities surround the core teams involved in each case. This is a rough and generalized depiction, derived from more detailed and case-specific illustrations offered in Fenlon et al., 2022. The goal is to illustrate how different types of communities radiate outward in metaphorical distance, or level of active involvement, from the center of each project. In every case the center constitutes a small, core team of volunteers. Beyond this team, participants perceived a variety of groups ranging on a spectrum from closest to furthest involvement in the active maintenance and development of each project, from being core partners, to contributors, to users, to potential allies whose involvement is latent but potentially beneficial to each project’s sustainability. Each general category depicted was described by one or more participants as having immediate or potentially useful roles to play in the sustainability of the project.

![Figure 1. Characterizing the types of groups and communities that surround each case study core team](image.jpg)

The most significant outcome of this work pertains to how participants in each case define sustainability in the context of the various communities they identified. Critically, participants across all cases tended to understand sustainability as manifesting not only through durable digital resources or financially stable and consistently staffed projects, but also through direct and indirect benefits to the wellbeing and sustainability of the core communities surrounding each project. In other words, they understood their projects to be sustainable if and only if their projects were actively contributing to the sustainability of their communities in various ways. In this section we explore the dimensions of this perceived mutual relationship between the sustainability of communities and their community-maintained knowledge infrastructures.

The principal benefit of a community-generated knowledge infrastructure for its community, in every case, was the most intuitive: to serve the purpose for which it was built, which reflects an immediate need among participants in the project and wider, related communities. In Lakeland’s case, the most immediate factor in how the digital archive supports the Lakeland community is in how it preserves the community’s valuable story from obscurity. In MEI’s case, the data model serves the community most directly by opening novel avenues of research, musical representation, and engagement. In the case of OpenITI and KITAB, the immediate purpose is to build digital tools and textual resources, which will provide broader access to Islamicate texts and enable computational and cross-language analysis of texts that have been historically inaccessible to relevant fields of research.
Beyond these immediate benefits to communities, our findings below highlight more nuanced ways in which the digital projects and resulting knowledge infrastructures support community wellbeing, by helping to build communities and increase social cohesion, by confronting issues of labor and credit that stymie fieldwide sustainability, and by promoting various advocacy and activism efforts.

**Sustainability as community and individual wellbeing**

For participants across projects, discussions about project sustainability often began with the maintenance and preservation of technical infrastructures or digital objects, but in every case the focus of the discussion rapidly shifted to the long-term wellbeing of the community itself, or individuals within the community. Participants were noticeably less concerned with the longevity of project artifacts or infrastructures—or even with the viability over time of specific constellations of people, funding, and technical resources that define “projects”—than with the human outcomes of their work. Participants defined the sustainability of their efforts as being realized through the wellbeing or sustainability of their communities, or of individuals within those communities. We originally identified this trend within the Lakeland case (Fenlon et al., 2021), where this sustainability imperative aligned closely with the impetus for the project as a whole—to maintain a community’s memory and impact. Our subsequent cross-case analysis has confirmed the pattern across cases, and it is striking to see this manifest among teams and communities defined around shared research rather than shared memory, where interpersonal commitments might be less intuitive or strong.

**Building community**

In the OpenITI and KITAB projects, for example, one participant characterized what they hope to sustain beyond the life of the project as an emergent network of collaborators with shared interests that exceed the boundaries of their current projects: “what we’re hoping to build is a network of people that will outlive the very specific formulation that is these funded projects” (I03). Multiple participants described how the network of collaborators on the OpenITI, KITAB, and related projects emerged from overlapping but distinct research interests: while all were invested in computational methods, and in different aspects of medieval history and literature, which cross linguistic boundaries: “we really have a common interest in joining together, developing standards together, developing infrastructure” (I02). The object of sustainability transcends the project’s intended deliverables—of a technical infrastructure comprising a digital corpus and analytic tools—to encompass social aspects. A participant described the emerging, sociotechnical research infrastructure as being built through “common webs of collaborations. And the corpus is the place we meet” (I03). From this perspective, the corpus—the ostensible main objective of the project and collaborations—is not the singular sustainability concern. Nor are the constellations of specific resources, people, and objectives that define the current cluster of projects. Instead, the corpus is positioned as a functional hub for an emergent, enduring collaborative network, which is the actual object of sustainability.

Sustainability for this collaborative network, in turn, depends in part on other social factors: drawing in new collaborators, and ensuring job stability for vulnerable members of the team. OpenITI and KITAB participants described the importance of expanding the communities invested in the project. Some participants talked about the strategy of involving the technical resources in classroom education, or hosting training workshops, as a way of broadening the user base (I01). Others talked about making the resource or the collaborative development process itself more inclusive—to reach people studying topics of tangential interest across related cultures or languages, such as researchers of the premodern Islamic world, of modern Islamic literature (I02), or African Sufism (I05); to engage broader publics of readers (I05); and to involve other projects doing more niche corpus-development work (I02). Participants were not unanimous about what the scope of the OpenITI and KITAB communities or audiences should be, whether in the project’s current stage or in the future.

**Labor and credit**

The other aspect of sustainability for a collaborative network stemming from the OpenITI and KITAB projects pertains to the careers of individuals within the network. Participants placed emphasis on the vulnerability of early-career members of the team, including graduate students and postdoctoral scholars as all of these projects are set against a broader backdrop of resource-scarcity in the humanities, including a dearth of full-time, permanent academic jobs in the humanities. Beyond ensuring that the data are accessible, graduate students and postdoctoral scholars associated with the project need tangible recognition for their intellectual contributions to collaborative work, to get credit toward career advancement: “sustainability requires probably both of those—making sure all the data is accessible…and then under that, too, is that those who are contributing to it are recognized for that” (I03). This is not a simple matter, as multiple participants recognized, both within the OpenITI case and the MEI case, that collaborative, digital scholarship is rarely rewarded or fully credited by traditional mechanisms of academic evaluation, which favors traditional modes of scholarship. As the same participant described of their graduate students and postdoctoral scholars, “I powerfully want to advocate for them, so they individually end up doing really well out of this…. [but] the bottom line is, they can't create resources for other people. They can do that. Sorry, but they can’t only do that” (I03).
In the MEI community, too, participants pointed to the career impacts of involvement in the MEI effort as a key factor in the sustainability of the community and the standard in turn. The MEI community provides new opportunities for member-participants, but also illustrates how disciplines continue to devalue digital scholarship, which makes involvement risky especially for early-career scholars without stable, long-term positions. Still, the reluctance of the musicology field, particularly in North America, to give due credit for digital scholarship, by compensating or rewarding individuals creating digital projects or contributing to their upkeep, poses real challenges to individual community members and the sustainability of the community as a whole. Several interviewees touched on this subject, one pointing out that “the community members are the engine or the drivers of this sustainability of the standard itself” (M15), and another explaining that “people are still a little bit reluctant” to embrace MEI or digital methods more broadly. Several participants recognized that, for this reason in part, much of the work falls upon a small number of people, which is in itself a sustainability risk. As one participant noted, “it’s not a really big community … the active ones. If you go to the different interest group meetings, you don’t have thousands of people there … and you don’t have dozens” (M11).

**Maintenance of social ties through process vs. product**

The intertwined relationship between the sustainability of the research communities and their knowledge infrastructures parallels what we found in the Lakeland case, which is centered in a different kind of community. Lakelanders are unified around shared identity, history, and memory—as opposed to a community or network of practice formed around intersecting research topics and shared research infrastructure, as in the other cases. In Lakeland, as previously reported in Fenlon et al., 2021, the core conception of sustainability for the community archive is inextricable from the wellbeing of the community itself. The maintenance of social ties within the community, despite its ongoing experience of diaspora, is one of the core objectives of the archive. Indeed, the processes of the archive’s development—as much as the product of the archive itself—serve the function of social maintenance, and therefore define sustainability for the archive. As one participant noted, it “wasn’t just about an archive. It was about a whole bunch of people relating around the archive and the organization of LCHP itself” (L02). The archive also plays a role in generating awareness and political goodwill for the community, by documenting the community’s importance to regional history, as a “hotspot of African American history” (L06). Furthermore, the Lakeland community understands the archive to advance the wellbeing of the community—including historic and current residents and descendants, and even people with shared aspects of identity in the local area or Black students at the adjacent university—in direct, active ways, as discussed below.

**Advocacy, activism, and social change**

Our cases also see their digital knowledge infrastructures as participants in direct and indirect efforts toward activism or advocacy for positive, sociopolitical and disciplinary change. In Lakeland’s case, the effort has helped catalyze a restorative justice initiative for the historic community, and participants see the archive as useful for guiding active urban development planning efforts. In the other two cases, the digital infrastructures are understood to be participating in intentional but more gradual efforts to influence broader disciplinary cultures, by diversifying disciplines and advancing the uptake of digital methods.

In prior work, we described how participants saw the value of the Lakeland Digital Archive for informing present-day development decisions related to transportation, zoning, and land use, as the archive documents this historically harmful effects of the creation physical barriers such as high-rise architecture and train tracks that divided and separated the community from nearby neighborhoods and local amenities (Fenlon et al., 2021). Multiple participants sought to bring the archive’s stories to bear on ongoing city strategic planning initiatives. Participants acknowledged, however, that leveraging the archive for political purposes carried attendant risks to its sustainability—by inviting political opposition or subjecting the archive to the wax-and-wane cycle of broader political interest (Fenlon et al., 2021). The social justice impacts of the archive have since progressed from advocacy to an active restorative justice initiative.

Participants understand the archive to be a catalyst for an emergent restorative justice initiative, which has been taken up by the City of College Park. Participants saw the archive—and particularly the collaborative energy and momentum built around it—as key factors in drawing attention to Lakeland’s story and motivating a response from actors and institutions that played active or passive roles in the destruction of the Lakeland community. While acknowledging that the restorative justice initiative had not yet borne out in tangible reparative benefits for the Lakeland community, one participant related the archive to maintaining attention at a critical juncture in the process, “from the current state where there’s a commission looking into making recommendations…to an actual restorative justice process” (L12). For most participants, the activist effects of the archive were not necessarily perceived to be the original or core objectives, but were a secondary, welcome outcome. The archive “widens the table for the City to come to” in negotiations about restorative justice (L06). Multiple participants, in fact, saw the restorative justice initiative as feeding back into the sustainability of the archive itself: “When we talk about reparations, we can
discuss ways to improve the archive. It’s not just opening your checkbook, it’s promises that can be made to ensure the sustainability of our documentation, heritage, and culture” (L06).

**Advocating for disciplinary change**

In our more academic cases, the advocacy work underway through the community-based knowledge infrastructures targets disciplinary cultures rather than public communities and governing bodies. In MEI, this work is focused on diversifying the discipline and increasing the recognition and acceptance of digital methods. In OpenITI, too, the focus is on increasing the recognition and valorization of computation work within relevant humanistic disciplines.

Several participants cited the increasing work of MEI to diversify the groups of people and types of music they support as a source of sustainability for the project and the community as a whole—by opening gateways to new communities while broadening the individuals contributing to the project, noting the symbiotic relationship of the contributors and benefactors. One participant noted, “we're moving more to geographically diverse, as well as … racially and ethnically, but it's slow, right? I think it's because it's such a niche thing” (M05). The goal is to diversify the types of music capable of representation in the MEI data model, and to simultaneously open the community itself to broader participation, internationally and demographically. MEI projects, created by community members, provide new and nearly always open access means by which to study scores and musical compositions individually or at the corpus level, making new methods of study available to a wider range of graduate students. A consistent group of committed members, many of whom serve on the technical committee, put on regular “intro to MEI” workshops at conferences, and contribute to tutorials on the MEI website to facilitate asynchronous learning of the basic tenets. The pedagogy group furthers these causes by creating materials and space for educators to incorporate MEI into their classrooms. They also frequently present at conferences to spread awareness of opportunities for engaging students with MEI and promoting it as a transferable skill. Further, the organization also provides subsidies for their travel to conferences and have continued the pandemic practice of online and now hybrid conferences as a means of increasing accessibility and diversity. To increase the use and standardization of MEI as a preservation and encoding standard, the metadata interest group often provides feedback and answers for librarians and archivists who use MEI in their work. Its proliferation in this space saw it recently added to the Library of Congress’s preferred digital formats, which will increase the number or works in this format that they collect and continue to validate the use of the standard, for both academic and preservation and access purposes.

Participants in both the MEI and OpenITI/KITAB case studies described working despite and against the resistance of disciplinary traditions, as mentioned above in our discussion of labor and visibility as factors in the sustainability of both communities. In OpenITI and KITAB, participants considered how their projects contributed to broader trends in the humanities, including incremental progress toward integrating digital methods into disciplinary cultures. One participant acknowledged that this work confronts “a longstanding issue that’s bigger than the OpenITI or KITAB project”, of barriers not only between digital humanists and people deploying traditional humanistic methods, but also within the digital humanities, “a rigidity in thinking…about what is important to look for”, or what kinds of analytic work have merit (I05). Their hope for the sustainability of these projects was to influence disciplinary cultures towards advancement past such divides, and to help foster common vocabularies among disparate researchers working on shared problems.

**DISCUSSION AND CONCLUSION**

In this paper we have explored the nuanced ways in which the digital cultural knowledge infrastructures support community wellbeing, by helping to build communities and increase social cohesion, by confronting issues of labor and credit that stymie fieldwide sustainability, and by promoting various advocacy and activism efforts. Figure 2 synthesizes our findings on the reciprocity between the sustainability of communities and the digital knowledge infrastructures that they create and maintain.
This synthesis focuses specifically on community-related factors in digital project sustainability. Clearly there are a plethora of other critical factors that affect the long-term viability of projects and digital resources, including financial factors, management and organizational factors, staffing, etc. The table omits the acknowledged tradeoffs or risks of these factors, which do not have exclusively positive effects on community wellbeing. For example, participation in these kinds of digital projects can result in unrecognized and unrewarded labor for vulnerable early-career scholars; and the activism of a digital archive may invite unwanted visibility or political opposition.

However, our findings shed new light on how we can reverse our approach to sustaining digital scholarship and digital community archives: from one that prioritizes the endurance of digital resources or formal organizations, to one that puts communities first, and considers how community-based digital knowledge infrastructures sustain communities themselves. Our findings also affirm that sustainability is a distinctively sociotechnical phenomenon, one that will not have exclusively financial or technical solutions, but which must fall back on the complex and shifting landscape of nebulous social groupings that surround, support, and use digital projects.

While prior work on community archives and public-facing digital humanities scholarship has emphasized the importance of such efforts for advancing the social justice causes of communities (Treloyn and Emberly, 2013; Cifor et al., 2018; Caswell et al., 2018; Stevens et al., 2010; Flinn et al., 2009), our findings shed light on additional ways in which a variety of community-based projects, as collaborative sites of knowledge production that engage a spectrum of academic and non-academic participants, support other kinds of advocacy, including toward disciplinary change and community diversification. These forms of activism and advocacy, while less immediately relevant to broader social causes, may play an important role in the impact of the cultural record emergent from community-based projects, given the increasing convergence of public humanities scholarship and community archiving initiatives. Disciplinary changes, like those advocated within our case studies, can promote the public impact of humanities and cultural work both inside and outside of the academy.

Future work will incorporate analysis of a fourth and final case study, of the Enslaved.org project, which is an explicitly public-facing humanities project. Through further analysis across all cases, we hope to flesh out a fuller set of sustainability factors for community-based digital collections and digital scholarship, beyond the single factor we have explored in this paper, of how digital projects support community wellbeing. In so doing we will connect this work to emergent, broader literature on the relation of cultural heritage to community resilience, with the overarching goal of amplifying the impact of a more equitable, digital cultural record.

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Audit Team Communication and Risk in Trustworthy Digital Repository Certification

Frank, Rebecca D.  
University of Tennessee, USA; Einstein Center Digital Future, Germany | rfrank7@utk.edu

Wylie, Jessica  
University of Tennessee, USA | jwylie6@vols.utk.edu

ABSTRACT
This paper aims to investigate the Trustworthy Repositories Audit & Certification (TRAC) process by examining the communication practices and risk communication dynamics among auditors during the audit. Through an in-depth, qualitative analysis of the audit process and the interactions between auditors, this paper provides valuable insights into the importance of diverse backgrounds, effective communication, and consensus building in the assessment of TRAC checklist requirements. Furthermore, the paper highlights potential areas of improvement within the audit process, addressing concerns related to disagreements, reliance on leadership, and the comprehensiveness of risk identification and communication.

KEYWORDS

INTRODUCTION
Much has been written about the essential role that digital repositories play in the curation and preservation of valuable information (e.g., Boyd, 2021; Kriesberg & Kowall, 2020; Thomer et al., 2022). Repositories carry out the vital work of preserving and providing access to a wide array of information, including research data, government information, and cultural heritage information. Processes have been established to evaluate whether the organizations entrusted with this uniquely valuable information are indeed up to the task (e.g., Consultative Committee for Space Data Systems, 2012a; CoreTrustSeal Standards and Certification Board, 2022; nestor Certification Working Group, 2013).

These processes evaluate whether repositories can be considered trustworthy for long-term preservation through a process of risk assessment that asks auditors to review and evaluate evidence submitted by repository staff members against a set of formal criteria (e.g., Consultative Committee for Space Data Systems, 2012a; CoreTrustSeal Standards and Certification Board, 2022; RLG-NARA Digital Repository Certification Task Force, 2007). When an audit process determines that a repository is indeed trustworthy in this regard, they are deemed a Trustworthy Digital Repository (TDR), and may receive certification confirming this status (e.g., Center for Research Libraries, 2010, 2011, 2012, 2013, 2014, 2015, 2018).

The Trustworthy Repositories Audit & Certification (TRAC) process is one such certification system (Center for Research Libraries, n.d.). In this system, auditors play a key role in interpreting the requirements and evaluating documentation of repository policies and practices against those requirements. Despite the central role that auditors play in this process, scholarship about TRAC and other TDR certification systems has not focused on this group.

In this paper we ask the following research questions about the auditors who were involved in conducting TRAC certification audits for the Center for Research Libraries (CRL):

1. In what ways do members of the audit team communicate during a TRAC audit?
2. How do their communication processes influence their perceptions of risk in the context of a TRAC audit?

Our findings indicate that diverse expertise and open communication using a variety of tools were essential elements of the TRAC certification process. Disagreements among audit team members were resolved through iterative discussions, allowing auditors to reach a consensus and achieve a shared understanding of the risks facing repositories in the context of the audit process. And finally, interviewees were confident in the accuracy of risk information communicated during an audit, but were aware that the process did not surface all of the risks facing the repositories that they reviewed.

LITERATURE REVIEW
Trustworthy Digital Repository Audit and Certification
Repositories can be certified as trustworthy for long-term digital preservation via several different systems, such as CoreTrustSeal, nestor, and TRAC (Center for Research Libraries, n.d.; CoreTrustSeal Standards and Certification Board, 2022; nestor Certification Working Group, 2013). All of these certification systems evaluate repositories against a set of criteria that are informed by the Open Archival Information System (OAIS) Model (Consultative Committee for Space Data Systems, 2012b). In this paper, we focus on the TRAC certification process as administered by CRL (Center for Research Libraries, n.d.).
In 1994, the digital preservation community identified a need for trusted organizations to manage, curate, and preserve digital information, and called for a process to certify those organizations as trustworthy (Garrett & Waters, 1996; RLG-NARA Digital Repository Certification Task Force, 2007). The TRAC certification process was developed as a joint effort between CRL, the Research Libraries Group (RLG), the National Archives and Records Administration (NARA), and the Consultative Committee for Space Data Systems (CCSDS) (Yakel, 2007). The checklist for TRAC was published in 2007 (RLG-NARA Digital Repository Certification Task Force, 2007). The ISO 16363 standard formalizing repository certification criteria was approved in 2012, and the ISO 16919 standard creating a process of accreditation for auditors was approved in 2014 (Consultative Committee for Space Data Systems, 2012a, 2014).


Research about TDRs has been critical of various aspects of the certification process such as the Designated Community (e.g., Bettivia, 2016; Frank & Rothfritz, 2023; Moles, 2022), but overall has emphasized the importance of understanding the value proposition of certification (e.g., Donaldson & Russell, 2021). However, scholarship has not yet established whether TDRs are more effective at long-term preservation than other repositories, meaning that the primary goal of certification – to identify and label repositories as trustworthy for long-term preservation – remains an open question (Bak, 2016; Donaldson, 2020; Maemura et al., 2017). Despite these challenges, several benefits of TDR certification have been identified, including increased stakeholder confidence, transparency in documentation, and improvements in repository processes (Donaldson & Russell, 2023; Lindlar & Schwab, 2018).

Much of the literature about TDR certification has consisted of self-reports from organizations about their experiences with certification, both through formal audit processes and self-audits (e.g., CLOCKSS, 2014; Houghton, 2015; Kirchhoff et al., 2010; Kraher et al., 2017). Literature also describes the work of groups who develop standards for TDR certifications (e.g., Dillo & De Leeuw, 2018; Giaretta et al., 2019; L’Hours et al., 2019). Missing from scholarship about TDR certification, and especially about TRAC certification, is empirical research that focuses on the experiences of the individuals and/or groups who carry out the work of the audit and make decisions about whether to award certification to repositories. Understanding their perspectives and experiences is essential for developing a well-rounded understanding of the audit and certification of TDRs.

**Risk and Communication**

Risk is fundamental to digital preservation (e.g., Barons et al., 2021; Conway, 1996; Vermaaten et al., 2012), and repository certification is largely an exercise in risk assessment (e.g., Frank, 2022). Research about TDR certification has tended to emphasize trust rather than risk (e.g., Bak, 2016; Berman et al., 2008; Donaldson & Conway, 2015; Dryden, 2011; Faundeen, 2017), a focus which emphasizes the goal of certification rather than the process or audit outcomes.

Communication influences the ways in which people construct their understanding of risk (e.g., Lachlan et al., 2009; Nelkin, 1989; Renn, 1991). Scholarship about risk communication has argued that perceptions of risk can be amplified or attenuated depending on factors such as the source, audience, and method of communication (Arvai, 2007; Kasperson & Kasperson, 1996; Lachlan et al., 2009). Communicating risk information requires an understanding of the audience (Konheim, 1988). Risk communication has been examined in the context of many different groups and types of actors, taking into consideration both the source and the recipient of information. For example, the involvement of media, government, political actors, scientists, and/or other types of experts can amplify or attenuate messages about risk (Arvai, 2007; Kasperson & Kasperson, 1996; Lachlan et al., 2009).

Different people, if presented with the same risk information, will not necessarily share the same perception of risk. In addition to the source and the audience, it is also important to consider the mode of delivery any time risk information is communicated (Arvai, 2007). For example, relevance of the information source to the recipient of the communication is an important factor influencing risk perception (Lachlan et al., 2009). The social amplification of risk, a theory about the "social experience of risk, behavioral responses, and secondary consequences relating to economic, legal, social, or institutional changes" argues that risk is a social construct and that hazards can interact with social processes to amplify risk and create secondary effects (Renn, 1991, p. 288).

Research has shown that formal risk assessment processes conducted by groups of experts do not necessarily address the questions or concerns that the general public (i.e., non-experts) have – when it comes to risk information, the two groups are often talking past one another (Konheim, 1988). Indeed, Konheim (1988) argues that people tend to trust, for example, their neighbors, more than experts when it comes to risk assessments. This is
relevant for TDR certification, a process in which the expert/non-expert dynamic emerges between stakeholder groups: standard developers and auditors, who are experts in the certification processes, and repository staff members, who are experts in the policies, procedures, and technologies used by their organizations. The expert/non-expert dynamic also emerges within each of these three groups. Members of the audit team during a TDR audit are selected for their particular knowledge and expertise in order to conduct the most thorough audit possible, but they do not have expertise in all aspects of repository management and thus are both experts and non-experts at the same time during their work as audit team members. Rather than TDR certification only being an example of experts communicating risk information about digital repositories to the public, it is also a process in which the stakeholders are both experts and non-experts and must communicate with one another in order to reach a consensus.

The process of TDR certification is one of risk identification and assessment. The goal of this process is for repository staff members to effectively communicate information to a team of auditors, who in turn evaluate that information and communicate their findings to the repository and the general public. Certification is a social process that has the potential to amplify risk information and create secondary effects in the context of digital preservation. Theories of risk perception that emphasize communication help us to understand that it is not only the identification of risk that influences digital preservation outcomes, but also the ways in which that information is communicated and received, and the actions that people take in response to this information.

In the context of a TRAC audit, an area in which communication about risks is particularly salient is the interactions among auditors who are evaluating repositories for certification. Auditors receive information from repository staff members, discuss and share additional information among themselves, and communicate information out to repositories and to broad audiences who may seek out the results of their audits. Communication about risk information between and among members of these different groups may amplify or attenuate risks depending on the mode of communication, the way in which the risk message is communicated, and the relationship between the source and recipient of the message. This has the potential to influence the outcome of TDR audits, and also repository practices if staff members rely on and trust in the expertise of the auditors (e.g., Bostrom, 1997; Wynne, 1992). Professional discourse around digital preservation and TDRs may also influence perceptions of risk for different types of stakeholders depending on their connections to the digital preservation community, and the ways in which the communication norms of this community either match or diverge from the communication norms of their own professional communities.

RESEARCH METHODS
This qualitative paper is part of a research project which investigates the social construction risk in digital preservation, focusing on the TRAC audit and certification process. The study involved 42 interviews with standard developers (n = 11), auditors (n = 10), and repository staff members (n = 21). In this paper we draw upon the 10 interviews with auditors who administered TRAC audits via CRL.

Data Collection
In-depth, semi-structured interviews were conducted with developers of the ISO 16363 standard, members of the audit team from CRL, and staff members from TRAC certified repositories. At the time of data collection in 2016, there were six TRAC certified repositories, and all audits had been conducted by CRL, as shown below in Table 1 (Center for Research Libraries, 2010, 2011, 2012, 2013, 2014, 2015).

<table>
<thead>
<tr>
<th>Repositories</th>
<th>Initial Certification Date</th>
<th>TRAC Score</th>
<th>Full or Partial Repository Certification</th>
<th>Repository Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadiana.org</td>
<td>2015</td>
<td>11</td>
<td>full</td>
<td>digital resources documenting Canada’s national heritage</td>
</tr>
<tr>
<td>Chronopolis</td>
<td>2012</td>
<td>11</td>
<td>full</td>
<td>digital preservation network</td>
</tr>
<tr>
<td>CLOCKSS</td>
<td>2014 (updated in 2018)</td>
<td>14</td>
<td>partial</td>
<td>e-journals</td>
</tr>
<tr>
<td>HathiTrust</td>
<td>2011</td>
<td>9</td>
<td>full</td>
<td>digitized books</td>
</tr>
<tr>
<td>Portico</td>
<td>2010</td>
<td>11</td>
<td>full</td>
<td>e-journals</td>
</tr>
<tr>
<td>ScholarsPortal</td>
<td>2013</td>
<td>13</td>
<td>partial</td>
<td>shared digital information and collections</td>
</tr>
</tbody>
</table>

Table 1. TRAC Certified Repositories

Previous research has demonstrated that the work of digital preservation involves collaboration across three main functional areas: digital preservation, IT, and repository administration (Frank & Yakel, 2013). The auditors who
were interviewed held professional roles in digital preservation (n = 4) and repository administration (n = 6). The audit team for TRAC audits consisted of official auditors, as well as an advisory board who reviewed documentation and prepared an assessment. For the purposes of this paper, members of both groups are referred to as auditors and/or audit team members, terms which are meant to encompass the range of individuals who were involved in reviewing and auditing repository documentation during the course of a TRAC audit for the six repositories in Table 1 above.

Interviews asked participants to reflect on their experiences with the TRAC certification process and to identify potential sources of risk for digital repositories. They lasted for one to two hours, depending on the role and experiences of the interviewee. All interviews were recorded and transcribed for analysis.

Data Analysis

Interview transcripts were coded in NVivo using a set of codes that included descriptive, analytic, and thematic codes. The code set addressed several themes, including: potential sources of risk for digital repositories, factors that influence the social construction of risk, the TRAC audit process, attitudes about TDR certification, and communication during the audit process. Coding began with a code set that was developed prior to analysis, and additional codes were added during the analysis process as needed. Transcripts were analyzed by a pair of coders working together to achieve an acceptable interrater reliability score. We achieved a Scott’s pi of 0.719 for the subset of interviews with auditors (Craig, 1981; Scott, 1955). Additional analysis focusing on discussions about interaction among members of the audit team was conducted by a single researcher.

Limitations

In this research we encountered problems with memory and recall (Sudman et al., 1996). Interviewees were asked to recall details about events that took place anywhere from three to eight years in the past. As such, we sent copies of the audit reports ahead of the interviews and suggested that interviewees review their own records, calendars, communications, and documentation before, during, and after each interview. Due to the small population of this community, social desirability and expectancy effects were also likely present, as well as inaccuracy in self-reporting and deference effects (Bernard, 2013).

FINDINGS

Our findings are organized into four sub-sections. First, we examine the audit process, the composition of the audit team, and modes of communication among auditors, including tools and platforms used during the audit process. Second, we examine communication processes during an audit, including communication among audit team members, and between the audit team and the staff members of repositories. Third, we explore how disagreements were managed among the audit team. And fourth, we end with an examination of risk communication among audit team members during a TRAC audit.

Audit Process, Team Composition, and Modes of Communication

Interviewees described an audit process in which repository staff members would prepare and submit documentation to meet the requirements in the TRAC checklist. The audit team would review the documentation, asking for additional information when necessary, which happened frequently:

“Always, 100%. I mean, if you ask how often, it always happens. And it’s a question of how much really. There are some repositories that do, have done a really stellar job. Like the [repository] people at [location]. [Full name of organization] did really a spectacular job of generating documentation and having it really very clearly written and addressing really all of the issues. But even in that case there were instances where we needed more information or explanation or something. So it’s always the case that there will be back and forth and the organization will need to add more documentation or better or new versions of documentation to better explain what is happening” (Auditor 06).

The extended audit team (i.e., audit panel members) would prepare recommendations for the auditors who would then conduct a site visit, investigating repository practices and confirming the accuracy of documentation. After the site visit, the full audit team would reconvene to prepare a final assessment and audit report: “It really depends on what kinds of responses we get from the self-audit and the documentation what we decide to look at at the site visit, but we need to confirm all the things that we had questions about and talk to the right people to help clarify other questions. Then we go back to the panel and talk to them about what we found, and then we come out with the report” (Auditor 03).

Interviewees discussed the importance of having a team of auditors with diverse knowledge and expertise, in order to ensure that all areas of the TRAC checklist could be assessed accurately. Several interviewees described situations in which someone with a particular expertise was able to ask questions, or identify a gap in repository documentation, which resulted in a more responsible audit. “Yes, because everything is not black and white. You
know, there’s some areas where you need to rely upon the group expertise, to do an analysis of a component of the metric. So it may be that someone is more familiar with something than somebody else, and they want to double check on something. Or if we want to double check to make sure that we’ve received all the documentation that one would like to have about a certain thing. So there’s a lot of backing each other up, and making sure that we’re right on target. And I think that makes it a more community-based and responsible effort, ‘cause it isn’t just one person coming in, and making a judgment call, exclusively, on their own” (Auditor 10).

The process described was one which required the contributions of multiple individuals with different types of expertise, communicating with one another around a set of documentation in order to evaluate repositories against a checklist of requirements. Multiple points in the process involved written and verbal communication among audit team members with different types of expertise, and the final result was one in which they needed to reach a consensus in order to determine the final outcome of each audit.

Interviewees described a variety of tools and methods that were used in the context of their work as audit team members to communicate with one another. The auditors used a mix of tools and platforms for communication and collaboration, including Google Docs, Excel, email, and various content management systems (CMS). These tools focused on document-centric collaboration, as the goal of the process for most of the audit team was to analyze repository documentation and write a report summarizing their assessment of that documentation.

While simplicity and accessibility were described as important, interviewees acknowledged challenges in finding a system that would work well for everyone. As a result, various communication methods were used, including both synchronous (e.g., group calls) and asynchronous (e.g., collaborative document editing, email, etc.) methods:

“If memory serves me, there were a lot of email ... They produced documents and the documents, we could comment on them. There was a CMS that CRL provided that we had to access, you logged into a member’s area and you could leave comments and that sort of thing. I kind of forget, a lot of organizations or a lot of, sorry, distributed groups at that time we were still using Microsoft Word and Excel. I say still, because they’re never really good at collaborative editing. You had to pass it around via email attachments or you had to upload it to a CMS. Google Docs became ascendant then. People realized that they could do real, real-time collaboration on documents. I recall lots of emails where we had discussions via email. We had regular, or not regular but a number of meetings, phone calls like teleconferences. And I do recall uploading documents to a CMS after we commented on them” (Auditor 09).

The general theme among interviewees was a pragmatic approach to collaborative tools that facilitated communication between audit team members without boxing them in to any one system or platform.

**Communication Processes**

We found that communication processes among audit team members were open, with regular synchronous and asynchronous interactions. In contrast, communication between auditors and the staff members of repositories under review were highly controlled, with one person managing all communications between the two groups.

**Among Auditors**

When discussing their experiences and interaction with one another, interviewees discussed the importance of communication and interaction to share knowledge across diverse areas of expertise. An open and supportive environment among auditors allowed them to ask questions and engage in collective decision-making. Most said that they were in regular communication through the process, and that this allowed them to divide tasks amongst themselves in order to distribute the workload and allow each auditor to contribute in areas relevant to their own expertise.

For each TRAC audit the team of auditors was broken down into smaller groups, depending on their areas of expertise. Different subgroups chose to communicate in different ways and with varying frequency. For example, Auditor 04 explained a process in which the team was in regular communication via email, with meetings as needed: “I don’t remember but it would seem like it would be monthly or every six weeks. Sometimes it depends on how quickly we get responses back from the repository as questions come up and we put them to the repository. Within the subgroups there is often just a steady low-level email conversation going on.”

In contrast, Auditor 06 described a process of regular conference calls, “during that process we generally break up into smaller groups and focus on a particular section of the three main sections of the audit. And meet via conference call, usually, to discuss issues or questions and then write up a summary report for the auditors and give it to them. And then there are regular calls of the whole group to discuss them.”

Auditor 08 said that the frequency of communication depended on the quality of documentation submitted by each repository, and the amount of additional documentation that auditors would need to request:
One interviewee, however, expressed uncertainty about the communication among the audit team. Auditor 09 explained that the process was opaque, and that he had the impression that decisions were being made behind the scenes which influenced her work but to which she was not privy:

“There were times when I distinctly recall that I thought there was a lot of things had gone on between communication cycles. I didn’t really think too much of it at the time, because I thought, we’re just giving our input. The people at CRL are, they’re actually doing the work of collecting all this information and putting it into their, kind of, their packages and their envelopes and templates. There were honestly, there were times and it may just have been an artifact of me having a busy schedule and not paying attention or something, but there were times when I felt like there was a lot of, there were side discussions going on that had shaped the questions that I was not being asked” (Auditor 09).

Interviewees described adaptable communication processes that varied depending on the conditions of each repository audit and on the preferences of the sub-groups within the audit team. Some interviewees spoke with confidence about these processes, while others found them to be opaque. The lack of standardization was helpful for a process that needed to adapt to the conditions of each individual audit. However, we argue that it also had the potential to be problematic in light of the fact that the certification process was meant to assess repositories based on a clear set of criteria in order to produce results that could be compared across audits.

**Between Auditors and Repository Staff**

A feature of the TRAC audit process is the limited interaction between members of the audit team and staff members from the repositories being audited. “The panel never really talks to the repository” (Auditor 03). Interviewees explained that communication with repository staff was typically channeled through a single point of contact in order to streamline the process and ensure consistency. This separation had the benefit of maintaining a degree of separation between auditors and the staff members of the repositories under review, as it was likely that members of the two groups would know – or at least be familiar with – one another: “No, I think we were over to the side. CRL dealt with them and us, even though these are people that I work with all the time, the staff at [repository], but we didn’t go to them directly, no” (Auditor 07).

Interviewees explained that the initial documentation provided by the repositories was not sufficiently clear or comprehensive enough for their needs, necessitating clarification and/or additional documentation. The additional back-and-forth required to meet this need was channeled through the single point of contact described above. While this simplified the process in some ways, limiting the number of requests that repository staff members would receive, it also created opportunities for miscommunication by having information travel across multiple people, like a game of telephone:

“[T]here's usually some more back and forth because it invariably happens, they'll mention something. I'll remember it, and then I'll be like, "Wait a minute. I need to see that. They talked about it, but I didn't see it," or something along those lines, so I need to do that sort of thing. Then sometimes, we'll go back to the panel, and they'll be like, "Wait a minute. What about this?" We'll have to go back and talk to them about that. Then sometimes if there's deficits or there's something that needs to be fixed, there's a lot of back and forth about that. If we found out that they didn't have some sort of system for checking their files or something along those lines, we'd want to see them doing that before we could certify them, so there would be all of that hand holding, too” (Auditor 03).

Communication between auditors and repository staff members was channeled through one representative from each side of the audit process. This served to streamline communication and shield auditors from potential conflicts of
interest although people with connections to the repositories, and/or staff members of those repositories, were still able to participate in the process. The streamlining did not always save time or make the process more efficient, however, because the specific people handling communication between the audit team and the repository staff did not necessarily have expertise in areas relevant to the discussion.

**Managing Disagreements Among Auditors**

Interviewees described instances of mild disagreement among members of the audit team. When disagreements would arise, they were addressed through iterative rounds of discussion and deliberation. Auditors would work together to resolve disagreements, reaching a shared understanding and consensus in order to ensure that the final result was one that they could all support.

In some cases, disagreements were resolved through discussion and negotiation: “There's certainly disagreement about, as we're discussing, as we move through each of the sections when talking about the individual items and the documentation provided by the organizations there are disagreements. There have been disagreements about, as we talk about any particular item, about the significance of how serious somebody felt a problem might be, or just a range of opinion about how to assess any particular item. But we talk through them and come to an agreement that’s in the process. And I think that by the end of the process everybody agrees with, and is ready to sign off on, the assessment that CRL comes to” (Auditor 06).

In other cases, interviewees deferred to the opinions of CRL leadership in resolving disagreements. Auditor 08 explained that when the audit team had trouble resolving a disagreement, they would rely on the opinion of a particular high-ranking staff member at CRL, “When we had questions, we would defer to [name] at CRL, who was the most experienced person with all of this, with more than [number of years] of doing this kind of thing.” This practice seems to run counter to the design of the audit process, in which people were brought in to the team for their particular expertise in order to inform and advise CRL staff.

Auditors also recognized that there was a balance between seeking more information and the diminishing returns of excess detail. They were able to achieve consensus about how much information was needed to resolve disagreements, in order to assess each repository for TRAC certification. Auditor 08 explained that through the process, auditors came to see that there was a point at which more information did not necessarily help the team make a determination about the repository being evaluated. “You could always ask for more and more information, and at a certain point, the additive piece of what you get out of a certain piece of information becomes less and less” (Auditor 08).

Interviewees characterized disagreements as opportunities for communication amongst audit team members, and to request additional information from repository staff members. Some found that there were limits to how much conflict could be resolved with additional documentation. Others were over-reliant on the opinions of CRL leadership, a group of people who were themselves relying on the audit team members for their expert assessments.

**Communicating Risk**

Interviewees were confident that information about risks was communicated accurately among audit team members. When asked directly, Auditor 07 was unequivocally confident in the accuracy of risk information shared among audit team members. “Yea, I felt confident in that, as well.” However, some were less confident that the process could surface all the relevant risks facing the repositories being audited: “I'm pretty confident about that because of the way those risks are shared, because of the report on the site visits that come up in discussions that follow. There's usually a conference call discussion that's part of the ... there's always a conference call discussion that's part of the process. The folks who are involved in the site visit are giving their perspective and addressing questions which spawn more questions. Through that I think all the risks identified come up. Obviously, have we identified all the risks? Probably not” (Auditor 04).

It was important for members of the audit team to have diverse backgrounds and different types of expertise, in order to inform all of the aspects of the TRAC requirements. Auditor 06 explained that in addition to needing sufficient expertise, it was also important for diverse perspectives in order to prevent over-emphasis on any one aspect of the repository in a process whose goal was a comprehensive analysis of each digital repository:

> “And the importance of having people from organizations on this advisory committee helped shape that more consistently so that there weren’t people with particular hobby horses always insisting on certain ways of doing things. You could have a multiplicity and heterogeneity of backgrounds to temper ... Because the standard doesn’t prescribe any particular, doesn’t prescribe a whole lot really. It really asks, for the most part whether what the repository is doing meets the expectation and understandings of its members. And so that’s what we’re trying to assess is whether they can, first explain what they’re doing, and then second whether this meets what they’ve told their members they’re doing and the members have agreed.”
Besides recognizing the significance of diverse viewpoints for assessing a repository against all TRAC criteria, which evaluate a repository's risk assessment, interviewees were at ease discussing risk-related matters with each other. Auditor 04 expressed confidence about discussing risk, and asking for input from other audit team members, “I felt very free to contact my colleagues and say, ‘I don’t understand this, or this seems like a risk to me. Am I reading this correctly?’ Or to check in on things that I didn’t feel comfortable with before we went to the larger group” (Auditor 04).

In the context of a TRAC audit, a process that evaluates trustworthiness for digital preservation through a process of risk assessment, audit team members were confident that communication about risk information was accurate but were aware that the risk information communicated was not comprehensive. They relied on the varied types of expertise of their audit team members to reach accurate conclusions about the risks facing each repository.

**DISCUSSION**

Auditors play a central role in TDR certification as the people responsible for interpreting the checklist requirements and applying them to information provided by repositories. Despite their position as key players in the audit and certification process, the experiences and attitudes of auditors have been understudied in digital preservation research. This paper extends discussions about TDR certification to include an investigation into the communication practices of auditors across all of the TRAC audits administered by CRL.

While much has been written about the experiences of repositories going through TDR certification processes, and about the development of TDR standards, the experiences of those conducting the audits have received comparatively little attention. Indeed, one of the interviewees in this study identified communication among auditors in TDR certification as an understudied and opaque, part of the audit process:

>“It would be interesting to think about how the communication amongst certification panel members works and what role that plays. I wouldn’t say that it’s a terribly important flaw in the certification process, but let me put it this way, it was probably one of the least well understood aspects of it, from my perspective. One of the more opaque parts of the process. But I’m having difficulty expressing why” (Auditor 09).

Interviewees expressed confidence in the audit process and the resulting certifications. While they did describe challenges in communication during the audit process, their overall attitudes toward the process were positive and indicated that they were able to effectively communicate with one another to reach a consensus. This aligns with previous research about TRAC, which found that auditors as a group shared consistent understandings of the risks facing repositories and the effectiveness of TRAC certification for demonstrating trustworthiness for long-term preservation (Frank, 2022).

We have established that communication influences the ways in which people perceive and construct their understandings of risk (e.g., Arvai, 2007; Cho et al., 2015; Kasperon & Kasperon, 1996; Konheim, 1988). Communication among audit team members during the TRAC audits was pragmatic, allowing sub-groups of auditors to self-organize and use a variety of synchronous and asynchronous modes of communication. Interviewees expressed positive attitudes toward, and deference to the expertise of, CRL leadership and their fellow audit team members. As the organization coordinating the TRAC audits, CRL leadership also selected the members of the audit team for their expert knowledge. This appears to have facilitated a process in which auditors trusted the expertise of their team members in part because they trusted the judgment of those managing the process. This created conditions that allowed them to be confident in the accuracy of risk information that was communicated during the audit process, while also understanding that the risk information was likely not exhaustive.

The relatively smooth communication about risk information among members of the audit team reflected their shared view of the audit team as consisting of people with expertise in digital preservation. It is likely that the selection process, regular communication, and emphasis on the audit team as a group of experts with a shared goal reinforced this perspective while minimizing the differences in their expertise and areas in which audit team members may have lacked a shared understanding of risk. Research seeking to further examine the social amplification of risk in relation to TDR certification should examine perceptions of risk outside of the direct stakeholders in the certification processes (i.e., standard developers, auditors, and repository staff members), in order to investigate secondary effects as described by scholars such as Renn (1991).

Our findings describe a collaborative, multi-disciplinary process for evaluating digital repositories against the TRAC checklist of requirements. The process involved adaptable communication methods and tools, with the audit team tailoring their approach based on specific conditions and preferences. Although the lack of standardization allowed flexibility, it is possible that pragmatic approaches to communication and consensus-building could also lead to concerns about comparability across audits. Communication between auditors and repository staff was channeled through one person, which had the potential to both prevent and create opportunities for miscommunication (e.g.,
Fischhoff et al., 1990). Disagreements were seen as opportunities for further communication, but some interviewees noted that there were limits to the amount of additional information that could be gathered to help resolve those disagreements. We have also identified instances of over-reliance on the opinions of people who were looking to the audit team for expertise and advice. While audit team members were confident in the accuracy of risk information communicated during the TRAC audit process, they were also aware that the information they had could be accurate without being comprehensive.

The high cost of certification, particularly for certification via processes with formal audit teams, brings urgency to the need to understand the inner workings of audit teams in the context of TDR certification processes (e.g., CoreTrustSeal, 2023; PTAB – Primary Trustworthy Digital Repository Authorisation Body Ltd, 2023). Scholarship about risk and audit processes has demonstrated the importance of understanding those who are responsible for interpreting and applying standards to real world organizations (e.g., Vaughan, 1996). The role of auditors in TDR certification is an aspect of certification that has not been the primary focus of empirical research in digital preservation thus far. This paper contributes to the growing body of research about TDR certification by examining communication among auditors during the TRAC certification process.

CONCLUSION
This paper investigates the TRAC audit and certification process, focusing on communication among auditors. The study, based on 10 interviews with audit team members, explores the audit process, communication, disagreements, and risk in TRAC. Findings show that auditors communicated regularly and openly, resolved disagreements through iterative discussions, and recognized the importance of diverse backgrounds for comprehensive analysis. However, they were also aware that the process did not surface all the relevant risks for the repositories being reviewed, and we argue that deference to CRL leadership may have contradicted the TRAC process, in which a team of auditors – selected for their expertise – evaluate a repository in order to determine whether to award certification. Overall, these findings produce a picture of the audit process that inspires confidence in the ability of auditors to work together to evaluate repositories for certification.

Future research should continue to investigate the role that auditors play in TDR certification processes, as this group represents a key component of certification. We also suggest that standards and processes for TDR certification would be strengthened by a stronger focus on the selection of auditors, and by making their work more visible and transparent.

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Development of a Recordkeeping Culture in Community-Based Organisations in Bangladesh

Frings-Hessami, Viviane
Monash University, Australia | viviane.hessami@monash.edu
Hossain, Md. Khalid
Monash University, Australia | md.khalid.hossain@monash.edu
Bhowmik, Joy
Monash University, Australia | joy.bhowmik@monash.edu
Meem, Jemima Jahan
United International University, Bangladesh | jemima@eds.uiu.ac.bd

ABSTRACT
Records play an important role in supporting business activities and in ensuring accountability in all types of organisations. However, recordkeeping research has mostly focused on the government sector and on large organisations. Little attention has been paid to small organisations which have limited resources to create and manage the records that they are required to produce and the records that could support their engagement in diversified activities. In this paper, we report the findings from 16 focus group discussions with community-based organisations in Bangladesh which are in the process of transitioning from informal to registered organisations and, in order to do so, must formalise their recordkeeping practices. We discuss the recordkeeping needs and capabilities of these organisations and the recordkeeping problems that they are experiencing. We argue that it is important to support the development of a recordkeeping culture as part of capacity-building in these organisations so that they can function effectively and be sustainable.

KEYWORDS
Recordkeeping culture; Recordkeeping practices; Community-based organizations; Bangladesh

INTRODUCTION
Organisational records provide evidence of business activities and support accountability and transparency in organisations of all types and sizes (Cox & Wallace, 2002; Shepherd & Yeo, 2003; Shepherd & McLeod, 2020). By providing an evidence base of resources available and past activities, they also support capacity-building and organisational development. However, different organisations have different information and recordkeeping cultures, different ways of interacting with information and records, which are based on several factors including the national culture and the regional technological infrastructure (Oliver & Foscarini, 2020). For recordkeeping policies and procedures to be effective in ensuring good recordkeeping practices in an organisation, they must be based on the recordkeeping culture(s) of the organisation (Oliver & Foscarini, 2020). Newly-formed organisations which have not had sufficient time to develop a recordkeeping culture, still have to reckon with the cultural preferences of their staff and the local environment in which they are working. In this paper, we argue that in order to support the development of newly-established organisations, it is important to support the development of an awareness of the importance of records as instruments of accountability and capacity-building and the development of a recordkeeping culture based on the cultural preferences of their staff and adapted to the local socio-economic and technical environment.

The recordkeeping literature has focused on large organisations, and particularly on the government sector (e.g. Kennedy & Schauder, 1997; Lowry & Wamukoya, 2014; Duranti & Rogers, 2019). Records management standards (such as ISO 15489) are designed for large organisations with budgets to employ records managers and to finance electronic records management systems. Very little research has been done on the recordkeeping practices of small organisations with limited budgets and little guidance on recordkeeping practices appropriate to their context is available to them. In particular, we could not find any study of recordkeeping practices of informal grassroots organisations in a developing country.

In this paper, we discuss the recordkeeping needs and capabilities of community-based organisations in Bangladesh, which are in the process of transitioning from informal grassroots organisations to registered organisations, and the development of a recordkeeping culture in those organisations. Our research studied 8 grassroots community-based organisations led by middle-aged people and 8 community-based youth organisations led by young people (18-35 years old) in 4 different parts of the country. All of these organisations had been supported by local non-governmental organisations (NGOs) as part of two development projects of an international non-governmental organisation. The 8 grassroots community-based organisations had been included in a resilience-building project which focused on women transformative leadership development through economic empowerment and climate action. The 8 youth organisations had been involved in a youth empowerment project which focused on skill development for exploring economic opportunities, supporting job placement and entrepreneurship development, enabling youth-led social and climate action in the communities, and advocating for youth rights at the national level.

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After a brief review of the literature on recordkeeping in organisations and on recordkeeping culture, we explain our methodology which involved conducting focus group discussions with each of the 16 community-based organisations and interviews with key informants in each location and at the national level. We then present our findings on the recordkeeping needs and capabilities of these organisations and the problems they encounter in managing their records. We argue that it is important to support these organisations in developing recordkeeping cultures which value records as essential tools for accountability and for capability development, and which are aligned with the culture of the organisations’ members and the resources available locally so that they can be sustainable.

LITERATURE REVIEW
Records are defined in the international standard ISO 15489:2016 as “information created, received, and maintained as evidence and as an asset by an organization or person, in pursuit of legal obligations or in the transaction of business” (International Organization for Standardization, 2016). Records play an important role in organisations as instruments of accountability (Hurley, 2005). They provide evidence of transactions and help to constitute an evidence base of the activities undertaken by the organisations and the lessons learnt from them. Therefore, the management of the records created in the organisation and the setting up of one (or several) recordkeeping system(s) to manage these records are essential activities that must be performed in every organisation. In this paper, we adopt the records continuum-based definition of recordkeeping as “making and maintaining complete, accurate and reliable evidence of business transactions in the form of recorded evidence” (Standards Australia, 1996).

Recordkeeping includes the design of recordkeeping systems to accommodate records before records are created; the creation of records as evidence of activities of all sorts; and the management of records as evidence of these activities as well as the management of archives of long-term value (McKemmish et al., 2010; McKemmish, 2017). Therefore, our research is interested in records that the organisations in our study must keep as evidence of their activities and the records that they may want to create and preserve to support capacity-building and the development of an organisational memory, as well as in the proactive development of recordkeeping systems to manage those records.

Records management research has mostly focused on large organisations and on the government sector. Most authors have been concerned with assessing whether organisations’ records management practices met legislative and international standards’ guidelines for records management and with determining how their adherence to best practice frameworks could be improved. The literature on records management in developing countries has been mostly concerned with the adoption of digital records management systems to improve records management practices and with efforts to develop digital skills, particularly in the government sector (Lowry and Wamukoya, 2014; Busari, 2019; Mutsagondo, 2023).

A small number of studies have looked at records management practices in small and medium-size enterprises (SMEs) (Okello-Obura, 2012; Ghasia et al., 2017; Ajibade & Khayundi, 2017, 2018). Webster et al.’s (1999) study of 62 SMEs in North-East England discovered a correlation between the existence of a formal management structure in the organisations and the number of records management procedures in place, but the authors did not find a correlation between the size of the enterprises and the quality of their records management practices. Balagoei’s (2019) more recent study of 75 SMEs in Sri Lanka found that records management practices have a “significant positive influence” on the business performance of those enterprises, while a study of top and mid-level managers in small and medium enterprises in Bangladesh conducted by Hosain (2019) showed a correlation between records management performance and organisational performance.

However, the SMEs in those studies are organisations with paid administrative staff and organisational systems. Studies of recordkeeping practices in organisations run by volunteers are rare. Yet, as Joseph (2016, p. 330) wrote, many community groups face “considerable difficulties in capturing, managing and accessing their information assets”. Joseph (2015, 2016) studied recordkeeping practices in two historical motor-sport community organisations in Australia, one being a national confederation with paid staff and the other one an affiliated club run by volunteers. Like in the records management studies previously mentioned, her focus was to assess whether the recordkeeping practices of these organisations conformed to international standards. Although she looked at the management of current records, she was particularly interested in the preservation of records for their cultural value. She observed that in those two organisations, recordkeeping roles were often assumed by unskilled members and that practices often did not conform to best practice standards. A more recent study by Courtney (2022) looked at recordkeeping practices in an amateur choir in London which relied entirely on volunteers to manage its records and archives. She observed that because records were managed by volunteers, they were dispersed between several locations and the systems were informal, and she commented that since the organisation has to rely on volunteers, it is important to take into account the preferences of the members and their information culture.
Whereas most of the recordkeeping literature has been concerned with assessing whether organisations were correctly managing records in accordance with legislation and best practice standards and with finding ways of improving recordkeeping practices in organisations so that they comply with laws and standards, a growing strand of research argues that to be effective and sustainable, recordkeeping practices must be adapted to the information culture of the organisations (Oliver and Foscarini, 2020; Oliver at al., 2018; Lian et al., 2022; Frings-Hessami & Oliver, 2022a, 2022b). Recordkeeping in an organisation is impacted by the information culture of the organisation. Every organisation, whatever its size, has ways of interacting with information, which are influenced by the socio-cultural and technical environment in which it is situated and by the cultural background, knowledge and skills of its employees. Oliver & Foscarini (2014, p. 11) defined information culture as “the values accorded to information, and attitudes towards it, specifically within organizational contexts”. Research has shown the importance of taking into account the context in which recordkeeping activities are performed (Oliver, 2008) and adopting a human-centred approach to the management of information in organisations (Lian et al., 2022). The information culture of an organisation is influenced by many factors, including the national and regional culture, the organisation type, its purpose and its history, its organisational structure, the personality of its leaders and the background and skills of its employees (Oliver, 2008; Choo et al., 2008; Lian et al., 2022). Oliver and Foscarini (2020) developed a 3-level Information Culture Framework to analyse the information culture of organisations, which identifies the factors that are easy to change in order to improve information practices in an organisation, the factors that are harder to change, and the factors that are very difficult to change because they are based on deep-seated cultural preferences or on external elements. The latter, the Level 1 factors, include the preferences for information formats (e.g. oral communication vs. written communication, images vs. texts) and the regional technological infrastructure. Factors at Level 2 that are easier to change include the information-related competencies of the employees, in particular their information and digital literacy skills, which can be improved through training programs. Oliver and Foscarini argued that the factors that are the easiest to change, the Level 3 factors, are the information governance model and the recordkeeping system and tools used in the organisation, which can be changed through policy decisions. However, they asserted that the systems in place in the organisations should take into account the cultural information preferences of the employees to enable those systems to be used efficiently.

In the context of Bangladesh, Frings-Hessami & Oliver’s (2022a) study of information culture in an INGO in Bangladesh showed that it is important for the design of information and recordkeeping systems to take into account the Bangladeshi employees’ preference for oral communication and for the organisation’s formal systems to allow the use of Bangla language to encourage their use.

However, all the studies of information and recordkeeping cultures have been conducted in established organisations. We did not find any previous study of information and recordkeeping culture in newly-formed organisations that have to develop a recordkeeping culture when the organisation is set up and where the members given responsibility for recordkeeping have no previous experience of creating and managing organisational records. Therefore, our research with community-based organisations in Bangladesh is innovative both for its focus on grassroots organisations in a developing country and for its focus on newly-established organisations.

**CONTEXT: COMMUNITY-BASED ORGANISATIONS IN BANGLADESH**

Bangladesh was chosen as the research context because hundreds of NGOs have been facilitating community-based groups and supporting them to become formalised and registered (Cawood, 2021; Datta, 2007; Sultana, Ahmed & Shiratake, 2020). According to Marwell (2004), community-based organisations are organised around a particular geographic place or a “community” with significant regular participation of “community members” in the organisations to operate programs to meet the needs of disadvantaged residents in their local geographic space. These organisations have been contributing to socio-economic and socio-ecological development through community-based management of natural resources, empowering local communities to take community actions on development issues and making the government accountable for the distribution of social benefits and disaster relief. As they mature, these grassroots organisations often opt to transform from informal groups into formal registered organisations like cooperatives (Abegunde, 2009; Emmanucl, 2013; Zook, 2023).

In Bangladesh, based on their mission and goals, scope of activities, internal governance structure, and sources of funding, community-based organisations decide on their suitable organisational forms among several options: non-governmental organisations (NGOs) seeking to receive foreign donations registered under the NGO Affairs Bureau, voluntary social welfare agencies registered under the Department of Social Services or under the Department of Women Affairs (if they are led by women and aimed at supporting women’s well-being), cooperative societies under the Department of Cooperatives, or youth organisations formed by young people for youth development, registered under the Department of Youth Development (ICNL, 2019). While a notable number of community-based organisations opt to become registered as cooperatives and youth organisations, the registration process and associated requirements from different registering government bodies have significant similarities. To be registered as a cooperative society under the Department of Cooperatives, a community-based organisation needs to apply by...
using the prescribed application form, pay a registration fee based on the nature of the cooperative and submit required documents along with the application. Considering the nature of cooperative societies, cooperatives need to demonstrate a minimum paid-up share capital received from shareholders or cooperatives members. After receiving the application, a sub-district Cooperatives officer makes an inspection, checks the submitted documents and writes a findings report to the district office of the Cooperatives Department. If the report is satisfactory, the district Cooperatives office issues the registration certificate. The whole process requires around 2 months. However, if the application is not accepted because of an unsatisfactory report, the community-based organisation can appeal to the Department of Cooperatives within 30 working days and the appeal process is completed within 30 working days. For youth organisations wanting to be registered under the Department of Youth Development, the process and timeline are the same although some requirements related to the amount of the registration fee and demonstrating share capital are different (ICNL, 2019).

Recordkeeping plays a key role in this process because organisations must keep and present some types of records that need to be submitted as supporting documents with the application form for registration. A memorandum of association/constitution with stamp on each page in the prescribed format and signed by the organisation’s president and general secretary is one such record that community-based organisations need to keep and submit during the process. They also need to keep records of the details of their executive committee members, meeting minutes for previous meetings, annual financial report for previous years, updated bank account statement, attested photo and copy of the national identity cards (NID) of the organisation’s president and general secretary, share register, deposit register, loan register, cash book, etc. (ICNL, 2019).

Therefore, records play an important role in the registration and in the development of the community-based organisations and youth groups into formally recognised organisations. Our research project investigated the current recordkeeping practices of community-based organisations in 4 locations in the districts of Satkhira, Nilphamari, Barishal and Rangpur with the aim of identifying challenges and opportunities for recordkeeping in those organisations. These 4 locations are all in climate-vulnerable geographic regions of Bangladesh. In our research, we got access to 16 organisations (4 in each location) that recently progressed from informal community-based groups to become registered organisations

**METHODOLOGY**

Our research used a qualitative case study design with focus groups discussions (FGDs) and semi-structured interviews. We conducted FGDs with 16 organisations in 4 locations in different parts of the country, 4 in each locations. In 2 locations (Shyamnagar in the district of Satkhira and Dimla in Nilphamari district), we worked with grassroots community-based organisations; in the other 2 (Bakergonj in Barishal district and Mithapukur in Rangpur district) with youth organisations. All these organisations had taken part in development projects supported at the national level by an international NGO and at the local level by local NGOs. The grassroots community-based organisations had been included in a large development program which aimed at strengthening community resilience in the most vulnerable agroecological regions of the country by fostering economic empowerment and women’s leadership. Most of these organisations had been founded in 2010 and achieved registration as cooperatives in 2020 or 2021. The youth organisations had been included in a youth development program for young men and women between the ages of 18 and 35 that focused on skills development. They were founded later than the grassroots community-based organisations, in 2017-18, but they achieved registration faster, with most of them being registered in 2019-20.

The FGDs were organised between April and July 2022. Each FGD comprised 6-10 members of one organisation, in most cases including the president, vice-president, general secretary and treasurer. In each location, we also conducted 5 interviews with local-government elected representatives, staff from the local NGOs who were supporting the community-based organisations, and officers from the Department of Youth Development (responsible for the registration of youth organisations) or the Department of Cooperatives (responsible for the registration of the grassroots community-based organisations as cooperatives) as appropriate. In addition, we interviewed one official from the Department of Cooperatives at the national level, and two employees of the international NGO who had worked with the programs that supported the community-based organisations. In total, 23 interviews were conducted. FGD and interview questions were prepared by the Australian-based authors. FGD participants were asked questions about the types of records their organisation created, the ways those records were managed, the problems they encountered with managing records, the support they received from the local NGOs and government departments in matter of recordkeeping, and their future plans for improving recordkeeping in their organisation. The key informants answered questions about the records that need to be presented at the time of registration, about their understanding of the recordkeeping capabilities of the community-based organisations, and about whether they supported the organisations to improve their recordkeeping practices. The FGDs and interviews were conducted face-to-face by a Bangladeshi team consisting of two research collaborators and seven students/research assistants, in accordance with the ethics approval from the Australian university. The interviews of
the 3 informants at the national level were conducted remotely by one of the authors through video conference. All the FGDs and interviews were done in Bangla, translated into English, then coded and analysed thematically by the authors.

FINDINGS
Records kept by the community-based organisations
The findings from our research show many limitations in the recordkeeping practices of the community-based organisations due to a lack of resources and skills to manage records. Their recordkeeping systems are mostly paper-based and ad-hoc and they do not have a formal strategy for creating, capturing and preserving records. As the community-based organisations were formed during projects supported by NGOs, they received a lot of assistance from the NGOs with the activities they performed, including with keeping records of these activities. Their transition towards registered organisations near the end of the funded projects was also supported by the NGOs. From that time onwards, they had to start creating and keeping more records because they were required to present a number of records when applying for registration and to keep those records since they could be audited. For grassroots organisations, records required for registration as cooperatives included a list of members, a resolution book, copies of the identity cards of committee members, photos of leaders, and bank account papers showing a positive balance. After registration, they must keep those records and keep a resolution book, meeting minutes, attendance sheets with signatures, and evidence of all financial transactions. Youth organisations who wanted to register with the Department of Youth Development also needed a constitution and a membership policy. After registration, they must keep all the records they presented for registration, hold frequent meetings and keep evidence of the events they organise and of all their financial transactions. The registration process was supported by the local cooperatives and youth development officials and by the local NGOs which advised them on the records that they needed to create and keep, their format and their content. After registration, the cooperatives can provide micro loans to their members and the youth organisations can apply for funding to organise events, all of which require the creation and management of more records and better recordkeeping practices.

The organisations generally keep paper records in a trunk in the house of one (or several) of their members because most of the organisations do not have office space. The records move to another house when responsibilities change in the organisation. This places the records at a risk of being destroyed by cyclones and floods, poses security and privacy risks, and makes it difficult for other members to access them. In case of leadership change, there are risks of records being lost. The participants were aware of these risks, but most of the grassroots organisations could not afford to have an office with lockable cabinets to store their records more safely.

Digital capabilities
Capacities to create digital records or to digitise records were very limited particularly in the grassroots organisations. Only one of those organisations had a laptop which its members could use to keep organisational records. The digital literacy skills of the members and their awareness of privacy and cybersecurity issues were very limited. Not all of them owned smartphones and their access to the internet was limited. However, some members who owned smartphones sometimes took photos of important documents to keep them as a backup on their phones in case the paper records would get damaged. One FGD participant explained that:

Many times, the children went to play and ruined the passbook given by the organisation, or the notebook got burned or got wet in the water. Therefore, as a precautionary measure, we keep a personal record to keep track of our transactions with the organisation (vice-president, grassroot community-based organisation (CBO) 2, Shyamnagar).

This precaution was taken at the individual level, but two of the grassroots organisations from Shyamnagar were interested in managing their organisational records digitally and in hiring a person with digital skills to help them with this.

The youth organisations’ digital capabilities were higher, but varied among the groups. Seven out of the 8 youth organisations kept some digital records, but these were scanned copies kept as a backup rather than records created in a digital system. Three of the organisations had laptops on which they kept scanned copies of important records. Two of them also kept copies on memory sticks as an additional backup, while the third one uploaded copies in Google Drive. The youth organisations which did not have an organisational laptop nevertheless kept digital copies of some important records. In two of the organisations, members kept them as photos on their phones, while one organisation kept them in Google Drive and the member of another one went to a computer shop to scan their important records and save them on a memory stick, and also uploaded them on Google Drive. In addition, all the youth organisations except one had a Facebook page which they used to advertise their events and share information and on which they kept photos of their activities. This is an important difference with the grassroots organisations which did collectively use Facebook although some members might have personal accounts.
Impact of registration on recordkeeping

Noticeable improvements in recordkeeping practices can be linked with the registration process. Because of the registration requirements, the organisations keep more records and their records are better organised, but the grassroots organisations find it stressful and time-consuming to keep all the records that they are required to keep, especially the financial records associated with making small loans to members. Currently, the people responsible for looking after their records are not paid despite the considerable amount of time that they must spend on recordkeeping. Many participants agreed that the members in charge of the records needed more training and should be paid for their work. Several of them said that, when their finances would allow it, their organisation would pay those people or hire someone with recordkeeping expertise. Participants from Shyamnagar were particularly interested in getting training on digital recordkeeping processes as they believed that digital recordkeeping would make their work easier.

However, most of the organisations did not have a recordkeeping strategy since their recordkeeping had developed to meet external requirements rather than as the result of a need to build a memory base. Both in the grassroots organisations and in the youth organisations, the members’ understanding of the importance of recordkeeping was limited to the records that they were required to keep for accountability purposes. None of the organisations had a recordkeeping policy or even any plan on how long they would keep the records that they had. None of the grassroots organisations showed an interest in building an archive of their activities that they could use to develop the capacities of their members or to document their history.

Reasons to keep records

All the participants from grassroots organisations said that they kept records to follow rules and regulations and for “transparency”. Since they started giving small loans, there were more transactions to keep track of and it was important to write them down to remember them. Their use of the word “transparency” usually referred to internal transparency (to their members), rather than external transparency (to auditing agencies). Since they were administering small loans, they found it important to keep track of lending transactions as evidence in case any member asked questions about how they had spent the organisation’s money. As one of the participants said, “by keeping all these records, there is transparency among all the committee members; we can trust each other; there is no conflict” (FGD participant, CBO 2, Dimla).

The youth organisations also kept records to follow rules and regulations. They were particularly concerned with the need to keep the records that they needed to present if they wanted to apply for funding. Because they did not administer loans, accountability to their members was less prominent in their answers. Participants from two youth organisations from Bakerganj spoke of the importance of keeping records to support their organisation’s development. When asked what were the benefits of recordkeeping, one FGD participant declared that:

We can find and use these records even after 10 to 15 years. We can look into these records and realise what we have done thus far. Even other organisations can get assistance from us for forming their own organisations. The new members can use the records properly if we store them. It is better if they find them updated and stored correctly (FGD participant, youth organisation (YO) 2, Bakerganj).

Therefore, if they kept their records well, they could use them for their own organisation, but also to assist other groups seeking registration.

Role of the NGOs

The NGOs played a key role in supporting the organisations’ development during the projects they were involved in, including in matters of records and recordkeeping. They assisted them when they were putting together the records required for registration. Officers from the Department of Cooperatives and the Department of Youth Development provided advice about the regulations and the records that the organisations needed to produce when applying for registration. However, their budget was insufficient to provide training for all the new cooperatives. A Department of Cooperatives official from Dimla asserted that training in account keeping was not provided in the sub-district and that the training budget only allowed for 20 people to be trained for the whole division of Rangpur which encompasses 15 million people. The NGOs played a bigger role in assisting the grassroots organisations with obtaining registration, including in the matters of records and recordkeeping, than they did with the youth organisations. According to one NGO officer, during the development project that they supported, the field facilitators checked the records maintained by the community-based organisations: “Whether the records are properly kept in their books, whether or not an unintentional mistake is being made, they are immediately corrected by our field facilitators” (NGO interviewee, Shyamnagar). The project officers and finance officers of the NGO also inspected the grassroots organisations’ records, as the same NGO officer explained: “every 2 months, we [brought] all their transaction documents to our office. Then, I re-check[ed] everything carefully with the help of a finance officer”. An NGO officer from Dimla also reported that they regularly checked the records of the grassroots organisations and helped their members to correct them if they found any mistakes. Both officers said that they
provided training about recordkeeping to the grassroots organisations in their locations. One participant said that the local NGO had helped them in many ways, providing advice on how to keep notes and write resolutions, and telling them what financial records they should keep (CBO 3, Dimla).

The youth organisations also received support from the local NGOs during the project in which they participated. An NGO officer from Mithapukur asserted that they had helped the youth organisations to set up their recordkeeping systems and that at the end of the project, they provided them with a procedure on how to maintain their records. Like the Department of Cooperatives, the Department of Youth Affairs did not provide recordkeeping training to the organisations which were seeking registration, but only informed them on what was required for registration.

According to an NGO officer from Mithapukur:

The government is more focused on skills training. They don’t consider [recordkeeping] as a skill. They consider it as one kind of knowledge. Therefore, the Department of Youth Development, the Department of Social Services or the Department of Cooperatives don’t spend any money on recordkeeping systems or provide any training. They only provide training on poultry farming, domestic animal farming, cow fattening, or goat farming.

His NGO provided some training on writing a constitution and project proposals and on managing accounts, but one of his colleagues asserted that the 3-day training that they had provided was not sufficient and that organisation members were not practicing what they had learnt and still struggled with basic account keeping tasks. He asserted that: “Even though we have given them [the procedure], they don’t maintain [the recordkeeping system] … after handover, if you don’t teach them practically, [the system] … will not be used”. He thought that frequent reminders were needed and that new executive members should be trained, as well as alternates in case some members left the organisations.

DISCUSSION: DEVELOPING A RECORDKEEPING CULTURE

The community-based organisations in our study have taken a short-term view of recordkeeping requirements and do not have a recordkeeping strategy. They have been creating and keeping the records that they needed in order to acquire and maintain registration and for supporting their microcredit activities (grassroots organisations) or for applying for funding (youth organisations). With 1 or 2 exceptions, the organisations do not have a long-term view and do not think of records as tools to support their capacity development. They do not think of the records that they may need later. None of the grassroots organisations has thought of developing an archive documenting their activities, and the youth organisations rely on Facebook to keep photos of events that they have organised.

There have been noticeable improvements in their recordkeeping practices since the organisations became registered. However, because the registration process was driven and supported by NGOs and because this only took place at the end of the funded development projects, the organisations did not have much time to practice and develop their recordkeeping skills and it is doubtful whether they will be able to continue to manage their records without the support of the NGOs. As the national official from the Department of Cooperatives whom we interviewed commented, these processes could have been more effective if they had happened earlier in the projects and not when the projects were winding down. The organisations currently depend on key leaders to look after their administration and their recordkeeping, rather than on trained staff employed to do it. This poses a risk for the organisations since if these leaders leave the organisations, there may not be someone with the necessary skills to replace them. This is particularly the case for the youth organisations because the youths may leave when they get a job. This is less likely to happen in the grassroots organisations, which are more stable, but the skills level of their members is lower and recordkeeping tasks are a heavier burden for them, which could make it difficult to find members who agree to do them.

The environment in which the community-based organisations operate and the resources available to them make it difficult to improve their recordkeeping practices. They are relying on volunteers to manage their records, they do not have a budget to employ staff with recordkeeping expertise or even to buy a computer, and their members’ digital skills are low. Moreover, in rural areas, internet connectivity is poor and power cuts are frequent. Although many participants believe that a transition to digital recordkeeping would reduce the risk of records being lost during cyclones and floods, the use of digital records in that environment could lead to critical records being lost due to a shortage of skilled people to maintain the recordkeeping systems or a lack of resources to continue using those systems. When making recommendations regarding recordkeeping systems for these organisations, it is essential to take into account the local technological infrastructure, the capabilities of their members and their cultural preferences for some types of records. Frings-Hessami and Oliver (2022a) observed that Bangladeshi employees in the Dhaka branch of an INGO preferred to ask colleagues for information rather than consult records of past activities in information systems. The cultural preference in Bangladesh for oral communication over written communication is a factor that is not favourable to the creation, management and use of records in organisations.
Nevertheless, for the organisations to maintain their registration and to develop their capacities, it is essential that they develop a recordkeeping culture that values records as tools of accountability and capacity-building. In order to do this, they need a leadership group who will encourage that process and training for key leaders to develop their recordkeeping skills. Webster et al. (1999) have observed that having a formal management structure was a factor that was linked with better recordkeeping practices, whatever the size of the organisations. In the case of the community-based organisations in our study, key leaders who understand the importance of recordkeeping and have a vision for building capacities in their organisations could make a significant difference.

Some of the problems faced by these organisations are common in community-based organisations run by volunteers. Although the Australian context in which the community organisations studied by Joseph (2015) operated is very different from that of the organisations in our research, most of the challenges listed by Joseph – difficulty in sourcing, organising and managing records and archives; challenges in accessing past information; inconsistent information management practices; lack of guidelines or principles to follow; assumption of roles by unskilled members; lack of awareness about information management professional standards; and absence of a national service to assist in guiding good practice – apply to the Bangladeshi community-based organisations, and at a higher degree than they apply to Australian organisations. As observed by Courtney (2022), because community organisations have to rely on volunteers to manage their records, it is particularly important for them to take the preferences of the volunteers and the culture of the organisations into account. If people are expected to accomplish some tasks for an organisation in their own time, it is crucial that they understand the importance of what they are doing and that they are given some freedom in the way they do it.

For a recordkeeping program to be successful, it needs to take into account the information culture of the organisation. Training programs to develop the digital literacy skills of the people in charge of recordkeeping must be based on the Level 1 factors from Oliver and Foscarini’s Information Culture Framework, that is their preference for some types of information formats and the regional technological infrastructure (Oliver & Foscarini, 2020). In the case of the Bangladeshi organisations in our study, the regional technological infrastructure is a particularly important factor, which restricts and poses risks for the use of digital records. Whereas the digital capacity of the people can be increased through training, the local technological infrastructure will be more difficult to change. The Bangladeshi government is pushing for the use of digital services throughout the country (Government of Bangladesh, 2019), but in some of the areas where we conducted our research, the technological infrastructure is not ready to support this and not all the members of the grassroots organisations have access to smartphones, which would restrict their access to their organisation’s records if records were to be kept only in digital format. At present, some of the organisations (both grassroots organisations and youth organisations) are keeping digital records as backups for their paper records. This is a prudent risk management strategy that had previously been observed in one of the locations from our study (Frings-Hessami, 2023). In the present circumstances, it would not be prudent to move entirely to a digital recordkeeping strategy and to discard paper records.

In the next stage of our research, we are planning to develop an action research project with some of the grassroots organisations and youth organisations to co-design recordkeeping systems that meet their needs in collaboration with a development agency and local NGOs. The preferences of the organisations’ members for some information formats and the technological infrastructure in the areas will be key factors to be taken into consideration. Since the cultural preferences are likely to be similar in other community-based organisations in the same areas, we envisage that this project may lead to the development of a series of recordkeeping processes that may be used for other community-based organisations in Bangladesh and recommendations for NGOs and government departments which work with those organisations on practical actions to support recordkeeping practices in those organisations.

**CONCLUSION**

The recordkeeping literature has not paid much attention to the management of records in community organisations. Our research into the recordkeeping practices of community-based organisations in rural areas of Bangladesh which are in the process of transitioning from informal to registered organisations is innovative for two reasons, firstly for its focus on community-based organisations in a developing country, and secondly for its concern with the development of a recordkeeping culture and recordkeeping practices in new organisations. The findings from FGDs with 16 community-based organisations in 4 different districts discussed in this paper showed that these organisations have limited capacities to manage the records that they are required to keep to maintain their registration and to support their activities, and that they have not yet developed a recordkeeping culture that values records as instruments of accountability and capacity-building. We have argued that in order to encourage better recordkeeping practices in those organisations, it is important to foster the development of recordkeeping cultures based on the information preferences of their members and adapted to the local technological environments.
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Voices of the Stacks: A Multifaceted Inquiry into Academic Librarians’ Tweets

Ghosh, Souvick  
San José State University, USA | souvick.ghosh@sjsu.edu

Thajudeen, James  
San José State University, USA | james.cook-thajudeen@sjsu.edu

ABSTRACT
Twitter has emerged as an important forum for discussion among academic librarians. In this research, we take a mixed-methods approach to study the thematic content and sentiment of tweets authored by academic librarians in the United States, Canada, and the United Kingdom. We found differences in the semantic content and themes present in the data from each country that point to differences in how librarians in each country engage on Twitter. While more work remains to be done, we cast new light on how members of professional communities use social media. Our qualitative analysis identified 11 thematic categories in academic librarians’ Twitter discussions, focusing on professional topics. UK librarians exhibited a higher frequency of labor- and employment-related terms compared to their US and Canadian counterparts. Sentiment ratios for US and Canadian tweets were similar, while the UK displayed nearly double the positive-to-negative tweet ratio. We also present a methodological intervention comparing two different sentiment analysis methods, VADER, and Zero-Shot Learning (ZSL), to classify posts by academic librarians. ZSL significantly outperformed the off-the-shelf classifier, highlighting how accurate prediction is possible without annotated training data.

KEYWORDS
Social Media, Academic Librarians, Thematic Analysis, Sentiment Analysis, Zero-Shot Learning

INTRODUCTION
Over the past decade and a half, the social media platform Twitter has emerged as a prime gathering place for various professional communities, including those in medicine, public health, academia, law, and journalism. While few professional communities have been as profoundly impacted as journalism, the imprint of Twitter is significant in the realm of librarianship, with numerous librarians participating in discussions and identifying themselves as professionals in the field. Custom hashtags (words or phrases prefaced with a “#”) are now common at library conferences, where organizers use them to prompt online discussions and facilitate exchanging ideas and experiences. For librarians, work, labor, and employment issues have been particularly salient in recent years. The COVID-19 pandemic strained the resources of libraries around the world, and, as perceived cost centers, libraries have often been targeted for budget cuts by governments and educational institutions. Moreover, the perception of librarianship as a “pink collar” profession, coupled with the disproportionate representation of women in the library workforce, has fostered an impression that librarians are poorly compensated and lack prestige compared to professionals with similar levels of education (Rosa & Henke, 2017). However, research on job satisfaction among librarians does not indicate that librarians are less satisfied than other workers. This paper advances our understanding of librarians’ behavior on Twitter and examines the question of job satisfaction through an analysis of librarians’ tweets. More specifically, to what extent do academic librarians tweet about work and employment topics, and are those tweets more negative in sentiment than academic librarians’ tweets overall?

Aggregating tweets by hashtag is a common method of Twitter data collection and has even been applied among the librarian community (Hicks, 2021). However, this paper goes beyond hashtags and seeks to explore the richer data available in the content of tweets shared by librarians and other professionals. Therefore, we approach this work with three research questions.

- **RQ1:** What do academic librarians discuss on Twitter? In particular, what do they write about issues relating to work, labor, and employment?

- **RQ2:** How does the content of academic librarians’ Twitter engagement differ between the United States, Canada, and the United Kingdom?

- **RQ3:** With minimal or no training data, how can we apply and evaluate unsupervised computational methods to analyze the sentiment polarity of academic librarians’ tweets?

By examining these questions, we gain insight into the conversations academic librarians engage in on social media, especially about their professional lives and the sentiment within these discussions. We also explore the potential of unsupervised computational methods to accurately detect the sentiment polarity (positive or negative), with minimal or no training data. To answer the first and second questions, we develop criteria for classifying tweets as about work, labor, and employment using computational methods. We then augment the results by manually annotating the themes in a subset of the tweets. To answer the third question, we use two different approaches for sentiment
analysis, VADER and Zero-Shot Learning (ZSL), and add sentiment labels to our dataset. While VADER is an off-the-shelf classifier that is accessible and easy to implement, ZSL is one of the state-of-the-art approaches popularized by recent developments in generative artificial intelligence (Yadav & Chakraborty, 2021; Wang et al., 2019; Xian et al., 2017). Since our dataset does not contain gold-standard labels, we design a unique evaluation scheme to test and validate the performance of the models.

The rest of the paper is organized as follows. The following section presents relevant literature related to our research, followed by our data collection and preparation process. In the next section, we highlight our methodological approach. Next, we present our results and discuss them. The last two sections conclude the paper and discuss limitations and directions for the future.

RELATED WORKS
In this section, we discuss some of the works related to workplace and academic librarians, social media and professional communities, and the applications of NLP techniques (and sentiment analysis) to Twitter data.

Work and the Academic Library Profession
Job satisfaction, morale, and burnout among librarians and library workers have become favored topics among library and information science researchers (Colon-Aguirre & Webb, 2020; Falcone & McCartin, 2022; Kendrick, 2017; Kendrick & Damasco, 2019; Martin, 2020). The recent surge in such studies reflects broader societal concerns about social justice and institutional accountability, especially in the US academy (Lopez, 2021; Rothman & Barraza Mendoza, 2021; Wilder, 2013). Work in this domain can be divided into several categories: research on job satisfaction, morale, and burnout and, more recently, research on vocational awe.

Research in the first category is largely pragmatic and is concerned with maintaining the librarians’ and staff’s productivity and minimizing turnover. On the other hand, concepts from critical theory have been used to explore how libraries function as centers of power and privilege at the expense of marginalized employees and patrons (Alabi, 2015; Fiedler & Sterling, 2021). It has also highlighted the subjective experience of burnout, fatigue, and emotional labor endured by librarians from diverse identity categories. While research on morale and burnout reveals no evidence that academic librarians experience these issues more than the general population, it acknowledges the existence of abusive practices in academic libraries. In contrast, studies on vocational awe have emphasized the negative aspects of library employment and portray the library profession as exploitative and oppressive toward its members. Recent literature on academic librarians’ job satisfaction and morale has delved into the phenomenology of workplace morale, examining the experience of low morale among librarians (Kendrick, 2017) and the extent to which marginalized groups experience it (Kendrick & Damasco, 2019). Furthermore, research has investigated the extent of “burnout” – the end state of low morale – among academic librarians (Colon-Aguirre & Webb, 2020). Research suggests that although low morale and burnout are real phenomena, they are not experienced at particularly high rates by academic librarians. Researchers have identified triggering events and behaviors, such as workplace abuse by managers and administrators, as potential causes for low morale and burnout among librarians. Relatively little data has been collected in this area thus far, with the largest and only quantitative study by Colon-Aguirre and Webb (2020) garnering 525 full responses.

The term “vocational awe” (Ettrah, 2018) is defined as “the set of ideas, values, and assumptions librarians have about themselves and the profession that results in beliefs that libraries as institutions are inherently good and sacred, and therefore beyond critique” (Ettrah, 2018). However, Ettrah argues that libraries, like other institutions, are shaped by social forces and resist change. In the United States, this implies that libraries have been shaped and influenced by the country’s racist and exclusionary past and, like other institutions, continue to bear its imprint. Subsequent research has extended the theoretical thread, exploring vocational awe in specific subfields of librarianship (Vickers & Yang, 2022) and incorporating vocational awe into new visions of what the expressed professional values of librarians should be (Cheshire & Stout, 2020).

Social Media and Professional Communities
Scholarship on social media and professional communities has explored how platforms such as Twitter have been used for professional development (Singh, 2020), the expression and reconstitution of professional norms and identities (Olausson, 2017), targeted activism (Hicks, 2021), and networking (Mulatiningsih et al., 2013). Methodologically, these studies have utilized interviews, hashtag analysis, and quantitative textual analysis methods, such as sentiment analysis.

In the context of the Library and Information Science (LIS) profession, there has been limited research on social media usage and behavior. An early study of librarians’ Twitter usage employed semi-structured interviews with librarians to understand their motivations for using the platform (Mulatiningsih et al., 2013). The study revealed that most participants used Twitter to support “lifelong learning” and to connect with other librarians. However, the study’s age and small sample (participants) size warrant a fresh inquiry into librarian Twitter usage. Recently, Ming
et al. (2022) assessed library-related discussions on the Reddit platform. Unlike the earlier work, which made only limited use of data drawn from social media platforms, Ming and coauthors gathered a large number of posts made to topical subreddits and used manual coding and computer processing to determine the types of LIS organizations mentioned in the posts, topics of discussion, and factors driving user engagement. They found that the most discussed topics were “library services and usage,” followed by “librarians and jobs.”

**Application of NLP Techniques to Microblogging Data**

Natural Language Processing (NLP) has flourished as the cost of computing power has declined, and new, more user-friendly tools have opened it up to researchers across various disciplines. Traditional NLP methods, including those found in popular libraries such as Python’s NLTK, are oriented toward massive bodies of text rather than the short texts on microblogging platforms like Twitter. Nevertheless, the richness of Twitter as a data source prompted many researchers to adapt ways of working with smaller chunks of information. In particular, researchers have focused on word frequency and sentiment analysis, applying it to problems such as stock price prediction (Rao & Srivastava, 2012), measuring the relative “happiness” of tweets posted in different environments (Loureiro et al., 2022; Schwartz et al., 2019), as well as gauging attitudes towards major world issues and events (Qiao & Jiang, 2021; Rajput et al., 2020).

While frequency analysis involves counting the occurrences of information units, such as words or phrases, within a corpus and computing descriptive statistics to quantify their prevalence, sentiment analysis aims to approximate human judgments about the meaning and semantics of words and phrases. Together, they can help understand the topical content of texts and the cognitive state of the people who generated them. Rao and Srivastava (2012) paired frequency and sentiment analysis of tweets mentioning a selection of major technology companies with stock price information, developing a model (Naive Bayes classifier) capable of predicting price movements based on sentiment. Subsequent research used sentiment analysis methods that did not require large training datasets, but lexicons assessed by human raters. All of these methods assume that the sentiment of a text can be determined by taking the sum of the sentiment values of its component words. One such method, VADER (Valence Aware Dictionary for sEntiment Reasoning), is a rule-based heuristic that classifies input texts as positive, negative, or neutral in sentiment (Hutto & Gilbert, 2014). VADER also considers contextual influences on sentiment, such as emphasis indicators or negation (e.g., “This book is NOT good!”).

Other methods, such as the “hedonometer” approach, are less context-aware but incorporate greater nuance in sentiment values assigned to text features (Dodds & Danforth, 2010). While VADER and older sentiment lexicons like LIWC (Linguistic Inquiry and Word Count) produce binary (positive or negative) or ternary (positive, negative, or neutral) sentiment judgments, the hedonometer approach employs human raters to place words on a scale from most negative to most positive, creating a lexicon for more precise sentiment assessments. Researchers using the hedonometer lexicon have used not only the textual content of tweets but also the geographic data provided by the Twitter API to construct the gradients of sentiment around public parks in San Francisco (Schwartz et al., 2019) and wildfires in Iberia (Loureiro et al., 2022). Natural language processing and machine learning techniques enable researchers to parse large quantities of microblog posts computationally.

**DATA COLLECTION AND PREPARATION**

The data preparation steps are highlighted in Figure 1.

**Data Collection from Twitter**

To address the data collection requirements of this project, we developed (1) a collection of Twitter content authored by librarians, (2) criteria for tagging content as being “about” work, labor, or employment, and (3) a method for determining the relative prevalence of these topics within the content. The population of interest was further narrowed to academic librarians because the modifying term “academic” provide a convenient heuristic to identify population members and the expectation that librarians from a particular subfield within the profession would have more in common than librarians. Data collection for this project commenced with a Twitter search for academic librarians, defining an “academic librarian” as a Twitter user self-identifying as such in their bio. We recorded the screen names and handles of the top 100 public accounts matching this criterion in our search results. Our analysis was restricted to tweets from English-language accounts. Subsequently, we extracted data from these 100 accounts using the Snscrape tool (a social networking service scraper in Python) and associated Python wrapper. We selected the 100 most recent tweets from each account, which could have potentially yielded a maximum of 10,000 tweets (100 * 100 = 10,000). Since not all accounts were prolific posters, the dataset contained fewer than 10,000 tweets (specifically, 9,821). The tweets were collected on September 15, 2022 (several weeks before Elon Musk acquired the platform), and approximately 72% of tweets in the dataset were posted in the year prior to data collection (with ~90% posted in 2020-2022).
Data Cleaning and Processing
After extracting the data, the cleaning process involved removing mentions, hashtags, and URLs, which were subsequently added as features. Each tweet was then converted to lowercase and stripped of punctuation. Country-level geographic information about each Twitter account in the dataset was manually gathered from account details and, when possible, cross-verified using LinkedIn profiles and institutional websites. Most accounts were from the United States, Canada, or the United Kingdom; accounts from these three countries generated 9074 of the 9821 total tweets collected. The residual 747 tweets were not analyzed because we could not identify which country they came from. The data was augmented with a “Country” feature to facilitate country-level analysis.

A critical aspect of data preparation was determining the criteria for classifying a tweet as being “about” work. While various approaches could be employed, this study relied on a “positivistic” or “bibliometric” strategy (Hjoland, 2001), which assesses whether a text is “about” a particular topic based on the words the text contains. While this study did not adopt a formal definition of “work,” we used the common use understanding that work encompassed any activities carried out in exchange for payment, along with related side activities and concepts. Thus, our criterion for determining whether a given tweet was about work was whether the tweet contained one or more work-related keywords. We searched for the word “work” itself, a rough synonym such as “job,” and references to payments such as “pay” and “salary.” Concepts such as “contracts” and “unions,” which relate to work agreements and employment conditions, were all comprehended by our understanding of work. To generate a comprehensive list of work-related keywords, we started with an initial set of work-related terms (“work,” “labor,” “job,” “pay,” “union,” “contract,” “salary,” and “hire”). Using these terms, we expanded the list to create an augmented list of keywords. We leveraged vector representations of our initial keywords to identify the 100 most similar words in the built-in vocabulary of the SpaCy Python library. From this expanded list, we selected only those words that appeared within the corpus of tweets to create the final augmented keyword list. Finally, the dataset was partitioned into three parts, representing accounts from the United States, Canada, and the United Kingdom. This division facilitated country-specific analysis and comparison.

METHODOLOGY
This study analyzed a set of Twitter content created by academic librarians by starting with a set of topic-related terms, augmenting those terms with more terms based on vector similarity, and determining the topic’s prevalence using term frequency. This method allowed us to treat all tweets in our corpus as bearing information. For our analysis, we adopted a mixed methods approach, summarized in Figure 2. We used quantitative methods like word frequency analysis to explore the distribution of the most frequent words in the corpus and for each of the three countries (US, Canada, and UK). Next, we classified the thematic content of a subset of the collected tweets. Using machine learning, we determined the sentiments of the tweets in an unsupervised way and developed evaluation strategies to compare the performance of the prediction. We then dived deeper into the data qualitatively to (1) assess the difference in sentiment in the US, Canada, and the UK; (2) evaluate the prediction performance of the two different computational methods (VADER and ZSL).

Word Frequency Analysis
Our objective was to determine the relative frequency of individual work-related terms in comparison to one another and to all words within the corpus. A word cloud — a graphic that displays a collection of words, with the size of each word proportional to its frequency within a given text — effectively conveys the prominence of work-related terms in the analyzed corpus and highlights the relative frequencies of words. However, considering the data was collected using an augmented list of keywords, we performed three separate analyses — one for all the words in the corpus, one for keywords alone, and the other for text without keywords. By removing the keywords for the
analysis, we gather insights about the most frequent co-occurring words for academic librarians’ work-related tweets.

**Figure 2. Mixed Methods Data Analysis**

**Thematic Analysis**

Thematic analysis is a well-established qualitative method for approaching textual data. Conventional thematic analysis, which we applied to academic librarian tweets, involves a human reviewer identifying themes and ideas present in texts and then creating codes that encompass or generalize those themes, allowing the researcher to identify patterns within the texts (Guest et al., 2012). Thematic analysis originated as a method for studying longer texts generated by in-depth interviews in the context of psychological research (Braun & Clarke, 2006). More recently, it has been adopted in anthropological research (Wutich et al., 2021) and has flourished as a tool for understanding social media data. Such examples include analyzing public reactions (Schneider & Trottier, 2013) and online activism on social media platforms (Xiong et al., 2019). More recent research (Lindstadt et al., 2022; Mohammadi et al., 2022; Nutley et al., 2021; Tahamtan et al., 2021) have also focused on social problems or newsworthy events, including the Covid-19 pandemic. Such events help define research outlines and impose temporal boundaries on them.

We conducted a thematic analysis of a selection of tweets – using NVivo qualitative analysis package – to identify the major themes in our tweet collection. Ideally, these themes should illuminate some of the work- and employment-related topics academic librarians discuss on Twitter. We also wanted to gain insights into the topics being discussed in association with work. Considering that the tweets were selected using a set of work- or topic-related keywords, any analysis of word distribution would be skewed towards those keywords. Therefore, we randomly selected 100 tweets from each country, 50 with work-related keywords and 50 without. The instances are coded such that no tweet contained more than a single reference to any code. Therefore, a given tweet could reference multiple different codes, but a unique code can be referenced only once in each tweet. During thematic analysis, the codes were generated using the Grounded Theory approach (Bryant & Charmaz, 2007; Faggiolani, 2011; Halaweh, 2018; Lai, 2015). If we encountered a theme for which we had not created an appropriate code, we created a new one. Where appropriate, codes were created as child codes of previously created codes. Once the primary coder generated all codes, the secondary coder validated the codes and flagged disagreements. The disagreements were resolved over multiple iterations through discussions and code modifications.

**Sentiment Analysis**

**VADER**

VADER is a model for evaluating the sentiment of microblog posts, such as tweets, that uses a lexicon of human-reviewed terms and a set of semantic characteristics to measure the emotional character of posts (Hutto & Gilbert, 2014). We selected VADER as one of our computational methods due to its accessibility through common data sources. VADER was chosen because of its ease of use and accuracy in sentiment analysis, which is crucial for understanding the emotional landscape of academic librarian tweets.
analysis packages, ability to handle short, arbitrary texts, and ability to evaluate the sentiment of a text corpus without training data. VADER is an improvement upon earlier lexicon-based methods of assessing sentiments, such as Linguistic Enquiry and Word count (LIWC), in that it incorporates a set of rules regarding word sequence, negation, punctuation, and other factors that are commonly used to add emphasis or otherwise augment or diminish the sentiment of phrases. It is also popular among information and social science researchers (Bose et al., 2021; Cruz & Balahadia, 2022; Pano & Kashef, 2020).

Zero-Shot Learning (ZSL)

Recently, zero-shot learning has gained considerable attention among the scientific community because of its ability to generalize over unseen, unlabeled data. ZSL utilizes shared attributes or semantic embeddings (Palatucci et al., 2009) to identify new classes, leading to various methodological innovations. ZSL can be compared to unsupervised clustering approaches, except that it generates output labels without fine-tuning. Due to its ability to identify novel categories, ZSL has been applied for image classification (Akata et al., 2013), object recognition (Lampert et al., 2014; Socher et al., 2013), sentiment analysis (Yadav & Chakraborty, 2021), and action recognition (Liu et al., 2018). Some of the popular approaches are determining a compatibility function linking input instances with class embeddings (Akata et al., 2015), employing deep generative models (Verma et al., 2018), and utilizing graph convolutional networks (Wang et al., 2020). In recent studies, contrastive learning techniques have been used for zero-shot sentiment analysis, utilizing pre-trained language models. For zero-shot sentiment classification, the inherent semantic richness of natural language, along with the transferability of pre-trained language models like BERT (Devlin et al., 2018) and GPT (Radford et al., 2018), allows for the extraction of contextualized representations for previously unencountered sentiment classes.

In our work, we used ZSL to annotate the tweets with their respective sentiment labels. ZSL allowed us to overcome one major challenge of NLP research – the lack of human-annotated gold standard data. Our dataset was mostly unlabeled except for a small random sample we used for testing. The sentiment labels were positive, neutral, and negative. We used the pre-trained ‘facebook/bart-large-mnli’ model for our zero-shot model but did not fine-tune using our dataset. For evaluation purposes, two human coders annotated 100 random tweets. We also extracted 100 tweets for which the two models (Vader and ZSL) have maximum disagreements and reviewed them for accuracy.

RESULTS AND DISCUSSION

This section reports the results and answers the three research questions.

Predominant Themes in the Tweet Collection (answering RQ1)

In this section, we analyze the content of the tweet to investigate what academic librarians discuss on Twitter, in association with their employment and workplace-related keywords.

Most Frequent Words in the Tweet Collection

Analysis of tweets with keywords removed shows that the term “library” looms large in both the wordcloud of all words and those with keywords removed. After removing keywords, the word “thank” appeared most frequently in the wordcloud, reflecting the use of tweets to express gratitude and goodwill. Among keywords, “work” was the only one among the ten most frequently used words.

Thematic Analysis

Our thematic analysis revealed four major categories of themes: 1) Professional, 2) Personal, 3) Hobbies, Interests, and Recreational, and 4) Miscellaneous. The themes are summarized in Figure 3, with top-level themes in blue and the subcategories in yellow. Areas of each shape are proportional to the prevalence of a subcategory in the dataset.

![Figure 3. Distribution of Themes (Random Sample of 100 Tweets)](image)

Professional tweets constitute the most prevalent group of codes among the selection, with 159 references among the six selections. Subcategories of this group include Academic Libraries, Professional Development, Publishing, and
Thematic analysis revealed that tweets containing keywords are substantially more likely to refer to professional themes—lending support to our keyword frequency method as a decent means of identifying tweets relating to work and employment. Tweets from the United Kingdom are more likely to reference professional themes than those from the United States or Canada. Tweets from the UK that contain keywords are the most likely to reference professional themes, while tweets from the US that do not contain keywords are the least likely to reference professional themes.

The theme of burnout did not appear among the random sample of tweets selected for thematic analysis. A more comprehensive search of our collected tweets yielded only two tweets that explicitly referred to “burnout.” Furthermore, only one tweet in the dataset referred to “morale.” These findings do not cast doubt on the research conducted on these topics so much as they do the hypothesis that Twitter is a forum for discussions of these important topics.

**Country-specific Analysis for the US, Canada, and the UK (answering RQ2)**

The wordclouds in Figure 4 show the distribution of words excluding the work-related keywords in the tweet collection for the United States (Sample Size = 5885), Canada (Sample Size = 1010), and the United Kingdom (Sample Size = 2179). This unbalanced geographic distribution was a limitation of our data collection process.

![Word Clouds](image)

### Word Clouds of Country-specific Tweets with Keywords Removed

**United States**
Tweets from the United States comprised most of the dataset (5885 tweets out of 9821). As can be seen in the wordcloud for US tweets, the word “im” (“I’m” with the apostrophe removed - an artifact of our data cleaning process) was the most frequently used. This possibly reflects a tendency among US users to write tweets from the first-person perspective rather than on behalf of groups or institutions. In contrast to the data overall, words expressing gratitude, such as “thank,” appeared to be less prominent. Nevertheless, one word expressing a high degree of positivity, “love,” was among the most frequently used words.

**Canada**
Among the three countries represented in the dataset, the smallest number of tweets pertained to Canada (1010 of 9821). The words most frequently represented in the Canadian data deviated substantially from those in the data overall. The two most frequently used words in Canadian tweets, “ontario” and “hamilton,” are references to Canada’s largest province and a major city in that province. Given that a plurality of Canadians resides in Ontario, it is unsurprising that so many tweets mention it. However, names of places were not among the most frequently used terms in either the US or UK tweets. Interestingly, the word “library,” the most frequently used term in the dataset overall and among the most frequently used in both the US and UK subsets, was not among the ten most frequently used words in the Canadian data.

**United Kingdom**
Tweets from accounts based in the United Kingdom represented the second largest group in the dataset (2179 of 9821). Keywords related to work appeared in UK tweets with a frequency similar to the frequency with which they appeared in tweets from the US and Canada, with a few noteworthy differences. The term “hiring,” which appeared among the ten most frequently appearing keywords for the US and Canada, is not present among them in the UK data. With regard to non-keywords, the term “access” is the most frequently used term, followed by “library.” The terms “thank” and “thanks” are among the ten most frequent terms in the UK data, providing evidence that UK-based academic librarians may be somewhat more likely to use Twitter to express gratitude than other academic librarians.

**Distribution of Sentiment across Locations**
In Figure 5, we present the boxplots for the US, Canada, and UK subsets. Despite the broadly similar confidence levels of VADER and ZSL (0.82 and 0.77, respectively), the methods differed significantly in the actual labels applied to the tweets across the three countries. The VADER results are notable due to the overwhelming propensity of the classifier to label tweets as neutral in sentiment (see Figure 5). To compare countries based on sentiment, VADER is not reliable due to this flattening effect. The labels applied by ZSL, which more reliably distinguished
tweets as either positive or negative in sentiment, revealed that tweets in the United States and Canada had similar ratios of positive, negative, and neutral tweets. ZSL also highlighted that the set of tweets originating in the UK contained nearly twice as many positive tweets as negative tweets. Although ZSL performed better than VADER, it is not comparable with human evaluation. Also, the collection of tweets is not exhaustive. Therefore, further qualitative work is needed before making any broad generalizations.

Unsupervised Analysis of Tweet Sentiments (answering RQ3)

Performance of Unsupervised Prediction Models

To better understand which of the computational sentiment judging processes, VADER and ZSL, more closely corresponded to human judgments, we randomly selected 100 tweets from the dataset and had two human raters (researchers) assign sentiment labels (positive, neutral, or negative) to each of them. Following an initial round of human rating, we took a second pass through the tweets to reconcile our judgments. We calculated Cohen’s kappa – a measure of interrater agreement that accounts for the possibility of the agreement due to random chance, with 0 indicating no agreement and 1 indicating perfect agreement – between the human raters after each pass. After the second pass, the kappa statistic (see Table 1) revealed that raters 1 and 2 were in nearly perfect agreement, lending credence to the assumption that human raters could come to a consensus about the sentiment of the random tweets (McHugh, 2012). Finally, for the few tweets for which the differences between raters 1 and 2 were irreconcilable, we turned to a third human rater and regarded the label applied by rater 3 as authoritative. We created a composite set of human labels (the labels for which raters 1 and 2 agreed along with the labels of rater 3, where raters 1 and 2 could not agree) to serve as the ground truth against which we compared the VADER and ZSL labels. Using the gold-standard human annotations, we calculated the precision, recall, and f-1 scores of VADER and ZSL models (see Table 2).

<table>
<thead>
<tr>
<th>Iterations</th>
<th>Interrater Agreement Between Human Raters 1 &amp; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass 1</td>
<td>0.55</td>
</tr>
<tr>
<td>Pass 2</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Table 1. Inter Annotator Agreement for Randomly Sampled 100 Tweets

Overall, the judgments yielded by ZSL more closely resembled human judgments. Specifically, ZSL was more likely to apply the correct label to tweets that human raters judged to be negative or positive. However, VADER proved to be the more accurate judge of tweets that were neutral in sentiment, but only because it classified all but six tweets as neutral in sentiment (see Figure 6). While VADER performed abysmally on tweets human raters judged to be positive or negative, it did not demonstrate the apparent propensity of ZSL to place tweets into the binary categories of positive or negative. The performance of both models can be found in Table 2.

Disagreement Analysis - Comparing Models

In order to understand the degree of disagreement between VADER and ZSL, we calculated a “disagreement score” for those tweets for which the models selected different labels. For each tweet, both ZSL and VADER gave the confidence scores of the corresponding labels (positive, neutral, and negative), and the sentiment with the highest confidence score was assigned to each tweet instance. Then, for all tweets with conflicting sentiment assignments (where VADER and ZSL are not in agreement), we computed the disagreement scores as the sum of the ZSL and the VADER confidence scores. Therefore, tweets with opposite labels received a confidence score in the range of 0 to 2, with 2 indicating that each model had perfect confidence in the label it selected and yet was in disagreement. A
score around zero (0) would signify that the models differed in their judgment but were not confident in their predictions. For further analysis, we selected the top 100 tweets with the highest disagreement scores. Two human annotators rated the tweets with an agreement of 86% (86 instances out of 100). We evaluated both the VADER and ZSL performance over the 86 tweets for which human annotators agreed. ZSL predicted 63 of these 86 instances correctly (accuracy of 73.2%), while VADER predicted 21 instances correctly (accuracy of 24.4%). Once again, VADER predicted all these instances as neutral, while ZSL marked them as either positive or negative. Interestingly, ZSL exhibited a greater range of confidence scores (like humans) than VADER (which was confidently incorrect).

![Figure 6. Confusion Matrices for Zero-Shot Learning (ZSL) and VADER](image)

Next, we performed a qualitative analysis of the top disagreements. We picked instances where VADER and ZSL predicted the sentiment to be on the opposite end (positive and negative, with neutrals removed). The two computational processes were more likely to disagree on tweets that contained both highly positive and negative words or emojis. Often, such tweets expressed sarcasm, humor, or sympathy. Such tweets defy common notions of goodness, badness, or neutrality or else express one of those sentiments in recondite or ironic ways. For example, does the tweet “Ooof, hoping for the best.” express a positive or negative sentiment? On the one hand, the phrase “ooof” seems to be expressing shock or discomfort, while “hoping for the best” seems to express optimism and, perhaps, well wishes. In all cases of the most extreme disagreement, ZSL labeled the tweet as negative, while VADER labeled it positive. Multiple instances with conflicting sentiments contained only two words, which meant that the models had a small amount of text to analyze and derive a sentiment label. In the case of VADER, which uses a lexicon and a set of rules, one of the words strongly outweighed the valence of the other word.

<table>
<thead>
<tr>
<th>Tweet Polarity</th>
<th>Precision</th>
<th>Recall</th>
<th>F-measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>VADER</td>
<td>ZSL</td>
<td>VADER</td>
<td>ZSL</td>
</tr>
<tr>
<td>Negative</td>
<td>0.00</td>
<td><strong>0.39</strong></td>
<td>0.00</td>
</tr>
<tr>
<td>Neutral</td>
<td>0.43</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td>Positive</td>
<td>1.00</td>
<td><strong>0.65</strong></td>
<td>0.14</td>
</tr>
</tbody>
</table>

**Table 2. Model Performance**

**CONCLUSION**

We took a mixed methods approach to explore the behavior of academic librarians on Twitter and how their engagement and sentiments differed between the United States, Canada, and the United Kingdom. We had a special interest in observing the degree to which academic librarians in our dataset discussed issues relating to work, labor, and employment and how discussions of these issues differed between three countries with many cultural and linguistic similarities, but different institutional environments. To do this, we performed a word-frequency analysis of tweets from each country and a thematic analysis of random samples of tweets from each country. We also performed sentiment analysis of the dataset, labeling the sentiment content of tweets using two computational methods, VADER and Zero-Shot Learning, and discussed the advantage of ZSL in classifying the sentiment of academic librarians’ tweets. Employers and organizations could leverage such a sentiment analysis approach to assess certain workplace policies and their influence on employee satisfaction.

For our first research question, we found that expressions of gratitude are common in academic librarians’ tweets and that professional topics (encompassing subtopics such as academic libraries, work and employment, professional development, and publishing) were the largest categories represented in the random sample. This gives
us a better understanding of what can be learned about academic librarians from their Twitter usage. For the second research question, we found that academic librarians in the United States and Canada were more likely to discuss non-professional topics than those in the United Kingdom. Librarians in the UK were also more likely to express positive sentiments in their posts than in the US and Canada, which hints at differences in how librarians in the three different countries are socialized to regard social media.

To answer our third research question, we used a state-of-the-art approach for sentiment classification – Zero-Shot Learning (ZSL) – and compared the performance against an off-the-shelf classifier like VADER, commonly used by information and social scientists. One major methodological contribution of this research is that it highlights how we can develop accurate sentiment classifiers with minimal or no training data. Our evaluation suggested that ZSL significantly outperformed the lexicon-based VADER method by more often correctly classifying the sentiment content of tweets. The approach could be extended to other social media data where a faster turnaround time may be required, as is often experienced during disasters, medical emergencies, and important events. Our findings also suggest that the tweets in the United States and Canada had similar ratios of positive, negative, and neutral tweets, while tweets originating in the UK contained nearly twice as many positive tweets as negative tweets. This research raises interesting possibilities for future research on the content and sentiment of online communications by members of professional communities. We demonstrate that by incorporating state-of-the-art unsupervised models like ZSL, it is possible to outperform traditional libraries like VADER, especially when generating output labels for large volumes of data which are not annotated.

LIMITATIONS AND FUTURE WORK

One weakness of our research is the potential impact of the bandwagon effect on the data. While online behavior is often thought of as looser or less inhibited than face-to-face interaction, factors that researchers have identified as promoting disinhibition, especially dissociative anonymity, are inapplicable among the academic librarians we studied, who tended to eschew anonymity on Twitter (Suler, 2004). The bandwagon effect could manifest in two ways: self-censorship (refraining from speech an individual thinks may not be well-received by their social network) or engaging in speech that signals group belonging, which is not sincerely felt.

Self-censorship on social media has often been studied in authoritarian regimes where individuals may voluntarily restrict their posts to avoid state surveillance and repression (Bodrunova et al., 2021; Lee & Chan, 2009; Ong, 2021). It has also been studied in the context of hotly contested elections in democracies (Powers et al., 2019). However, studies of internal social media in workplaces have also demonstrated evidence of self-censorship by employees wanting to conform to workplace norms (Madsen & Verhoeven, 2016). Similarly, survey data of scientific researchers indicate the potential for a poor online reception to result in self-censorship (Väliverronen & Saikkonen, 2021). Social media accounts associated with their owners’ profession and place of work may also engage in a certain amount of self-censorship, even when posting outside the office or on topics not directly related to their professional expertise. We did not attempt to account for self-censorship in the data, and assumed that tweets reflected their authors’ authentic points of view. Concerning the bandwagon effect driving the types of content academic librarians choose to post, such behavior is analogous to the bandwagon effect in consumer behavior (Leibenstein, 1950). It is possible that, out of a desire to garner engagement, foster a closer connection with one or more individuals they follow, or acquire a reputation as an authority figure on a given topic, among other possible reasons, an academic librarian decides to post or re-tweet content. For our future work, assessing the impact of the bandwagon effect on tweet content would require marrying thematic analysis to network analysis to determine the degree to which thematic similarity is correlated with connections within a social network. The findings could be further bolstered by surveying academic librarians on Twitter to gauge their subjective motivations for or refraining from posting.

An additional limitation of the present study was the underrepresentation of UK and Canadian tweets relative to those from the United States. Future work should aim to collect more geographically balanced data. Finally, we were disappointed to find that discussions of burnout and shaky workplace morale, which have motivated so much other research in the LIS field, were largely absent from the data we collected. Again, we sense that it is likely that few librarians feel comfortable sharing thoughts on these topics in a public forum such as Twitter and that more research is needed to understand not only what librarians feel comfortable sharing on the platform but also what they feel is inappropriate or unwise to share. In light of Twitter’s recent change in leadership, it would be interesting to revisit the librarians sampled in this study to assess how their behavior may have changed.

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A Guided Tour Study of the Untidy but Inspirational PIM of Visual Artists

Hellmich, Helene
Humboldt-Universität zu Berlin, Germany | hellmich@hu-berlin.de,

Dinneen, Jesse David
Humboldt-Universität zu Berlin, Germany | jesse.dinneen@hu-berlin.de

ABSTRACT
While all individuals deal with increasingly large amounts of digital information in their everyday lives and professionally, prior works suggest visual artists have unique information management practices and challenges. This study therefore examined the personal information management (PIM) practices and challenges of six practising visual artists using guided tours and short interviews. It was found that the visual artists had some unique practices connected to their strong emphasis on serendipity, inspiration, and visual dimensions of information. Like non-artists, the participants faced challenges across all phases of PIM, chiefly an excess of information and fragmented organisation, and they found it especially hard to assess how personal and valuable their information could be. After characterising this rarely discussed PIM demographic, we draw on the findings to provide concrete recommendations for artists doing PIM, for information and cultural heritage institutions, and for designers of PIM software.

KEYWORDS
Personal information management; visual artists; guided tours; information behaviour; human-computer interaction

INTRODUCTION
Today individuals deal with increasingly large amounts of information (Vitale et al., 2020) including paper-based and digital personal information. This is also true for visual artists, defined here as professional creators of visual art (i.e. not of other art forms like music or dancing). Personal information management (PIM) examines how people keep, organise and re-find their personal information and has been described as "one of life’s essential skills" in today’s information society (Jones et al., 2017, p. 3584; Whittaker, 2011). The PIM of visual artists has only recently been examined in a small number of preliminary studies (reviewed below), which together suggest their practices and challenges may be unique and thus potentially elucidating for PIM research and tools more generally. It is also valuable to learn about how artists approach (or neglect) PIM and their struggles therein, because their personal information collections, if preserved, could become cultural heritage worth saving for future generations (Kralic et al., 2021; Post, 2017a).

The aim of this research is to discover more about the PIM of visual artists and the challenges they face regarding the management of their personal information. These insights might improve the visual artists' current day-to-day interactions with their personal information and address any PIM challenges they face, as well as guiding collaborations with memory institutions ultimately leading to the preservation of visual artists' personal information collections over the long-term. Additionally, the findings of this study can inform the development of PIM tools to match the requirements and practices of visual artists. The study in particular is concerned with the digital personal information of the participants that is related to their work as artists and that they manage on their computers, and seeks specifically to characterise their PIM practices and challenges (and especially their potential novelty).

As little is known about artists’ PIM, we employed an exploratory and qualitative approach, conducting interviews and guided tours with six practising visual artists with the goal to characterise their PIM and generate recommendations for individuals, information institutions, and PIM system designers and researchers.

LITERATURE REVIEW
Here we briefly review PIM practices and challenges before outlining the gaps in knowledge around artists’ PIM.

PIM and PIM practices -- PIM is "the practice and the study of the activities a person performs in order to acquire or create, store, organize, maintain, retrieve, use, and distribute information in each of its many forms... as needed to meet life’s many goals" (Jones et al., 2017) and today increasingly happens in the digital realm (Vitale et al., 2020). In the foundational PIM literature, both Jones (2007; Jones et al., 2017) and Whittaker (2011) propose a framework (or mode) for PIM activities describing a life-cycle of personal information, but whereas Whittaker (2011) names the three PIM stages keeping, managing and exploiting, Jones, (2007) calls them keeping, managing (or meta-level activities) and (re-)finding. It has been argued that these models are roughly equivalent because exploitation and (re-)finding are both describing how personal information can be retrieved and used (Dinneen & Julien, 2020). Since re-finding is less likely than exploiting to have an alternate interpretation in any given use and a narrower subset of management practices has been examined here, this study uses the terms keeping, organising and re-finding.
Although some PIM practices have been examined frequently (e.g. tagging, a kind of organising), there is no list of common PIM practices in the literature. This is perhaps understandable since PIM studies tend to focus on particular factors like emotions (Whittaker & Massey, 2020), formats (e.g. files; Dinneen & Julien, 2020), tasks (e.g. keeping; Vitale et al., 2018), tools (e.g. emails; Whittaker & Sidner, 1996) or demographic groups (e.g. knowledge workers; Alon et al., 2019). Reasons for this may include that PIM practices are determined by individual differences (Alon & Nachmias, 2020a; Boardman & Sasse, 2004), PIM practices are changing with the introduction of new technologies (Alon et al., 2019) and most PIM studies focus on particular aspects of PIM behaviour or specific practices (Alon & Nachmias, 2020b).

**PIM challenges** -- Not only is there generally more information available than ever before (Johnson, 2014), individuals also deal with large and growing amounts of personal information (Vitale et al., 2018). The accumulation of information makes all stages of PIM (selecting, organising and re-finding) more difficult and might lead individuals to feel stressed (Vitale et al., 2019). Determining the value of information items can be difficult (Whittaker, 2011) and individuals struggle to decide if they should keep or delete information (Boardman & Sasse, 2004; Vitale et al., 2018; Whittaker, 2011). This often leads to a tendency to keep information by default (Boardman & Sasse, 2004; Vitale et al., 2019), which in turn makes retrieving information more difficult and time consuming. If individuals do not have the time to process all the information they encounter or use it meaningfully, this experience is called information overload (Bawden & Robinson, 2020; Whittaker, 2011). Information overload can affect individuals negatively by deteriorating their health, making them less efficient, reducing their ability to make decisions, be productive, innovative and even creative (Bannon, 2006; Bawden & Robinson, 2020; Johnson, 2014).

Another aspect that makes the complex task of PIM difficult, especially in the digital realm, is that information can be experienced and stored on various devices as well as online platforms, thus forming ecosystems of personal information (Vertesi et al., 2016; Vitale et al., 2018). The phenomenon of storing information in various locations or applications, each using different organising schemes, is known as information fragmentation (Jones et al., 2017). Information fragmentation affects all three stages of PIM (keeping, organising, re-finding) and makes it harder for an individual to have an overview of their personal information (Jones et al., 2017; Vitale et al., 2018, 2019).

As individuals accumulate personal information throughout their lifetime, this information has to be managed not only in the short term, but also over long periods of time (Jones et al., 2016), including long-term project management (Copic Puchiar et al., 2016). Individuals keep personal information for the use beyond the immediate future (Bass, 2013) or to create a legacy (Kaye et al., 2006). There seems to be a tension between the increasing amounts of data that individuals keep (Vitale et al., 2019) and what they would like to share with future generations (Gulotta et al., 2013), ideally selecting only remarkable information to keep (Lindley et al., 2013; Vitale et al., 2019). Visual artists fall into one of the demographic groups whose personal collections might be valuable as cultural heritage and not only to the individuals personally (Krtalíč et al., 2021; Post, 2017a). Previous research investigated the personal collections and PIM behaviour of notable people, but this research did not focus on digital collections (Krtalíč et al., 2021). The personal collections of less well-known individuals, like emerging artists who might become famous or local artists, might equally be considered culturally significant in the future and thus should be kept (Post, 2017a). Knowledge about the PIM of visual artists can inform institutions that might potentially be interested in keeping this information, raise the awareness of artists regarding their own PIM practices and challenges and guide the future development of PIM tools for visual artists (Krtalíč et al., 2021; Post, 2017a).

**Visual artists and PIM** -- Although PIM tends to have an individual focus, PIM practices and challenges are often influenced by common demographic features, such as occupation, and such groups are therefore examined in PIM studies despite the usual focus on individuals. For example, PIM studies have examined teachers (Diekema & Olsen, 2014), knowledge workers (Alon et al., 2019) and immigrants (Krtalíč, 2021), among others. The demographic group of visual artists, however, has only been the focus of one recent study addressing the personal collections of writers and visual artists in New Zealand, which explored how they perceive the value of their personal collections, their collection management practices and challenges, and the influence these phenomena may have on the possible
future use of such collections (Krtalić & Dinneen, 2022). Among the findings were that the participants saw value in their personal collections and used idiosyncratic management practices (Krtalić & Dinneen, 2022).

The information behaviour of artists has been described as distinctly different from other demographic groups (Hemmig, 2008; Mason & Robinson, 2011). They were found to seek especially visual information for inspiration and use extremely idiosyncratic sources of inspiration, including intangible information (Hemmig, 2008, 2009; Mason & Robinson, 2011). Artists have been reported to potentially call anything a source of inspiration, often drawing on information sources that have no direct relationship to the art world (Hemmig, 2009; Mason & Robinson, 2011). Furthermore, they are described as information gatherers who use browsing to find information (Hemmig, 2008, 2009; Post, 2020). Browsing makes unintentional information encountering (serendipity) possible. Serendipity has been studied in information behaviour (Erdelez, 2005; Erdelez & Makri, 2020; Liu et al., 2022; Mason & Robinson, 2011) and, for example, as a design principle (Reviglio, 2019). Further, a connection between finding inspiration and serendipity has been made (Peterson, 2020).

Although not explicitly using a PIM perspective, a recent PhD thesis examined the value and management of digital information of visual artists in the UK, focusing on the wider context of what information practices are involved in art making and the value of digital information in artistic practice (Molloy, 2021). As might be expected, the use of digital information was found to be fundamental to contemporary art practices. However, the participants lacked the relevant digital skills and expertise, which were described as invisible skills and invisible labour (Molloy, 2021).

Previous research also examined the long-term preservation of new media artists and the collaboration between a local artist and an institution to preserve his personal information collection over the long term (Post, 2017b, 2017a). From these studies, we know that media artists keep original digital artworks and digital documentation of their artworks. They use their personal archives for various professional activities, including applying for grants, making portfolios or artist statements and addressing estate concerns. At the same time, new media artists believed that making artwork was more important than thinking about preserving it for future generations (Post, 2017b).

**Summary** -- Disparate studies have begun to indicate that artists’ PIM practices and challenges may be useful to learn about and support, but such phenomena have not been systematically investigated. Analysing the PIM of visual artists will help to understand how they keep, organise and use their personal information as well as what challenges they face. The importance of visual information and the heterogeneity of their information sources described above (Hemmig, 2009) might influence visual artists’ behaviour or require them to employ particular PIM practices. Previous research on visual artists gives almost no insight into the handling of contemporary, digital, PIM-related items and it has been noted that further research is needed to investigate the personal archives of artists (Post, 2017b). Beyond their use for the individuals themselves, the personal information collections of visual artists could potentially be valuable for others (Post, 2017a). Exploring visual artists' PIM practices and challenges thus has the potential to support artists and institutions in preserving personal information collections, raise artists' awareness regarding PIM, and inform the development of PIM tools.

**METHODOLOGY**

**Research objectives and questions**

Following the knowledge gaps identified above, the objective of this study is to examine the PIM practices of visual artists related to their work and identify what PIM-related challenges they may face. We thus pose the following research questions (RQs), with a specific concern for the digital personal information collections that relate to artists’ work (i.e. we examine no paper-based personal information nor information unrelated to artistic practice).

RQ1: Which PIM practices do visual artists use?

RQ2: What are PIM challenges for visual artists?

To answer the first question, it will be examined what PIM practices artists employ, and which of those are unique or common to non-artist PIM. To evaluate uniqueness, in lieu of an existing list of PIM practices, a list of known practices was compiled from existing literature; this list can be found in the Discussion section as codes (Practices shared by non-artists) in Table 3. Sources for the list included prior PIM publications that (a) give a comprehensive overview of PIM (Jones et al., 2017; Whittaker, 2011) or (b) collect and name a large number of practices regarding digital PIM (Alon et al., 2019; Alon & Nachmias, 2020b; Boardman & Sasse, 2004; Jones et al., 2015). Each practice was assigned to one of the three common PIM stages discussed above (keeping, organising, and re-finding).

**Data collection**

We employed a qualitative approach to identify possible practices and challenges and elicit further information about the relatively unknown phenomenon of artists’ PIM (Connaway & Radford, 2016).

**Sample and recruitment** -- A purposive sample of six participants was used in this study. Although non-probabilistic sampling often relies on data saturation to determine the necessary number of participants (Guest et al., 2006), it is
unlikely that data saturation would be attained in this study because of the nature of the participant group and of PIM itself; rather, the individualistic nature of PIM (Boardman & Sasse, 2004; Jones et al., 2015) and especially the uniqueness of artists with idiosyncratic information needs and types (Hemmig, 2009; Mason & Robinson, 2011) are among the study’s premises and are suggested by the research reviewed above. A sample size of six participants has been described as a conventional baseline for such studies (Helfferich, 2009, p.175) and recent meta-research indicates that in exploratory, qualitative studies "typically 6-7 interviews will capture the majority of themes" (Guest et al., 2020, p.13).

Participants were recruited through the authors’ connections to the local visual artist community (i.e., recruitment via gatekeeper). An important consequence was that some level of trust had already been established between the authors and the participants before the start of the guided tour, which is recommended (Thomson, 2018) since during guided tours participants’ private spaces and personal information are exposed. Participants were selected only if their primary profession is that of a practising visual artist (e.g. exhibiting and/or receiving grants) and they manage information themselves (e.g. without the help of an assistant). Although it was not a study goal to generalise the findings across all artists, variation was sought among participants practising different art forms (e.g. sculpture, drawing, painting, video) to avoid the findings being solely about practitioners of one art form and to instead enable examining a breadth of practices and challenges within the sample.

Participants -- A summary of the participants’ demographic and criteria-related data can be found in Table 1. All participants were working in Germany. The participants included three men, two women, and one non-binary person, each practising different art forms. All participants showed their laptops during the guided tour, with the exception of P1, who did not own a laptop and showed his desktop computer; all participants used MacOS.

<table>
<thead>
<tr>
<th>#</th>
<th>Art form</th>
<th>Gender</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>installation, drawing</td>
<td>man</td>
<td>desktop</td>
</tr>
<tr>
<td>P2</td>
<td>installation with video</td>
<td>man</td>
<td>laptop</td>
</tr>
<tr>
<td>P3</td>
<td>sculpture</td>
<td>non-binary</td>
<td>laptop</td>
</tr>
<tr>
<td>P4</td>
<td>drawing</td>
<td>man</td>
<td>laptop</td>
</tr>
<tr>
<td>P5</td>
<td>conceptual, documentary video and sound</td>
<td>woman</td>
<td>laptop</td>
</tr>
<tr>
<td>P6</td>
<td>painting</td>
<td>woman</td>
<td>laptop</td>
</tr>
</tbody>
</table>

Table 1. Summary of study participants.

Procedure -- The guided tour is a technique that has been applied to research in physical (Malone, 1983; Petrelli & Whittaker, 2010) and digital personal information spaces (Barreau, 1995; Boardman & Sasse, 2004; Vitale et al., 2018), wherein the participant leads the researcher through the physical or digital space in question while sharing thoughts and stories in a manner similar to the think-aloud protocol, thus leveraging a visual method (Hemmig, 2009) to elicit a description of the collection and related processes and perceptions (i.e. with the benefit of examples and not relying solely on memory) and allowing participants to show only what they wish (Thomson, 2018). The guided tours were conducted in October 2021 following a protocol and the guidelines of Thomson (2018; e.g. participants were assured their PIM would not be judged) and included only the digital spaces of participants’ desktop or laptop computers where personal materials related to their artistic work were stored. Two pre-tests suggested the approach was effective for collecting the necessary data and would take approximately 75 minutes per participant, which falls between the times reported in comparable guided tours (e.g. 45 minutes; Vitale et al., 2018, and 90 minutes; Bergman, 2013). Five of the guided tours were conducted in person and one remotely (i.e. with screensharing). As a guided tour generally reflects the current state of a participant’s personal information and, to some extent, their past practices, post-tour interviews were used to ask about the future of the collection. Sessions of one tour and interview each were video recorded and lasted between 47 minutes and 75 minutes.

Data analysis
The session recordings were transcribed and thematically analysed in MAXQDA Plus 2020 (20.4.1) until the themes below were identified (Braun & Clarke, 2006). Deductive codes (the practices and challenges collected during the literature review) and inductive codes (practices or challenges mentioned by participants but not found during the review, hereafter unique practices and challenges) were identified successively. The resulting themes are summarised with example codes in Table 2.
### RESULTS

**PIM practices of visual artists**

The PIM practices of the visual artists are described within three themes: *Keeping everything*, *Not tidying up* and *Using everything as inspiration*. The practices of individual participants were all very different from one another and consensus about any particular practice was rare. These cannot be fully reviewed here and instead will be summarised in favour of showing the overall trends.

*Keeping everything* -- The visual artists from this study created, received or collected digital information. Most of the documents, kept by the visual artists were self-created original artworks (P2, P5) like videos, documentary video- and audio-recordings or supportive material (all participants), especially digital reproductions of physical artworks. The digital reproductions were often compiled to serve as a basis to create various other types of documents (applications, portfolios, websites, newsletters, catalogues) or new artworks (books, films). The artists used and continuously accessed new and old digital materials to create these compilations. The participants mainly worked with images: *I operate with images pretty much all the time* (P1) and used images in many different formats, as each use case required different resolutions, file formats (e.g. RAW, tiff, jpg, psd) or different editing of the images. Especially P1 and P2 collected information extensively, mostly in the form of inspirational material from the web. Overall, 5 of the 6 participants preferred to keep digital information and avoided deletion even if the information was not useful. One participant even created an extra folder called "discarded" for materials that she had rejected in her selection process:

> if something is in there that is good then I select it and put it into another folder

(P6)

*Not tidying up* -- Neither computer desktops nor folders of the participants were organised clearly or consistently. All but one participant (P3) used a rather chaotic organising system: *It is just a huge chaos.* (P5). Five of the six did not use coherent naming schemes, nor clear folder structures. They either mixed different information together in one project folder, saved information items in the wrong folder or kept duplicates of the same information in many different places. Regarding folder structure, the most important practice of the participants was to sort information by project in an "art works" folder and an additional "grant applications" folder. Four participants keep all their projects (sometimes more than 50) sorted by name in a single folder. The participants did not use archive folders for older projects. Only P6 had a folder called "old applications" that could be described as an archive folder.

All of the participants mentioned that they felt that their desktop was untidy or referred to having the impression of it being chaotic or messy: *The desktop is ... kind of unsorted and there’s pretty much only stuff which I forgot about.* (P4) Figure 1 shows that P1 stored almost his entire information directly on the desktop, which he navigated like a map. The strategy of placing information in specific places on the desktop was also used by other participants.

*Sometimes there are these moments in which I start to arrange things towards the top or more into the middle and everything else to the bottom or the side, so that I can access certain folders very quickly for a meeting ...* (P2)

In contrast, as visible in Figure 1, P3 kept only current information on his desktop: *I have the ... desktop pretty empty actually... It just depends what I’m working on at the moment.* (P3), a practice that was also used by other participants.

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Table 2. Themes resulting from thematic analysis of interview and guided tour data (Braun & Clarke, 2006).

<table>
<thead>
<tr>
<th>Themes</th>
<th>Example codes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PIM practices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keeping everything</td>
<td>selecting, backing-up</td>
<td>What information was used if they kept or deleted information.</td>
</tr>
<tr>
<td>Not tidying up</td>
<td>piling, tagging</td>
<td>How and where information was kept by visual artists and if they tidied up their information.</td>
</tr>
<tr>
<td>Using everything as inspiration</td>
<td>navigating, searching</td>
<td>How the visual artists retrieved information.</td>
</tr>
<tr>
<td><strong>PIM challenges</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too much information</td>
<td>information overload,</td>
<td>Challenges experienced due to the amount of information kept.</td>
</tr>
<tr>
<td></td>
<td>experiencing time constraints</td>
<td></td>
</tr>
<tr>
<td>Allowing too much chaos</td>
<td>information fragmentation</td>
<td>Challenges experienced due to information fragmentation.</td>
</tr>
<tr>
<td>(Future) value of information</td>
<td>determining future value, &quot;finding it later&quot;</td>
<td>Challenges experienced by the visual artists regarding the value of their information.</td>
</tr>
</tbody>
</table>
participants: on the desktop I really have everything current, so, more or less current things that I kind of want to access quickly.  

Figure 1: Screenshots of the desktops of P1 (left), P3 (right). File names have been blurred.

Five of the six participants did not tidy up their digital personal information regularly. Two of the participants explained that they did not have the time or motivation to clean up: most of the time it’s like, that I, when I have finished something, then I’m just glad to be done and ... I don’t tidy up afterwards. It’s like after cooking, if I don't do the dishes. (P4) P5 noticed a difference between tidying up her artworks and "grant applications": like as if it would give me a better framework, if someone else directs me from the outside. So apparently, I am handling these applications more orderly than my artistic work. (P5)

To be able to access information more quickly, participants created reminders, most often in the form of screenshots: if I’m on the internet and I see things, I quickly take a screenshot, then they all accumulate in the top right corner. (P1) or by leaving windows open (used by half of the participants). Screenshots were also used by all artists for inspirational purposes: these are like stimulations or after research on certain materials, which I then save there. (P2) The screenshots were usually kept for their visual value and not as a reference to the original information, like bookmarks. Colour tags were used by all artists to mark selected images or to highlight projects that were recent, important, or in progress: the really important things, they then always have a colour like this. Or the things ... I access the most, have some colour and always a different one, so that, so that I can access them more quickly. (P6)

Using everything as inspiration -- The method preferred by participants for re-finding personal information on their computers was navigation and some even never used search (P4, P6), even if navigation was not successful immediately: if I had somehow been looking for these photos, I would have, I think, first gone here into the works and then here in [name of folder] ... they’re not in there, so I guess I have to look somewhere else. (P6) Four of the participants used the icons of the image preview to locate the correct file, stressing the role of their visual memory in the search process: if I see those in small, then I know right away which file it is. So, I know, okay, this is from that exhibition. (P1) Other participants used a mix of navigation and search. Some participants explicitly stated that instead of deliberately searching for information, they preferred to be inspired and enjoyed encountering information by chance as part of their creative process. P1 even saw his whole organising system as a way to accidentally discover information and regarded all his digital materials as potential sources of inspiration: And there is only this one connection with a very specific moment, with a very specific situation, an image and the connection to that text. And that is something that one has to rediscover first of all. (P1)

PIM challenges of visual artists
The PIM challenges of the visual artists are described within three themes: Keeping too much information, Allowing too much chaos and (Future) value of information.

Keeping too much information -- Four of the six participants stored large amounts of digital personal information. They were also aware that the accumulation of information was problematic, yet they found it difficult to delete anything: it’s always like that, things easily come to you, but then then it's difficult to let them go. (P4) Accumulating too much information was overwhelming for the participants: this potentially available material, I mean, it’s also totally overwhelming. (P1) One participant imagined that even without adding any new material, he would already have enough information to work with it for "years and decades" (P1). On the other hand, keeping a lot of clutter prevented the artists from concentrating on their tasks: and that’s why I would like to leave behind intermediary steps or bad quality and so on, to be able to concentrate better, so that I am not as distracted from what is essential. (P4)

Allowing too much chaos -- Information fragmentation occurred across devices, platforms, project spaces, formats and versions and affected participants to differing degrees as well as provoking negative emotional responses. Different versions of information items were kept abundantly by participants and versions were often hard to distinguish from duplicates: First of all, there are two different sizes, then I updated them because new ones were added ... there are ... different versions of the identical looking portfolio. (P1) The final versions of documents were
usually not marked and therefore could not be found easily. One participant (P2) reported that keeping her information in disorder was making her anxious and scared: There is just such a huge chaos and I’m more scared of that. (P5) Not finding information items could be very frustrating for the artists and caused many negative emotions or confusion: Some things I can’t find again immediately, then I have to look for a while... that’s more annoying. (P1) All of the artists expressed (mostly implicitly) that they thought that there was a right way to do PIM. Usually, they implied that tidiness would be more acceptable. As a result, participants felt bad and judged themselves for not being on top of things, not tidying up or doing PIM ‘wrong’: well, look, actually this is also totally idiotic... which is completely stupid. (P5) Half of the participants felt embarrassed towards the interviewer for being messy, as P1 expressed: it is already quite an effort to bring myself to show it like this. (P1)

The (future) value of information -- Five of the six participants did not know if any of the information they kept was even valuable at all or which information could be valuable: I think one would simply have to look at it all, as in: What is there? ... What is even relevant? ... What will even become relevant again? (P5) Some of the visual artists (P1, P2) even found it presumptuous to claim that their own digital work would be important enough to be kept as a legacy: it seems that for me it has some sort of ... relevance. But that doesn’t automatically mean that it is somehow relevant to somebody else. (P1) Putting personal collections into order was seen as a prerequisite to making them accessible to others: to have some sort of order in there, so that it is accessible for other people. (P5) Identity construction and sentimental reasons were not mentioned by the artists as being important aspects of their digital personal information. Most prevalent among the participants was a practical approach of keeping information to "find it later" (Kaye et al., 2006). Thus, (long-term) preservation was not a pressing concern for the participants: it’s only really for now. So, I don’t think about what it will look like in the long term. (P6)

DISCUSSION
RQ1: Which PIM practices do visual artists use?
The visual artists in this study used many common PIM practices and also employed several unique PIM practices that have not previously been described in the literature. As could be expected, many of these unique practices are visual. Another finding that stands out is that some of the participants enjoyed discovering their personal information serendipitously. Table 3 summarises which common PIM practices were applied by the visual artists and Table 4 shows their unique PIM practices. Each is discussed below.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Keeping</th>
<th>Organising</th>
<th>Re-finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>widely used</td>
<td>creating, acquiring (collecting, receiving), keeping / saving, assigning value, backing-up (external hard-drive)</td>
<td>using desktop, using folders and folder structure, naming files &amp; folders meaningfully, sorting by project, mixing, being inconsistent, re-naming, abandoning, creating empty folders, referring to ideal behaviour, accessing quickly, leaving windows open</td>
<td>navigating, searching, remembering</td>
</tr>
<tr>
<td>used little or just by one</td>
<td>selecting, deleting, backing-up, backing-up (cloud storage)</td>
<td>re-organising, being efficient, filing, piling, tagging, creating to-do lists, using apps &amp; tools, creating to-do lists, bookmarking</td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td></td>
<td></td>
<td>using archive folder</td>
</tr>
</tbody>
</table>

Table 3. Common practices used by the visual artists.

Common practices -- The keeping activities of the visual artists could generally be described as "keep everything," as they rarely deleted information even if it was not useful, which is common for individuals (Sweeten et al., 2018; Vitale et al., 2018; Whittaker, 2011). Most of the personal information examined were self-created images. The organisation of personal information on their computer desktops and in folders was mostly chaotic; participants, for example, did not tidy up their desktops or placed all projects in a single folder in a flat hierarchy, which is atypical but nonetheless done by some non-artists. Organising systems were used inconsistently and the personal information was not tidied up frequently, adding further clutter and making it hard to re-find information. The preference for re-finding files by navigating to them (e.g. rather than using desktop search) is consistent with previous studies (Bergman, 2013; Dinneen & Julien, 2020; Malone, 1983).

Unique practices -- In total eight unique practices not yet observed in the reviewed PIM literature, were identified as being performed by the visual artists, as shown in Table 4. The unique practices were observed in all three PIM stages (keeping, organising, re-finding) and were all widely used by the participants.
Perhaps unsurprisingly, many of the practices unique to visual artists were visual in nature or concerned images specifically. For example, rather than keeping old versions or reproductions purely for documentation purposes, as individuals concerned with long-term preservation of personal collections might do (Krtalíć et al., 2021), the artists re-use the items in as inspiration for new projects. This is arguably a visual version of behaviour observed in teachers who re-use content from their personal collections when creating new material (e.g. lesson plans; Diekema & Olsen, 2011). Some of the artists used their computer desktop like a map, organising files and folders visually in certain areas of the desktop. We know that individuals keep large amounts of images in personal file collections (Dinneen & Julien, 2019), but not necessarily how they are organised and used. Using the desktop like a map also served the participants to re-find information using their visual memory.

The use of web-content by artists has been described previously (Mason & Robinson, 2011; Robinson, 2014), but not the specific use of screenshots as reminders or for inspiration. The visual artists also used colour tags as reminders. Instead of ascribing a meaning to a particular colour, they just used the colour to draw attention to a particular file or folder. For sure, many individuals besides visual artists use colour tags, but this practice has not explicitly been studied in the PIM research. The visual reminders like screenshots and colour tags also functioned as visual shortcuts to re-find information. Visual memory was also used by looking at preview images to identify a particular version of a film or image, a behaviour Bergman (2013) also observed in a graphic designer.

The visual artists regarded their personal information as potential material for inspiration, confirming Hemmig (2009). Some further exploited this by using serendipitous discovery (Erdelez, 2005) within their digital personal information collections instead of searching for particular information. The importance of serendipity has been recognised in the design of information architectures (Reviglio, 2019), but to our knowledge, the accidental encounter of information has not been connected to PIM practices or tools. While serendipitous discovery may be distracting or inefficient during known-item retrievals, it could also be more rewarding or inspiring (Mason & Robinson, 2011; Reviglio, 2019). Perhaps there is a relationship between the preference for serendipity, not deleting personal information, and the unstructured way of keeping artistic projects, thus giving the artists the opportunity to be surprised and inspired by their personal information in their creative process.

**RQ2: What are PIM challenges for visual artists?**

The challenges the visual artists faced were all common challenges and no unique challenges were identified. Most challenges were experienced by all of the participants and were related to information overload, information fragmentation, and determining the (future) value of the personal information.

*Overload and fragmentation* -- The increasing complexity of PIM and the resulting challenges have been remarked upon in the PIM literature (Alon et al., 2019). In contrast to knowledge workers, however, the visual artists who participated in this study did not employ any high-level strategies to deal with these challenges. Instead, most of them rather lost their motivation to engage in any PIM activities. Both information overload (Bawden & Robinson, 2020; Jones et al., 2017; Whittaker, 2011) and information fragmentation (Jones et al., 2017; Vertesi et al., 2016; Vitale et al., 2018, 2019) are common PIM challenges and were experienced to varying degrees by all artists. The participants collected large amounts of digital personal information and did not tidy up their information spaces regularly or consistently, as they perceived PIM activities to be a waste of time. Thus, they kept information (mostly images) fragmented across versions, formats and duplicates (Jones et al., 2017; Vitale et al., 2018, 2019) which also made it difficult and time-consuming to re-find information (Whittaker, 2011). Due to information overload, the participants found it hard to make decisions or concentrate and it caused them to feel overwhelmed, anxious, frustrated or lead to information avoidance, which is common (Bawden & Robinson, 2020). Additionally, the participants all expressed feeling bad about their PIM practices and judged themselves for not "doing it right" (Vertesi et al., 2016). Previous literature describes the tension the visual artists felt between actual and ideal PIM behaviour as a common challenge (Alon & Nachmias, 2020b).

<table>
<thead>
<tr>
<th>Keeping</th>
<th>Organising</th>
<th>Re-finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compiling: combining old</td>
<td>Using the desktop like a map (i.e. placing icons</td>
<td>Explicitly using visual memory to remember and</td>
</tr>
<tr>
<td>information (mostly images)</td>
<td>in meaningful locations around the desktop)</td>
<td>re-find information</td>
</tr>
<tr>
<td>to create new projects (e.g.</td>
<td>Using tags’ colours for visual reminders</td>
<td>Intentionally using information from the</td>
</tr>
<tr>
<td>portfolios, publications,</td>
<td>Making screenshots as visual reminders</td>
<td>personal information collection as inspiration</td>
</tr>
<tr>
<td>Websites, applications)</td>
<td></td>
<td>Intentionally creating the conditions for</td>
</tr>
<tr>
<td>Reproducing: making digital</td>
<td></td>
<td>serendipitous information encounters (in</td>
</tr>
<tr>
<td>photographic reproductions or</td>
<td></td>
<td>addition or in contrast to planned re-finding)</td>
</tr>
<tr>
<td>scans of art works</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Unique practices used by the visual artists.
The (future) value of personal digital information -- The greatest struggle the visual artists from this study faced was determining the value of their digital personal information, which has been described as a common challenge (Whittaker, 2011). The main reason participants gave for keeping information was for future use, but the way they organised it made "finding it later" (Kaye et al., 2006) difficult. Especially the idea of "building a legacy" or estate (Kaye et al., 2006) was a challenging topic for the visual artists, as they did not believe that what and how they were currently storing their digital information would be accessible or valuable to other people. This finding is surprising because previous studies found that visual artists and writers see the long- and short-term value of their personal collections for themselves and for society (Krtalíč & Dinneen, 2022) and collections in the family context are valued as records, evidence of an individual's identity and personality and their broader societal value (Krtalíč et al., 2021). It would thus seem appropriate that artists should value the artworks they create and the processes around it.

Equally surprising is the fact that the visual artists hardly reported any personal or emotional involvement with their digital information. The literature, however, suggests that digital possessions are regarded as part of one's identity (Chen et al., 2021; Cushing, 2011; Kaye et al., 2006). Interestingly, leaving collections uncurated has been described as one reason why individuals would not view them as part of their identity and self-representation towards themselves (Odom et al., 2014) or others (Krtalíč et al., 2021). Additionally, digital information, compared to physical information, may seem less unique and thus less valuable to an individual (Odom et al., 2014). This has been attributed to the "spacelessness" (collections are physically not visible) of digital information (Odom et al., 2014). As the collections become less remarkable (Lindley et al., 2013) it is undesirable to share them with future generations (Gulotta et al., 2013). This behaviour and rationale were observed in the visual artists, endangering their personal information to be lost, even though it might contain valuable insights about the way artists work today, their creative processes or actual digital artworks that should be preserved as part of our cultural heritage.

This would confirm, that the way visual artists approach PIM affects how their personal information is valued (Post, 2017a). If the visual artists were to recognise the uniqueness and broader societal significance in terms of describing "time, place, and events" (Krtalíč et al., 2021, p. 170), it could potentially impact the value that they assign to their personal information. This highlights the importance of the artists themselves understanding how essential their PIM practices are in creating valuable information collections for themselves and for others. Molloy, (2021) suggests that this would require a greater appreciation of digital artistic practices in society at large, making this labour visible, as well as close collaboration between visual artists, memory institutions and LIS professionals in these matters.

**Recommendations**

Though the results of this study must be interpreted in their narrow context (see Limitations, below), they nonetheless suggest artists may need help selecting relevant information and deleting information to create personal digital collections that are more valuable for themselves and for others. They also seem to need support organising their personal information in a more structured way, and visually, to create a greater accessibility. The possibility of serendipitous discovery, which they favour, should also be taken into account. Addressing these areas would make the PIM practices of visual artists more efficient and consequently reduce their PIM challenges, including determining the value of their personal information and thus reduce the potential loss of important cultural heritage materials. The recommendations aim to address these concerns.

**Recommendations for artists --** Make tough saving decisions (Alon et al., 2019) and delete more information to make personal information collections smaller and therefore more personal, more accessible and more valuable for the artists themselves and for others and to avoid information overload. To help during the selection process, each project could be sorted into two folders with core and supportive information (Copic Pucihar et al., 2016).

**Recommendations for LIS professionals and cultural heritage institutions --** Build educational programs for visual artists that cover PIM topics related to digital information, making research more visible and accessible (Molloy, 2021; Post, 2017b). Offer these courses at art schools, institutions that publicly call for submissions or offer grants to visual artists (as these require applications in digital formats) and professional training programs (e.g. in Berlin the Goldrausch project for women artists, https://goldrausch.org/en/, currently providing some technical guidance for making artist websites but no input regarding PIM). This will firstly help provide a platform where artists can exchange their PIM experiences, expelling insecurities towards their own PIM style, or find new PIM practices suitable to their working environment. Secondly, it will share recommendations from PIM research about organising collections (Jones et al., 2015) and the importance of deleting (Hellmich & Dinneen, 2022).

**Recommendations for PIM tool developers --** Visual artists use screenshots as reminders and icons to re-find information. Therefore, support the flexible use of images in PIM tools, for example by allowing image view of images from several folders simultaneously, making screenshots searchable (visually, e.g. by colour, motif, or reverse image search), and including them in the image manager by default. Support serendipitous discovery of information by (e.g.) selecting and displaying a certain number of random images from the personal information...
collection or finding a complementary accidental image to a selected one. This could include drawing data from information resources commonly used in creative tasks (Li et al., 2022).

Besides the practical advantages of these proposals, it is advisable not to force tidiness upon visual artists nor reinforce the social stigma that sometimes exists around chaos and clutter. As Copic Pucihar et al. (2016) pointed out, messiness will not just disappear; it is part of PIM and especially visual artists seem to embrace and somewhat utilise it. Some enjoy being surprised by unexpected encounters and inspiration cannot be planned in advance. It thus seems promising to utilise this phenomenon to create PIM tools that support the creative process and help the artists with the PIM challenges they currently face. This will make it easier for visual artists to keep, organise and re-find digital information in the future and preserve their valuable digital material as cultural heritage.

Limitations
The main limitation of this study was the small and geographically narrow sample: despite their artistic variety, all six participants were from one region of one country. Thus, soundly interpreting and using the results requires considering that limited sample and that the findings may not generalise. While generalisability was not the study's goal, it is possible that further unique practices and challenges exist, and that other kinds of artists (e.g. performance) have vastly different PIM practices and challenges from the usual demographics studied. It would therefore be desirable to extend the current study to additional participants or recruit participants with different artistic practices, and from non-German and non-European backgrounds. For example, a more diverse sample could be recruited through professional associations or artists organisations (Molloy, 2021). There was also some inherent subjectivity in the identification and naming of the themes (Table 2), which were derived by a single coder and thus may not be fully replicable (however, that the themes align well with the typical PIM categories of keeping, organising, and re-finding suggests they are broadly reasonable). In future studies, using multiple coders would be preferable. Further, all participants used MacOS; while in some regions it is common for artists to use Apple computers, the software used may have an effect on their practices (Dinneen & Frissen, 2020). Finally, this study only investigated local digital collections shared by the artists and predominantly computer files (e.g. rather than email), so the role of additional digital and physical formats in visual artists’ PIM remains unclear.

CONCLUSION
This study investigated the PIM of visual artists regarding digital personal information that is related to their work and generated a list of digital PIM practices that may be used in future PIM studies. Using the method of the guided tour, data was collected by observing the artists navigate their personal information on their computers. The aim of the study was to gain more knowledge about the PIM of visual artists in the digital realm and the challenges they faced with this. The first research question asked what PIM practices the visual artists use and the second question what challenges they face. It was found that visual artists use common and unique PIM practices, but that they only face common PIM challenges. The unique PIM practices of visual artists included many visual practices. Keeping large amounts of information mostly unorganised could lead to many challenges that were experienced in all three stages of PIM activities (keeping, organising and re-finding), but was also used by some visual artists to make serendipitous discoveries. A major challenge for the visual artists was to determine what information would be valuable in the future. The results informed concrete recommendations for artists, memory institutions and PIM software developers.

This research contributed to the field of PIM by examining the previously understudied demographic group of visual artists. Studying the PIM of visual artists can, first of all, help to set up guidelines or workshops for this particular group, guiding their everyday interactions with their personal information related to their work as visual artists and secondly, guide artists and institutions alike to collaborate on finding appropriate ways of ensuring the (long-term) preservation of valuable personal information of the visual artists to help create their estates and legacies. Finally, the findings of this study can also contribute to the creation of new PIM tools that facilitate the keeping, organising and re-finding of digital personal information for visual artists so that they would be less burdened by its complexity and challenges. All these individual actions together can help to keep the personal collections as cultural heritage and be able to use them in the future.

Future research could examine the PIM of visual artists more holistically, including their paper-based personal information, as well as how visual artists share their information, how they use social media and how they collaborate with others. Additionally, the PIM of visual artists should be studied over the long term to gain more insights into long-term practices, challenges and the visual artists' attitudes towards their digital legacies, including the relationship to their identity. Such insights should enable improved or novel systems and services (Kljun et al., 2015) benefiting visual artists, cultural heritage institutions, and their future work together.
REFERENCES


The Mining of China's Policies against COVID-19 from Policy Targets and Policy Tools Perspectives

Huo, Chaoguang  
School of Information Resource Management, Renmin University of China; Institute of Digital Humanities, Renmin University of China, China | huochaoguang@126.com

Li, Xinru  
School of Information Resource Management, Renmin University of China, China | lixinru990807@163.com

Zhang, Chenwei  
Faculty of Education, The University of Hong Kong, China | chwzhang@hku.hk

Huo, Fanfan  
School of Information Resource Management, Renmin University of China, China | huo_ff@163.com

ABSTRACT
In response to the global disaster of COVID-19, every country has implemented various policies. China, as a developing country, has issued policies to combat COVID-19 that could serve as a reference for future pandemic prevention and control efforts, and may offer lessons for national governance. This paper employs bibliometric methods, text mining, and network analysis to mine and characterize the evolution of China's policies against COVID-19. Specifically, we extract policy targets and identify the policy tools from each policy, cross-compare the policy tools used for different policy targets, and characterize their evolution during the pandemic. Our findings show that policy targets have shifted over different stages to balance epidemic prevention with economic development. We also identify several shortcomings in distribution and utilization of policy tools. To improve policy implementation, it is crucial to align policy targets with appropriate policy tools and ensure a balanced and functional approach to policy implementation.

KEYWORDS
COVID-19 Prevention & Control Policy; Policy Document Mining; Policy Target; Policy Tools; Policiometrics

INTRODUCTION
Since the outbreak of COVID-19 in December 2019, it has had a seismic impact on the world. However, the impact has varied across different countries due to the diverse policies implemented to cope with the mutation of the virus, economic challenges, and the impact on the public (Dewi et al., 2020). Some countries have adopted strict measures to control the spread of COVID-19, while others have pursued herd immunity. These diverse policies have resulted in varying numbers of deaths and economic losses. While no country can be considered a perfect example, it is crucial to examine and analyze their policies in order to draw lessons for future national governance in the face of disasters like this.

China, being a developing country with a population of over 1.4 billion, has faced significant challenges and pressure in dealing with the COVID-19 epidemic due to limited medical resources. The Chinese government has implemented policies such as "Pandemic Lockdown" or "Dynamic Cleaning" at both the central and local levels, and the pandemic has persisted for three years in China. In November 2022, the number of the nucleic acid testing positives increase rapidly again in China. However, in December 2022, the Chinese government issued new policies regarding COVID-19, including the cancellation of nucleic acid testing as the only green pass for the public during the three-year period. This has led the public to perceive that the Chinese government has ended all prevention and control policies against COVID-19. Despite China's unique population characteristics, medical conditions, economic situation, and governance structure, which differ from developed countries, its policies in response to COVID-19 can provide valuable references for other developing countries around the world and may offer insights and lessons for future pandemic prevention and control efforts.

Therefore, in this study, our focus is to analyze the policies issued by the Chinese government during the COVID-19 pandemic. Instead of qualitative analysis of policy influence (whether the policies are better or worse) (Zhu et al., 2022), we employ text mining and network analysis techniques to quantitatively visualize the evolution of China's policies against COVID-19. We specifically examine the policy targets and policy tools, which are the two main components of policies. Policy targets represent the policymakers' intentions in textual form, while policy tools are the political actions and behavioral approaches employed to achieve the policy targets (Huang et al., 2018). Policy tools serve as measures to facilitate the attainment of policy targets and form the core contents of policies. Hence, we aim to analyze the evolution of China's policies from the perspectives of policy targets and policy tools.

RELATED WORKS
Policy Document Mining
Policy documents serve as carriers of policy and play a crucial role in governance and blueprint planning. Scholars use policy documents as a means to explore policy contents and policy processes (Wu, 2019). Quantitative research or mining of policy documents has emerged as a new direction in public policy studies (Huang et al., 2015). However, policy document mining is distinct from traditional scientific text mining, such as papers and patents, as...
accurately mining the content of policy text using bibliometric methods can be challenging (Huang et al., 2021). Previous research has mainly focused on policy topic mining, policy issue ministry network analysis, policy diffusion, policy tool/instrument analysis, among others.

Policy target and policy tool are also two crucial domains for policy document mining. However, there is limited quantitative research on policies against COVID-19 from the perspectives of policy target and policy tool, despite some exploration of COVID-19 policies. For instance, Wang (2021) assessed the impact of national culture and government policies on social distancing measures to combat COVID-19 and found that government stringency had a larger impact on social distancing. Zhu et al. (2022) analyzed the specific policy tools used in different periods of China's COVID-19 pandemic, but lacked deep quantitative statistics on different policy tools. Therefore, in this study, we employ text mining methods to extract policy targets and identify policy tools from policy documents and utilize quantitative analysis methods to explore the evolution of China's policies against COVID-19.

**Policy Target**

Policy targets are fundamental elements of policy documents that articulate the purpose and intention of policy-making. They are crucial for improving the implementation of policy actions. Relying solely on long-term targets makes it challenging to recognize and support early contributions, resulting in less effort being dedicated to the initial actions necessary for achieving long-term change (Lester & Neuhoff, 2009). Therefore, it is essential to have a mix of long-term, short-term, and specific policy targets to address policy issues effectively. In this case, the policy target cannot be summed up in one or two simple words and phrases. And, policy targets are shaped by the dynamic characteristics of the policy context and evolve with time and situation. Hence, timely and automated extraction of policy targets from policy documents is crucial for policy analysis and supervision.

The extraction and analysis of policy targets can unveil critical insights into the policy design and implementation process (Yang & Huang, 2022). For instance, Huang et al. (2018) proposed a bibliometric method to detect changes in policy targets and analyze the core policy targets in different time periods of China's nuclear energy policies. Yang et al. (2020) employed China's information technology policies as an example, constructing policy target keyword co-occurrence networks for discrete time periods to analyze the evolution of policy targets. Leveraging policy documents, the extraction and analysis of policy targets can facilitate the public's understanding of policy in a more direct and accessible manner.

For COVID-19 policies, policy targets pertain to the direction of prevention and control. If all policies against COVID-19 solely focus on achieving "Zero Clearing" without considering economic losses and pressures, then the policy targets must exclusively focus on prevention and control. The policy targets of Chinese policies against COVID-19 will directly and objectively reveal the purpose and intention of the Chinese government. Therefore, in this study, we aim to extract policy targets from policy documents to shed light on the Chinese government's thinking and considerations in their policies.

**Policy Tool**

Policy tools, also known as policy instruments, are instruments designed to encourage or enable people to take actions they might not have otherwise taken, or to overcome obstacles to policy-relevant actions (Schneider & Ingram, 1990). Policy tools have been an important dimension of exploration and promotion of policies, as exemplified by studies such as Xu et al. (2022), which investigated the relationship between environmental policy tools and economic development, examined the mediating effect of public health. Chai et al. (2020) also examined the structure and function of China's environmental policy based on policy tool theory. One of the most fundamental and significant aspects of policy tools research is the classification of policy tools, namely how to identify the category of policy tools used in various policy contexts.

Various scholars have proposed classification frameworks for policy tools over the years. For instance, Rothwell and Zegveld (1981) summarized 12 specific categories of policy tools, which they further grouped into three broad categories: supply-oriented policy tools, environmental oriented policy tools, and demand-oriented policy tools (Rothwell & Zegveld, 1985). Howlett et al. (2009) proposed three broad categories: command control tools, economic incentive tools, and social autonomy tools, along with eight specific categories. Bemelmans et al. (2011) summarized three categories: carrots, sticks, and sermons. Despite the passage of more than 40 years, the policy tool classification framework put forward by Rothwell and Zegveld remains the most widely used framework and has been applied in various domains (Huang et al., 2018; Qin et al., 2020; Kuo & Shyu, 2021; Zhu et al., 2022).

In this study, we employ an improved classification framework based on Rothwell and Zegveld's framework, derived from classical and recent research on policy tools, as shown in Table 1.
Table 1. The Classification Framework of Policy Tools

<table>
<thead>
<tr>
<th>Policy Tool</th>
<th>Meaning Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivation of Talent</td>
<td>Providing talent guarantee through talent training, talent introduction, talent development planning.</td>
<td>Rothwell &amp; Zegveld, 1985; Qin et al. 2020; Kuo &amp; Shyu, 2021</td>
</tr>
<tr>
<td>Funds Support</td>
<td>The direct governmental financial support for the development, such as R&amp;D investment, science and technology funds, financial subsidies etc.</td>
<td>Rothwell &amp; Zegveld, 1985; Qin et al. 2020; Kuo &amp; Shyu, 2021</td>
</tr>
<tr>
<td>Technical Support</td>
<td>Policies to provide technical support to promote the development.</td>
<td></td>
</tr>
<tr>
<td>Public Enterprise</td>
<td>Policies mobilizing the state-owned enterprises and institutions, joint with private enterprises.</td>
<td></td>
</tr>
<tr>
<td>Infrastructure Development</td>
<td>Policies supporting infrastructure development.</td>
<td></td>
</tr>
<tr>
<td>Target Planning</td>
<td>Policies about the plan or strategy.</td>
<td></td>
</tr>
<tr>
<td>Financial Support</td>
<td>Policies to encourage and attract financial and derivative institutions to provide loans, guarantees, venture capital and other support.</td>
<td>Rothwell &amp; Zegveld, 1985; Melnikov &amp; Karelin, 2021; Yao et al. 2021</td>
</tr>
<tr>
<td>Tax Preference</td>
<td>Tax measures, such as tax exemption and reductions for specific projects, R&amp;D tax credits, capital gain tax exemption, personal tax allowances.</td>
<td></td>
</tr>
<tr>
<td>Political Support</td>
<td>Strategic planning or national programs, regional policies, think-tank and public consulting for policy exploitation, political and legal system</td>
<td></td>
</tr>
<tr>
<td>Government Procurement</td>
<td>Central or local government purchases and contracts, R&amp;D contracts, and transactions via government procurement.</td>
<td>Rothwell &amp; Zegveld, 1985; Melnikov &amp; Karelin, 2021; Yao et al. 2021</td>
</tr>
<tr>
<td>Service Outsource</td>
<td>Government's R&amp;D plans distributed to enterprises or industry university research collaboration organization.</td>
<td></td>
</tr>
<tr>
<td>Demonstration Project</td>
<td>Industry university research demonstration base, demonstration projects or major demonstration projects.</td>
<td></td>
</tr>
<tr>
<td>Guidance and Encouragement</td>
<td>Measures to encourage and lead the public into related action.</td>
<td></td>
</tr>
</tbody>
</table>

**RESEARCH DESIGN AND METHODOLOGY**

The key steps of our research design and methodology are outlined in Figure 1, as follows:

**Data Collection**

The policy documents pertaining to COVID-19 were collected from the PKULaw database, which is a highly authoritative and comprehensive legal database in China. Within this database, a special sub-database dedicated to "epidemic prevention & control" was utilized as an example. To ensure the representativeness and validity of the policy sample, only national policies issued by the central government or its direct agencies were considered. The policies included in the study were limited to those that published between December 27, 2019 and September 10, 2022, in order to ensure that the data specifically pertained to COVID-19 and its prevention & control measures.

The collected data then underwent a manual screening process based on the following criteria: (1) The policy document had to be in the form of a law, regulation, circular, or other official document representing government policy. (2) The main content of the policy had to be closely related to COVID-19. Following the screening process, a total of 1154 policy documents were obtained. According to the publication "Fighting COVID-19 China in Action" by the State Council Information Office of the People's Republic of China, the COVID-19 epidemic is categorized into four distinct temporal stages known as "stage 1", "stage 2", "stage 3", and "stage 4". Table 2 provides a detailed overview of these stages and the distribution of China's policy against COVID-19.
## Policy Targets Extraction

The "policy target" refers to the objective and intent behind the policy-making action, that is, the main problem that the policy aims to address. Policy targets are often implicit and difficult to discern. In order to address this issue, we utilize a policy target identification procedure (Yang et al., 2020), which leverages natural language processing methods and regular expressions. The procedure is outlined as follows:

1. First, the introductory paragraph of each policy document is located. The end of the introductory paragraph is determined by identifying the appearance of structures such as "ࠋ" or "㸸" in the policy text.

2. Second, policy targets in the introductory paragraphs are identified based on a verb/noun thesaurus constructed from common policy expressions. In Chinese policy document, policy targets are often expressed in the form of "in order to + verb + noun phrase". If this specific structure is identified and the words in the structure belong to the verb/noun thesaurus, which was pre-constructed using expert knowledge and extensive browsing of policy texts, it can be determined that a policy target has been identified. A partial summary of the "verb/noun thesaurus" is provided in Table 3. For the small number of policy texts for which the policy target could not be successfully extracted, manual reading was employed for additional extraction.

<table>
<thead>
<tr>
<th>verb</th>
<th>noun</th>
</tr>
</thead>
<tbody>
<tr>
<td>implement, provide, reduce, carry out, safeguard, maintain, promote, increase, support, strengthen, protect, curb, win, mitigate, improve, accelerate, enhance, promote, cope, encourage, guide, strengthen, play, help, establish, help, raise, reduce, regulate, prevent, control, simplify</td>
<td>spirit, deployment, service, risk, thought, work, principle, safety, stability, development, requirement, strength, recovery, management, health, instruction, supply, momentum, war, prevention, control, burden, integrity, progress, construction, capacity, guarantee, resumption, impact, resumption, epidemic, initiative</td>
</tr>
</tbody>
</table>

Table 3. Verb/noun thesaurus(partial)

(3) Clean the policy targets extracted initially, including removing stop words, and merging synonymous terms, etc;

(4) Identify the core terms in policy targets based on term clustering. To do this, we used TF-IDF to perform term clustering on the cleaned policy targets, which resulted in a set of words/phrases. The clustering results were then manually reviewed and modified, and core terms were abstracted from each set of words/phrases. These core terms served as the final policy target keywords. The TF-IDF weight was calculated as Expression (1) and (2), where $TF(t, d)$ represents the frequency of term $t$ in document $d$, and $IDF(t)$ represents the inverse document frequency, which was used to determine the importance of term $t$ in expressing a semantic dimension.

$$TF - IDF(t, d) = TF(t, d) \times IDF(t) \quad \text{(1)}$$

$$IDF(t) = \frac{\log \text{Total number of documents containing } t}{\text{Number of documents containing } t + 1} \quad \text{(2)}$$

After extracting the policy target keywords, we constructed policy target keyword co-occurrence networks and identified the core policy target keywords based on eigenvector centrality. Eigenvector centrality is a technique used to compute the significance of a node in a social network. It is based on the PageRank algorithm, with the objective of evaluating the performance of a node based on the impact of its neighbors. The mathematical basis for this method is the eigenvalue and eigenvector, it is defined as Expression (3), where $P(v)$ is the set of neighbors of node $v$, $\lambda$ is a constant representing the eigenvalue, $Adv$, $k$ is the adjacency value between node $v$ and $k$.

$$E_v = \frac{1}{\lambda} \sum_{k \in P(v)} E_k = \frac{1}{\lambda} \sum_{k \in P(v)} Adv_{v,k} E_k$$

(3)

## Policy Tools Identification

In the process of policymaking, policy documents often contain various policy tools. It’s challenging to identify them accurately. So we utilized a trained policy tool classification model based on the classification framework shown in Table 1. This model consists of pretrained WordBERT-ZH and BiLSTM. WordBERT-ZH is an improved
version of BERT specifically designed for Chinese text classification (Feng et al., 2022). The BiLSTM acts as a classifier to map the relationship between the embedding of policy text and the policy tool categories.

This policy tool classification model was trained on 8910 manually labeled samples derived from digital economic policies and data governance policies by the authors, making it the most accurate policy tool automatic classification model for Chinese policies (Huo et al., 2023). To ensure and improve the accuracy of this new dataset, we followed the active learning theory and added manually labeled samples derived from COVID-19 policies. Active learning is a mechanism that reduces the need for human annotation in training datasets and selects the most informative cases to achieve better performance compared to passive supervised learning algorithms (Figueroa et al., 2012). It has been successfully applied in various domains, such as text classification, image classification, etc. (De et al., 2021).

The identification of policy tools is carried out through the following steps:

1. First, we treat each policy paragraph as one policy unit, as considering one paragraph as one policy unit ensures that the statistics about policy tools are comparable and maintains semantic integrity, following the classical process of policy unit standardization (Lu et al., 2022). We then divide all policy documents into policy units, resulting in 8910 policy units related to COVID-19 policies.

2. Second, based on the model trained on digital economic policy and data governance policy, we classify the policy tools for each policy unit from the COVID-19 policy. To test the accuracy of the classification, we randomly selected 100 policy units and assigned a domain expert proficient in policy tool classification to independently encode them manually. By comparing the results of the model encoding and the manual encoding, we calculated Holsti's consistency percentage to assess the reliability of the model. The formula to calculate Holsti's consistency percentage is as Expression (4), Where M represents the number of codes that are completely the same in two encodings, and N1 and N2 represent the number of codes in the two encodings, respectively.

   \[ \text{reliability} = \frac{2M}{N_1 + N_2} \]  

(3) Finally, we optimized the classification according to the theory of active learning. As shown in Figure 2, we first checked the results of the policy tool classification model. If the accuracy of a certain category is not satisfactory, indicating that it is difficult to classify, we added more labeled samples to create a new training dataset for these categories with low performance. We then trained the model with this new dataset and tested the results again. After 9 rounds of coding and supplementing the training dataset, the final reliability of the first coding result reached 90%, meeting the reliability requirements. In total, we identified 8517 policy tool items from the COVID-19 policies.

**EVOLUTION ANALYSIS OF CHINA’S POLICY AGAINST COVID-19**

**The Evolution of Policy Targets**

Using the methodology of text mining and network analysis, an analysis of policy documents related to the COVID-19 pandemic was conducted. This process resulted in the identification and extraction of 208 policy target keywords. Subsequently, policy target keyword co-occurrence networks were constructed for each time period based on the relationships between the extracted policy targets in the documents, as shown in Figure 3, where each node represented a policy target, and edges between nodes represented co-occurrence in policy documents. The size of the nodes was determined by the frequency of occurrence of the policy target, and the thickness of the edges was determined by the frequency of co-occurrence of two policy targets.

To gain insight into the historical evolution of COVID-19 policies, eigenvector centrality was calculated for each node in the network, and the top ten policy target keywords with the highest eigenvector centrality were listed in Table 4. A comparative analysis of the core policy target keywords across different stages of China's response to the COVID-19 pandemic was conducted.
COVID-19 pandemic revealed several key findings:

(a) stage 1

(b) stage 2

(c) stage 3

(d) stage 4

Figure 3. China's COVID-19 Policy Targets Co-occurrence Network, stage 1-4.

(1) In stage 1, the central policy target was "COVID-19 prevention and control," which had the highest frequency and eigenvector centrality and was closely linked with "safety and health" and "implementation of the central strategy," which ranked among the top three in terms of eigenvector centrality and co-occurrence frequency. At the same time, the government also implemented measures to support the resumption of work and production, provide financial support, and ensure the orderly functioning of various industries. However, the market activation and support measures were primarily targeted towards the production of medical supplies and daily necessities, with the primary objective being to support the efforts to control the spread of the virus. In conclusion, the government prioritized efforts to combat the COVID-19 epidemic, placing it ahead of other market-related objectives.

(2) In stage 2, the core policy target remained "COVID-19 prevention and control." However, there was a shift in the combination of core policy targets, which included "economic and social development." This suggests that the government gradually shifted its focus to economic and social issues. Despite this, the government's priority still remained on epidemic prevention and control, with core targets related to this objective including "Precise and differentiated epidemic control strategies," "Personnel and materials supply," and "Medical treatment."

(3) In stage 3, there is a noticeable trend towards a more coordinated and unified approach in formulating macro-level policy targets. The difference in eigenvector centrality between the two core targets, "COVID-19 prevention and control" and "economic and social development," has reduced. This shift towards economic and social development is further emphasized by specific policy targets that focus on promoting economic development through various means, such as laws, foreign trade, and market environment. This highlights the paramount importance placed by the government on social and economic development.
(4) In stage 4, there is a heightened policy relevance, with a more discernible clustering and interconnectedness among policy targets, forming a systematic planning system that concurrently facilitates economic development and epidemic prevention and control. The core targets in this stage are almost consistent with those in the previous stage, such as "COVID-19 prevention and control" and "economic and social development", which highlights the Chinese government's commitment to integrating epidemic prevention and control with economic and social development. The policies emphasize the consolidation of prevention and control outcomes, such as "preventing the resurgence of the epidemic", "preventing the importation of the epidemic", "consolidating the outcomes of prevention and control", and "preventing the spread of the epidemic".

In summary, China's epidemic prevention and control policy targets have evolved from "emergency prevention and control", "prevention and control while stabilizing the economy", and "economic and social development", to "consolidating prevention and control results and promoting economic development". The sub-targets of epidemic prevention and control have evolved from treatment, material supply, and prevention of epidemic spread, to early detection and prevention, and to prevention of epidemic importation and resurgence. These targets are specific, up-to-date, and constantly optimized. However, there may be a paradox between pandemic prevention and control and economic and social development, as achieving both targets simultaneously may be challenging without effective vaccines and new measures to address COVID-19.

<table>
<thead>
<tr>
<th>No</th>
<th>Stage 1</th>
<th>Eigenvec</th>
<th>Stage 2</th>
<th>Eigenvec</th>
<th>Stage 3</th>
<th>Eigenvec</th>
<th>Stage 4</th>
<th>Eigenvec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COVID-19 prevention</td>
<td>1.00</td>
<td>COVID-19 prevention</td>
<td>1.00</td>
<td>COVID-19 prevention</td>
<td>1.00</td>
<td>COVID-19 prevention</td>
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<tr>
<td>2</td>
<td>Implement of the</td>
<td>0.76</td>
<td>Economic and</td>
<td>0.80</td>
<td>Economic and</td>
<td>0.89</td>
<td>Economic and</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>central strategy</td>
<td></td>
<td>social development</td>
<td></td>
<td>social development</td>
<td></td>
<td>social development</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Health and safety</td>
<td>0.60</td>
<td>Work resumption</td>
<td>0.61</td>
<td>Work resumption</td>
<td>0.74</td>
<td>Implement of the</td>
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<td></td>
<td>central strategy</td>
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</tr>
<tr>
<td>4</td>
<td>Implement the spirit</td>
<td>0.56</td>
<td>Implement of the</td>
<td>0.56</td>
<td>Implement of the</td>
<td>0.51</td>
<td>Implement the</td>
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<td>central strategy</td>
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<td>spirit of meeting</td>
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</tr>
<tr>
<td>5</td>
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<td>Implement the spirit</td>
<td>0.51</td>
<td>Protect legitimate</td>
<td>0.50</td>
<td>Health and safety</td>
<td>0.55</td>
</tr>
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<td>of meeting</td>
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<td>rights and interests</td>
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<tr>
<td>6</td>
<td>Strengthen financial</td>
<td>0.50</td>
<td>Precise and</td>
<td>0.38</td>
<td>Promote industry</td>
<td>0.44</td>
<td>Prevent the</td>
<td>0.54</td>
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<td></td>
<td>support</td>
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<td>differentiated</td>
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<td>epidemic from</td>
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<td></td>
<td></td>
<td></td>
<td>epidemic control</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7</td>
<td>Personnel and</td>
<td>0.46</td>
<td>Personnel and</td>
<td>0.37</td>
<td>Ensure stability in</td>
<td>0.38</td>
<td>Defending externally</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>materials supply</td>
<td></td>
<td>materials supply</td>
<td></td>
<td>foreign trade and</td>
<td></td>
<td>against importation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>foreign investment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Prevent the spread</td>
<td>0.44</td>
<td>Health and safety</td>
<td>0.34</td>
<td>Maintain economic</td>
<td>0.37</td>
<td>Maintain economic</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>of epidemic</td>
<td></td>
<td></td>
<td></td>
<td>and social order</td>
<td></td>
<td>and social order</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Medical treatment</td>
<td>0.38</td>
<td>Stabilize employment</td>
<td>0.32</td>
<td>Stabilize employment</td>
<td>0.36</td>
<td>Consolidate</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>prevention and control</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Ensure orderly work</td>
<td>0.38</td>
<td>Medical treatment</td>
<td>0.31</td>
<td>Reduce costs and</td>
<td>0.34</td>
<td>Prevent the spread</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>burdens</td>
<td></td>
<td>of epidemic</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4. Top 10 China’s COVID-19 policy targets**

The **Evolution of Policy Tools**

The policy tool classification model was utilized to categorize the policy units, resulting in the identification of 8517 basic policy tools, spanning three categories and 14 second-categories. As depicted in Table 5, there is a noticeable disparity in the distribution of policy tools, with 68.8% classified as environmentally-oriented, 23.8% as supply-oriented, and 7.3% as demand-oriented. This suggests that the government primarily employs "top-down" measures to manage the spread of the epidemic, by creating a favorable policy environment and directly supplying resources and services, while disregarding the pull effect from the demand side.

Firstly, the utilization of supply-oriented tools is relatively limited. Among these policy tools, public enterprise constitutes the largest proportion (12.0%), followed by infrastructure development (6.2%), and talent cultivation (3.1%). This indicates that the government prioritizes strategies that directly support epidemic prevention and
control measures and provides impetus for epidemic prevention and control through human, material, and service support. However, fund support and technical support tools only account for 1.1% and 1.4% respectively, suggesting that more attention needs to be given to fund allocation and application of science and technology in policy formulation. Strengthening these areas through increased fund support and technical assistance is imperative.

Secondly, the government heavily relies on environment-oriented policy tools throughout the four stages. The most frequently used policy tools are legal regulation and target planning, accounting for 26.2% and 33.7% respectively. However, financial support, tax incentives, and political support are relatively minor in proportion. Therefore, the government should also consider issuing more varied policy tools related to financial support, tax incentives, and political support in detail, rather than solely relying on general legal regulation.

Lastly, the use of demand-oriented policy tools is insufficient across the four stages. This indicates that the Chinese government focuses primarily on boosting the epidemic response through increasing supply and creating a favorable policy environment, but overlooks the need to stimulate development from the demand side. Demonstration projects, service outsourcing, and government procurement policy tools all account for less than 2%, with government procurement policy tools only accounting for 0.1%. This suggests that the government needs to introduce more measures to attract social and market forces to participate in the epidemic response and economic development.

In conclusion, the COVID-19 policy tools employed in China exhibit a tendency towards emphasizing environmental creation over demand stimulation, relying on government intervention over market forces, prioritizing regulation over cooperation, and favoring coercion over guidance.

<table>
<thead>
<tr>
<th>Policy Tool</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Total</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Oriented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultivation of Talent</td>
<td>2.8</td>
<td>3.7</td>
<td>5.9</td>
<td>2.3</td>
<td>266</td>
<td>3.1</td>
</tr>
<tr>
<td>Funds Support</td>
<td>1.3</td>
<td>1.8</td>
<td>1.3</td>
<td>0.7</td>
<td>91</td>
<td>1.1</td>
</tr>
<tr>
<td>Technical Support</td>
<td>1.9</td>
<td>1.3</td>
<td>2.1</td>
<td>1.0</td>
<td>119</td>
<td>1.4</td>
</tr>
<tr>
<td>Public Enterprise Infrastructure Development</td>
<td>14.1</td>
<td>19.4</td>
<td>11.3</td>
<td>9.2</td>
<td>1018</td>
<td>12.0</td>
</tr>
<tr>
<td>Environmental Oriented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal Regulation</td>
<td>25.4</td>
<td>19.5</td>
<td>25.7</td>
<td>28.3</td>
<td>2229</td>
<td>26.2</td>
</tr>
<tr>
<td>Target Planning</td>
<td>30.2</td>
<td>30.9</td>
<td>28.7</td>
<td>37.6</td>
<td>2871</td>
<td>33.7</td>
</tr>
<tr>
<td>Financial Support</td>
<td>3.3</td>
<td>3.0</td>
<td>3.9</td>
<td>3.5</td>
<td>292</td>
<td>3.4</td>
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<tr>
<td>Tax Preference</td>
<td>3.1</td>
<td>5.6</td>
<td>1.4</td>
<td>1.9</td>
<td>220</td>
<td>2.6</td>
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<td>Political Support</td>
<td>4.4</td>
<td>4.8</td>
<td>2.6</td>
<td>1.9</td>
<td>251</td>
<td>2.9</td>
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<tr>
<td>Demand Oriented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government Procurement</td>
<td>0.1</td>
<td>0</td>
<td>0.2</td>
<td>0.2</td>
<td>10</td>
<td>0.1</td>
</tr>
<tr>
<td>Service Outsource</td>
<td>1.8</td>
<td>2.2</td>
<td>2.6</td>
<td>1.0</td>
<td>133</td>
<td>1.6</td>
</tr>
<tr>
<td>Demonstration Project</td>
<td>0.7</td>
<td>1.4</td>
<td>5.4</td>
<td>0.8</td>
<td>129</td>
<td>1.5</td>
</tr>
<tr>
<td>Guidance and Encouragement</td>
<td>5.6</td>
<td>3.6</td>
<td>4.3</td>
<td>3.5</td>
<td>350</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Table 5. Distribution of policy tools

CONCLUSION
This study aims to shed light on the content and dynamics of the policy texts issued and implemented in response to the COVID-19 pandemic by conducting a keyword co-occurrence network analysis of policy targets and identifying policy tools, which will provide valuable insights and lessons for future epidemic prevention & control efforts, not only in China but also in other developing countries.

To summarize, in terms of policy targets, the policy targets of the Chinese government during the COVID-19 pandemic have gone through several stages, reflecting the changing characteristics of the outbreak and the government's response. In stage 1, the focus was on COVID-19 prevention & control, with the government striving to ensure basic livelihoods and implementing emergency control measures to prevent the spread of the virus. In stage 2 and stage 3, the policy targets shifted to a combination of epidemic prevention and economic development, with the government adopting flexible and tiered measures to control the spread of the virus. In stage 4, the government tried to balance the targets of epidemic prevention and economic and social development, with a relatively greater emphasis on nucleic acid testing.

Throughout the response process, the government attached great importance to implementing central deployments and spiritual indicators, reflecting the political advantage of unified leadership in China. However, some shortcomings were also revealed, such as the shortage, uneven distribution, and inefficient use of emergency health resources, as personnel and materials supply has been one of the core policy tools and important tasks of the
epidemic response in the first two stages. China's large population and relatively scarce medical resources exacerbate the problem of uneven distribution of medical resources, with quality medical resources mainly concentrated in first- and second-tier cities. In addition, people's lack of understanding of the actual situation of the epidemic caused panic, leading to the hoarding of large amounts of health resources, which resulted in waste of health resources and forced the government to build more health resources than needed, causing waste of financial and human resources (Li et al., 2020a; Li et al., 2020b).

The policy target of nucleic acid testing only emerged in the fourth stage and was not included in the top ten central targets. Medical-related targets such as "personnel and materials supply" and "medical treatment" were the core policy targets throughout the pandemic, indicating that China's public health resources were mainly used for the medical treatment of the population. However, in preventive fields such as nucleic acid testing, resources were inadequate for the large population. Information disclosure related targets were not included in the core policy targets, and public health information disclosure was not timely enough, indicating a need to increase the scope and degree of information disclosure.

In terms of policy tools, China's response to the COVID-19 pandemic has primarily relied on environment-oriented policy tools, while supply-oriented policy tools have been relatively limited in their application, and demand-oriented policy tools have been severely lacking. These findings are consistent with the research conducted by of Ma et al (2020). Specifically, legal regulation and target planning tools have accounted for a significant proportion of the policy tools used, exceeding 50%, while the utilization of financial support, technical support, government procurement, service outsourcing, and demonstration project has been relatively low, accounting for less than 2%. This indicates that the government needs to optimize the application of environment-oriented and supply-oriented policy tools, with particular emphasis on leveraging market forces, social organizations, and public engagement to enhance diseases resistance. Of particular concern is the relatively weak level of financial support, with the government's related policies involving funds support in supply-oriented policy tools, financial support and tax preference in environment-oriented policy tools all exhibiting low levels of involvement. Among them, funds support accounted for only 1.1%, while financial support and tax preference accounted for only 3.4% and 2.6%, respectively. China's government health expenditures as a percentage of GDP have historically been very low, with less than 1% from 2000 to 2007 and reaching 2.16% for the first time in 2020. This proportion is not only lower than the average level of developed countries such as Germany, the United Kingdom, and Japan, but also fall short of the level of public health government investment in developing countries (Zhu et al., 2022). Overall, at the national level, the process of formulating public health policies before and after the outbreak of the pandemic has been characterized by a lack of financial investment and specific financial policies, which has made it challenging to promote the development of the medical system and garner joint response from the public and enterprises in addressing the to the pandemic.

IMPLICATION
The analysis of previous epidemic prevention & control policies in China underscores the need for further improvements in several key areas. Firstly, there is a need to develop remote medical technology and improve the tiered diagnosis and treatment system to achieve rapid and equitable distribution of medical resources. Secondly, greater attention should be given to timely detection and prevention of epidemics, and a public health awareness of "prevention is better than treatment" should be established. Thirdly, information disclosure should be strengthened to facilitate effective epidemic monitoring and response. Fourthly, multi-party participation should be strengthened in epidemic prevention & control efforts. Fifthly, greater financial investment in medical care is necessary to support effective epidemic prevention & control measures. Finally, policy tools and targets should be coordinated to improve policy effectiveness.

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Multi-Modal Crisis Discourse and Collective Sensemaking on TikTok

Khoury, Christy
Syracuse University, USA | cjkhoury@syr.edu
Owen-Smith, Alexander
Syracuse University, USA | aosmith@syr.edu
Joh, Una
Syracuse University, USA | sjoh01@syr.edu
Duan, Yiran
Syracuse University, USA | yduan12@syr.edu
Hemsley, Jeff
Syracuse University, USA | jjhemsle@syr.edu

ABSTRACT
An explosion at the Port of Beirut resulted in over 200 fatalities and displaced many more. Hundreds recorded and thousands shared the event, sparking discourse across social media. We provide a mixed-methods analysis of 26 TikTok videos about the port explosion. Our study involved a semiotic analysis of the videos and a content analysis of the related 21,150 comments. The discourse surrounding the explosion extends a growing body of literature on the role of TikTok in disseminating crisis-related information. We use a collective sensemaking framework to investigate how TikTok contributes to the understanding of an event. The authors find that Middle Eastern content creators contributed more to collective sensemaking about the event than non-Middle Eastern creators. We additionally examine the current state of collective sensemaking on TikTok and provide platform implications.

KEYWORDS
TikTok, Crisis Informatics, Multimodality, Content Analysis, Beirut

INTRODUCTION
On August 4th, 2020, the Port of Beirut in Lebanon exploded due to the detonation of misgoverned ammonium nitrate that had been stored in one of the port’s warehouses since October 2014 (Ballout, 2023). As a result, there were over 200 fatalities, thousands displaced, and significant damage to the city’s infrastructure. The explosion occurred during an already vulnerable time for Lebanon as the country was facing consequences of political corruption and instability, COVID-19, and a worsening economic crisis. There have been ongoing investigations of what exactly caused the explosion, as rumors, speculations, and conspiracy theories spread. As of April 2023, justice has not been served for those impacted by the explosion. This includes those who lost their lives, and the Lebanese communities that have not seen a beneficial change in government leadership.

Initially, a fire in the port alerted emergency responders as Beirut citizens started recording the resulting smoke cloud (see Figure 1). Those already recording captured the second, larger explosion that caused the fatalities and infrastructural damage. Lebanese diaspora worldwide were glued to their phones after the crisis, as those on the ground and citizen reporters kept the world up-to-date. Information was communicated via multiple social media channels, including TikTok. Hundreds of uploaded TikTok videos, with hashtags like #lebanonblast or #prayforlebanon, were viewed over 100 million times. TikTok helped enable a local crisis event to be discussed amongst a global audience, with video creators from around the world. Some influencers took it upon themselves to share about the explosion, initiating discourse about the international disaster with their thousands or millions of followers. Plentiful research has examined the use of social media for collective sensemaking during a crisis event, mainly with a focus on the Twitter platform (e.g. Dailey & Starbird, 2015; Fischer-Preßler et al., 2019; Heverin & Zach, 2012). However, few studies have focused on the TikTok platform.

We address this gap using sensemaking theory and analyzing 26 TikTok videos and their corresponding 21,150 comments. Dervin’s theory of sensemaking focuses on how individual behaviors can contribute to the collective sensemaking of others (Dervin, 1998). Rooted in this sensemaking theory, our study explores and examines the collective sensemaking process of the Port of Beirut explosion. TikTok’s multimodal content including visual, auditory, and textual elements encouraged a mixed-methods approach including semiotic analysis and content analysis. We find that the volume and timing of the discourse around the disaster resembles a viral event, or a viral topic (Nahon & Hemsley, 2013). We analyze the difference in comment behaviors for videos created by Middle Eastern content creators, influencers, and for videos that include a TikTok sound. Lastly, we discuss platform implications pertaining to collective sensemaking and potential future research endeavors.

BACKGROUND: TIKTOK AND COLLECTIVE SENSEMAKING
TikTok
TikTok, a Chinese social media application founded in September 2016, had an initial focus on entertainment content, such as lip-syncing or dancing videos (Montag et al., 2021). Over time, TikTok has grown to have an estimated 1 billion global users that produce and share videos about healthcare, fitness, life hacks, and more (Ruby, 2023). Being in the contemporary media landscape, TikTok features multimodal content that permits audio, visuals,
and other means to deliver a message. Although multimodal communication is available via other platforms, TikTok’s sociotechnical structure shifts the engagement pattern from friend-focused to content-focused (Zulli & Zulli, 2022). This provokes research that examines TikTok’s function in engaging crisis content. Each user’s For You Page (FYP) is curated with custom content suggested by the platform’s algorithm. Users can like, comment, save, repost, duet, or send the video to friends in and outside of the application. Comments can be liked, disliked, and replied to; if the creator of the video conducts any of these actions, it is visually emphasized with a “Liked by creator” tag or by focusing on the creator’s comment via collapsing other replies. Inter-application messaging is available in the Inbox, which also alerts users to their friend’s activities or available ‘live’ videos from creators they follow. However, a majority of user activity resides in their FYP.

The emergence of TikTok scholarship is recent, leading to a comparatively small volume of available literature. However, significant strides have already been made as multidisciplinary researchers consider TikTok’s societal and cultural impact on subjects from healthcare to algorithmic othering. Some examples include Bhandari et al.’s highlight of ‘the algorithmized self’ which constitutes self-representation on the application (2022) and Zulli et al.’s research on imitation publics on TikTok. Demographically, approximately 50% of TikTok users are below the age of 24 years old (Iqbal, 2023) aligning with the generation more likely to use social media for activist pursuits (Tyson et al., 2021). From the years of 2019 to 2022, TikTok’s annual users grew by over 380% to more than 1 billion users globally (Iqbal, 2023). Although there is concern about the application’s potential ban due to political tensions between the United States and China, a prominent community is still engaging in online information behaviors that are worth examining. Indeed, Dervin (1998) argues that individual information behaviors can contribute to collective sensemaking, thus we examine this particular phenomenon on TikTok.

**Collective Sensemaking**

Sensemaking focuses on information seeking and use to construct one’s own understanding of the world. Dervin describes sensemaking as a dynamic process of new information situations that an individual emotionally, cognitively, or physically negotiates with (Dervin, 1998; Naumer et al., 2008). This process is incremental through the transformation and integration of new information into cognitive schemata, which is essential in crises as sparse information is used for decision-making (Pentina & Tarafdar, 2014). Social media provides a platform for human-mediated information processing and exchange, where individuals collectively undergo the sensemaking process for a given subject. Previous collective sensemaking scholarship has focused predominantly on Twitter. (Reuter & Kaufhold, 2018). However, there exists a small body of literature considering sensemaking on TikTok (e.g., Schellewald, 2022). There is a need to examine the process of sensemaking at the digital locations used for crisis communication. This is where the TikTok platform comes into play, acting as our research field site.

**RESEARCH QUESTIONS**

**RQ1:** How does the use of TikTok contribute to collective sensemaking during a crisis?

**RQ2:** How does the nature of collective sensemaking on TikTok change over the course of a crisis?

**METHODOLOGY**

**Data Collection**

To examine the discourse pertaining to the August 4, 2020, Port of Beirut explosion, snowball searching was used to discover relevant hashtags. The process began by searching for hashtags related to #lebanonblast. We only considered hashtags with more than 5,000 views, and for each hashtag, only the top videos with more than 10,000 views were included. This was done to filter out videos that used the hashtag incorrectly, like bot videos, and to focus on videos that spanned a larger reach. After collecting the videos from each hashtag that met the criteria, accompanying hashtags from the resulting videos were used. An example is provided in Figure 1, which is a video that includes the hashtag #lebanonblast and relevant hashtags #prayforlebanon and #التفجير_بيروت (beirut_explosion in Arabic). We used ScrapeTikTokComments.js - a publicly available web scraping script - to collect information for 26 videos. The following data were collected: URL, Creator Name, Creator Number of Followers, Video Posted Date, Number of Likes, Number of Comments, and Comments. A limitation of this work is that the tool only collects up to the top 3,000 comments per video. A total of 21,150 comments were collected. Additionally, we recognize the ethical dilemma of collecting social media data; to mitigate, we emphasize anonymity of creators and point to the research goal of highlighting the significance of typically marginalized communities experiencing crisis.

**Data Analysis**

The analysis was divided into two main components: videos and comments. We analyzed videos with a semiotic analysis approach, and comments with content analysis, classification modeling via Bidirectional Encoder Representations from Transformers (BERT) (Devlin et al., 2019), and time series analysis of collective sensemaking.
I. Videos
Gillian Rose’s “Visual Methodologies” (2016) informed our video analysis, with a specific focus on semiology, the study of signs, which questions how images make meanings. The semiotic analysis looked at how each individual video collectively contributed to a cultural understanding of the crisis event. Given the varying lengths of the TikTok videos, we analyzed the auditory, visual, and textual signs at the following time increments: cover page, ½ through, ¾ through, and last section. For example, a 45-second video’s signs would have been analyzed on its cover page, at 15 seconds, 30 seconds, and then at the end.

Additionally, videos were tagged with three of the following attributes:

- Originating from a Middle Eastern content creator
- Creator having more or less than 500,000 followers, as a way to signal influence
- Using a TikTok sound or music, or using the original audio of the video

II. Comments
The characteristics of our population of TikTok comments include:

- Short comment length, with an average of 38.2 characters per comment. Although the maximum length of a comment is 150 characters, TikTok users in this comment set had on average much shorter comments.
- Frequent use of emojis, with approximately 31% of comments containing emojis.
- Multiple languages, with at least 10 languages detected in comment exchanges.
- Comments being highly relevant to the content of relative video, but not always so.

To preserve the sentiment of emojis, the UNICODE_EMOJI dictionary in the Python emot.emo_unicode module was used to convert emojis to text representations. Additionally, as there were multilingual comments, the GoogleTranslator class from the deep_translator package was used to translate comments into English. We note that there are contextual and cultural limitations that come with using a standard translation tool.

Content Analysis
While our approach to annotating comments falls within a methodology of quantitative “content analysis” (Krippendorff, 1980), technically the content is “discourse” focused. Comments are often responses to the video or ongoing discussions in the comments. While the comments are annotated in isolation, a large portion of what the machine learning methodology captures is a classification of the pragmatic function of a comment in an ongoing discourse. In early comparisons, we found a remarkable similarity to the codebook provided in Heverin and Zach’s (2012) collective sensemaking study. This enables a comparison of the content related to the Lebanese crisis to theirs.

In Heverin and Zach’s study, tweets were analyzed for collective sensemaking of three college campus shootings in the United States (2012). Given the relevancy of the article to our research, collective sensemaking themes from their study were used as the starting point for our codebook. After an initial inductive pass through the TikTok comments, the codebook was adjusted to reflect the international context of the field site and functionality of the TikTok platform. The tags, in Table 1 below, include both some of the original themes seen in Heverin and Zach’s study (Source: H&Z) and additional themes added by this study’s authors (Source: Original). As seen in *italics* below, some of Heverin and Zach’s codes were modified to fit the context of the study.
### Categories of Sensemaking Themes

<table>
<thead>
<tr>
<th>Source</th>
<th>Theme</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H&amp;Z</td>
<td>Information Sharing</td>
<td>Individuals posting comments containing information. Individuals contributing to the collective conversation about the crisis.</td>
</tr>
<tr>
<td>Original</td>
<td>Information Negotiation</td>
<td>Individuals questioning information contributed via auditory, visual, and/or textual signal in TikTok video.</td>
</tr>
<tr>
<td>H&amp;Z</td>
<td>Information Seeking</td>
<td>Individuals posting questions to the collective conversation about the crisis.</td>
</tr>
<tr>
<td>H&amp;Z</td>
<td>Talking Cure</td>
<td>Individuals communicating inner feelings, prayers, or thoughts without the expectation of receiving a response from others.</td>
</tr>
<tr>
<td>Original</td>
<td>Information Appreciation</td>
<td>Individuals sharing messages of appreciation for creators who spread awareness about the crisis.</td>
</tr>
<tr>
<td>H&amp;Z</td>
<td>Other</td>
<td>Comments that do not fit one of the other categories.</td>
</tr>
</tbody>
</table>

Table 1. Categories of Sensemaking Themes

Heverin and Zach’s codebook includes other collective sensemaking themes that were not included in our study’s codebook due to data fit and model fine-tuning. For example, one theme was “Understanding the Why” which is linguistically very similar to the “Information Seeking”. For the sake of linguistic clarity, these codes were collapsed. However, general findings about the use of comments for collective sensemaking are similar.

**Classification Model Analysis**

We used the BERT to classify our 21,150 comments into the six classes listed in Table 1. For simplicity, the authors decided to classify a comment in a mutually exclusive fashion, where a comment could be labeled with only one collective sensemaking tag. We randomly selected 1,936 comments from the dataset and manually labeled them via content analysis to create a training set for the BERT model. We fine-tuned the pre-trained BERT model on the training set and used it to classify the remaining 19,214 comments. The BERT model was selected for two main reasons. Firstly, BERT is a contextual language model that can capture the meaning of words in context, making it better suited for text classification tasks than the bag-of-words approach. Secondly, BERT is a pre-trained model that has learned the underlying structure of language from a large amount of text data, allowing it to extract relevant features for our classification task. These features can be fine-tuned on our specific task, resulting in better classification performance than training a model from scratch.

**FINDINGS**

**Result of the Classification Model**

We assessed our BERT-based classification model using key evaluation metrics, particularly focusing on the F1 macro score. The F1 macro score calculates the average F1 score for each class, ensuring that minority classes are not overlooked in imbalanced datasets. This comprehensive evaluation allows for a robust analysis of the classification results. Our model achieved a Macro F1 score of 80.88, with all classes exhibiting F1 scores above 80, except for the ‘Other’ class. This is due to the linguistic diversity of this class. Notably, the model demonstrated exceptional performance in the ‘Information Appreciation’ class, with a score surpassing 90.

<table>
<thead>
<tr>
<th>Comment Tag</th>
<th>Precision</th>
<th>Recall</th>
<th>F-1 Score</th>
<th>Accuracy</th>
</tr>
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<td>76.52</td>
<td>88.89</td>
<td>82.24</td>
<td>86.94</td>
</tr>
<tr>
<td>Information Negotiation</td>
<td>100</td>
<td>66.67</td>
<td>80</td>
<td>98.97</td>
</tr>
<tr>
<td>Information Seeking</td>
<td>78.79</td>
<td>89.66</td>
<td>83.87</td>
<td>96.56</td>
</tr>
<tr>
<td>Talking Cure</td>
<td>88.52</td>
<td>81.82</td>
<td>85.04</td>
<td>93.47</td>
</tr>
<tr>
<td>Information Appreciation</td>
<td>89.47</td>
<td>94.44</td>
<td>91.89</td>
<td>97.94</td>
</tr>
<tr>
<td>Other</td>
<td>73.68</td>
<td>53.85</td>
<td>62.22</td>
<td>88.32</td>
</tr>
</tbody>
</table>

**Overall** | **84.50** | **79.22** | **Macro: 80.88, Micro: 81.10** | **81.10** |

Table 2. Results of BERT Classification Model
Description of Comment Tags
The following subsections primarily respond to our first research question, RQ 1, which is regarding the way in which TikTok facilitated sensemaking in crisis. Examples of each comment are paraphrased to prioritize anonymity of the users; however, each paraphrase remains similar to the original comment to preserve sentiment.

Information Sharing
Information Sharing comment examples include “we are corrupted, not at war”, “Donate to Red Cross – they are not corrupted”, “commenting for the algorithm.”, and “explosion not fireworks, they are not made from ammonium nitrate...”

Information sharing had the highest frequency of collective sensemaking tags, given the popular behavior of exchanging information generally pertaining to the crisis. Comments of this type contribute to collective sensemaking as individuals posted information about the crisis or replied to inquiries posted by other users. Similar to Heverin and Zach’s Information Sharing tweets, these comments helped fill the cognitive gap to build a collective picture of what occurred. There were five main types of Information Sharing comments. ‘Background Information’ included individuals adding cultural, political, or economic information to help set the social context of the crisis. ‘Crisis Help’ included individuals providing information about seeking safety or safety precautions. Similar to Crisis Help, ‘Crisis Response Actions’ included individuals discussing appropriate crisis response steps or recipients of donations. ‘Conscious Comments’ included individuals commenting with the clear intention of trying to “boost” the algorithm. Lastly, ‘Tagging’ includes individuals tagging (@-ing) accounts – both with a low and high follower count – to share the video with them.

Information Negotiation
Information Negotiation comment examples include: “Why did you choose this song?” and “Why the world peace hashtag, it was a leak...”

In Heverin and Zach’s research, Information Negotiation comments reflected the more contentious nature of discourse as users questioned contributed information, asked for clarification, or stated they had the correct information (2012). We adjusted Heverin and Zach’s definition of “Information Negotiation” to reflect the multimodality of information on TikTok. It is in this category of collective sensemaking comments that we see the flexibility of information mediums, as users interpreted information not only from comments but also from the semiotic elements of the video. The strength of pairing content analysis with semiotic analysis is the ability to connect the several sources of information that come with multimodal content. Intersemiotic dissonance is when elements diverge semiotically rather than merge to inform a unified meaning (Yu, 2021). A majority of information negotiation comments represent the intersemiotic dissonance that motivates users to comment with disagreement on an element of the TikTok video, including a hashtag, selected sound, or textual element. These comments can create noise, impacting the efficacy of information exchange relevant to the crisis (Khoury, 2023). Thus, information negotiation comments do not contribute to collective sensemaking.

Information Seeking
Information Seeking comment examples include: “Why did it blow up?” and “Is your family and you ok? 🙏💔”. Comments of type Information Seeking are more straightforward in nature. Typically using who, what, where, why, and how language, individuals seek information to help fill cognitive gaps. Information seeking comments thus contribute to collective sensemaking.

Talking Cure
Talking Cure comment examples include: “Praying for Lebanon from Cambodia 🇱🇧” and “astaghfirullah ya Allah….save me always... #prayforlebanon”.

Crisis communication can also include discourse that comes from the personal, cathartic perspective of the individual. Individuals posting comments about their overall sentiment towards the event are not necessarily providing a response, but instead care about expressing prayers, thoughts, or an otherwise emotional utterance. Popular across crisis communication are individuals stating their “thoughts and prayers” are with the impacted community, which can spark debate amongst those who demand mobilization. In general, Talking Cure comments do not greatly contribute to collective sensemaking. However, given the importance of religion in Lebanon and the greater Middle East, these comments still are included in the collective sensemaking collection as the global world can observe about talking cure culturally differs. Included in Talking Cure comments is the discourse of type ‘Commemorative Information’. ‘Commemorative Information’ included individuals paying their respects to those passed, injured, displaced, or somehow else harmed.
Information Appreciation

Information Appreciation comment examples include: “As a Lebanese, thanks for using your platform to help share.” and “Yes! Someone spreading awareness about Lebanon on TikTok!!! 😊”

A code added into Heverin and Zach’s original codebook is ‘Information Appreciation’, as individuals commented messages of appreciation to those sharing videos about the explosion. Many of these individuals were Lebanese, demonstrated either by their self-identification in the comment or by inferring the motivation behind their comment. The greater Middle Eastern community is aware of how the world can normalize crisis events in the Middle East, or how mainstream media outlets pay little to no attention to what is beyond the Global North. Thus, when TikTok users from the Lebanese community saw accounts - especially those with a large amount of followers - share information about the crisis, they commented their appreciation. These comments can contribute to collective sensemaking indirectly as the broader community becomes aware of the sentiment of the impacted country. As individuals post their appreciation comments that hint towards the marginalization of previous crises, they signal their know-how. Other users are able to reply with talking cure, information seeking, or other categories of comments.

Other

Other comment examples include: "you shouldn’t joke about this...", and "Who is from Bulgaria?"

Lastly in the codebook are comments that did not fit any previously stated comment category. Intuitively, comments in this category are widespread contextually and linguistically. There are three main types of these comments. ‘Joke’ comments include sharing nonserious/humorous commentary about the crisis event. Although there is previous literature about the use of humor in crisis communication, this was not a code relevant to the scope of our study. ‘Anti-Joke’ comments included individuals ridiculing creators of ‘Joke’ comments. ‘Spam’ comments included individuals commenting content that did not pertain to collective sensemaking or otherwise were undecipherable. Generally, comments in the ‘Other’ category do not contribute to collective sensemaking.

Discourse Over Time (Overall, First Month, First Week)

The following subsections primarily respond to our second research question, RQ 2, which examines the nature of collective sensemaking over the course of a crisis. We used time series analysis to look at the trend of the collective sensemaking tags over the span of three years (2020-2023), one month after the explosion, and one week after.

Information Sharing, Talking Cure, and Other comments were the most common comments in contrast to Information Negotiation, Information Seeking, and Information Appreciation comments. Approximately 60% of the comments occurred within the first month of the explosion, and 51% of the comments occurred within the first week of the explosion. The rate of growth and decay of the discourse comments over time resembles a viral event or what Nahon and Hemsley call a viral topic (2013). Viral topics emerge out of many viral events and often reflect what a society deems as important at a given time. In viral events, network gatekeepers are key proponents of information diffusion – or movement of information - as they broadcast content into their own networks, based on their own curation logics (Thorson & Wells, 2016). In the case of the Port of Beirut explosion, there are a few reasons why a TikTok user would have come across content related to the disaster. TikTok creators, acting as gatekeepers, who paid close attention to the explosion generated information and passed it into their followers’ networks. Additionally, the FYP functioned as an algorithmic gatekeeper as it recommended content to its users based on the content the users browsed (Bhandari & Bimo, 2022).

Figure 2 shows two peaks about the viral topic of the Port of Beirut explosion from 2020 to 2023. The first one happened in 2020, right after the event happened, and the other smaller one was in 2022, indicating that people reshared information about the explosion, which resulted in the formation of the smaller peak (Nahon & Hemsley, 2013). The spikes in 2022 were due to videos sharing “new angles” of the blast and clips of a new Lebanese short created to commemorate the experiences of those impacted. Therefore, spikes in comments can be broadly attributed to commemoration that re-stimulated discourse.
Figures 2-4: Trends of Sensemaking Tags Over Time, First Month & First Week

Figures 3 and 4 show the trend of the six sensemaking tags one month and one week after the explosion respectively. We zoom into the one-month and one-week period to explore what information users were sharing right after the explosion event in contrast to the 3-year span. Both figures show similar viral trends like Figure 2, but there are nuanced differences. For example, both Figures 3 and 4 show that users shared most of the information on August 5 and 6, 2020, the 2 days after the explosion, which formed the peak that is shown across the three graphs. However, Information Sharing had the highest frequency in Figure 2 in 2020, while Figures 3 and 4 show that ‘Other’ comments were the most used discourse type for approximately the first 2 days until Information Sharing and Talking Cure comments took lead. This trend aligns with the paradoxical role media plays in being both a source of relevant information and information overload, leading to suboptimal information processing (Pentina & Tarafdar, 2014).

Significance of Middle Eastern Creators, Influencers, and TikTok Sounds

To further examine gatekeepers, each video’s creator was tagged for being a Middle Eastern (ME) content creator, having more than 500,000 followers, and for choosing to incorporate a TikTok sound. By formulating three hypotheses around these three attributes, we explored how video creators and their decisions influence comment behavior.

<table>
<thead>
<tr>
<th>Middle Eastern Content Creator?</th>
<th>More than 500K Followers?</th>
<th>Uses TikTok Sound?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 3. Frequency of Videos Per Attribute

$H_0$: There is independence between the background of the content creator and the behaviors of comments.

$H_0$: There is independence between influence, determined by follower count, and the behaviors of comments.

$H_0$: There is independence between using a TikTok sound and the behaviors of comments.

A chi-square test is used to test these hypotheses as it can determine if a connection between categorical variables exists (Singhal & Rana, 2015). For each chi-square result, the p-value of <0.001 indicates we can reject the null hypothesis, that there is independence between each attribute and commenting behavior. Examining Figure 5A reveals that there is not a significant difference in Information Appreciation and Information Negotiation comment behavior between videos created by ME and non-ME publishers. While non-ME creators made more videos, ME creator videos had nearly double the amount of the rest of the comment types. As Information Sharing and Information Seeking comments more directly contribute to collective sensemaking, we see that ME creators sharing about the Port of Beirut explosion contributed more to collective sensemaking than non-ME creators. This may be due to their ethnic background signaling more credibility in discussing the subject matter, their follower’s increased interest in the topic, or another factor.

Figure 5B reveals that creators with more than 500,000 followers, or influencers, tend to receive more Information Appreciation comments. Their followers, cognizant of the creator’s influential status, see the role the video plays in information spread. However, videos made by creators with less than 500,000 followers tend to have more of every other comment type. Figure 5C illustrates TikTok videos using a selected sound having more Information Negotiation comments than videos using the original audio, indicating intersemiotic dissonance. As the selected sound was just one semiotic signal type, further research is needed to understand the relationship between specific semiotic decisions creators make and the impact on the collective sensemaking of an event.
We note the importance of considering the TikTok creators, regardless of ethnic background or follower count, in the sensemaking process. In sensemaking, a single individual cannot have a complete understanding of reality. Instead, we are dependent on multiple perspectives to make sense of information-sparse events. Conducting a semiotic analysis of the videos revealed numerous vantage points and footage that, together, helped form an understanding of the crisis event.

**DISCUSSION AND NEXT STEPS**

**Richness of Collective Sensemaking**

Outlets like TikTok can help combat the marginalization of international events by Western media. Both Lebanese and non-Lebanese chose to engage with information about the event. Although we cannot necessarily point to the motivations of the creators of the videos, we can say that information diffusion was an important part of this engagement. This was seen with influencers spreading awareness about crisis relief efforts and with citizens of Beirut sharing the horrors of their destructed city. The sensemaking discourse that occurred on the application was mostly surface-level. The algorithm's temporal element follows and enforces virality, as TikTok prioritized videos in the FYP during the “peak” time after the disaster event. As of April 2023, approximately 2.5 years after the disaster, the Lebanese community is actively discoursing and investigating the circumstances and offenders of the explosion. Lebanese are steadily broadening their cultural understanding of the circumstances that led up to the event, and the global community has already shifted its attention elsewhere. This situation is not unique, as communities worldwide seek attention from the global community for recognition and awareness of their country’s dilemmas. As a platform, TikTok has the power and potential to alter how cultural events are understood. Using a design or human-computer interaction theoretical lens, the platform can be inspected for how to more richly fill cognitive gaps of crisis events typically marginalized by the global community.

**Mis(information) Sharing**

In addition to the richness of collective sensemaking is the accuracy of information used to fill cognitive gaps. While information sharing comments most directly contribute to the collective sensemaking of a crisis event, they also additionally represent venues of misinformation. Qualitatively looking through the comments revealed inaccurate comments claiming the explosion to be a part of the Ukrainian invasion, or causing thousands instead of hundreds of fatalities. Although TikTok users are capable of correcting false information by replying to inaccurate comments, these replies are by default collapsed and thus not viewable at first glance. The exception is if corrective comments are made by creators commenting on their own videos, as TikTok visually prioritizes their comments. However, the labor of correction cannot be solely dependent on human interaction. We saw the platform warnings of inaccurate information at the video-level when creators uploaded information regarding COVID-19. An examination is required to consider how TikTok can help combat misinformation at the comment-level.

**Examining ‘Other’ Comments**

It should be noted that the model performance of our ‘Other’ category was worse than the others. This was expected as there were many different kinds of messages in this category that were hard for BERT to categorize. A significant amount of these were humor oriented, which is a difficult category to capture with independent codes (Boxman-Shabbat & Shifman, 2014). Previous research has already examined the role humor plays in crisis communication (e.g., Kuipers, 2002). Although jokes and their critical ‘anti-joke’ replies were observed in the dataset, their frequency was not sufficient for classification. Additionally, the added complexity of multi-lingual humor being captured made sarcasm and humor detection difficult.

Creators who typically were not in the interest network of Lebanese/Greater Middle Eastern content and chose to share content about the disaster were generally met with gratitude, as seen in “Information Appreciation” comments. However, there was a double-edged sword as individuals from communities also facing some level of crisis criticized their selectivity. For example, comments like “What about the war in Syria?” or “Why are you not talking about the Uyghurs in China?” illustrate spurts of condemnation toward the creator. These “crisis comparison” comments were not pertinent enough to be classified individually and thus were included in “Other” comments.
Further research is needed to understand the role of both crisis comparison and joke/anti-joke comments in the collective sensemaking process of a crisis event.

CONCLUSION
This study contributes to the larger literature surrounding collective sensemaking by considering TikTok’s role in disseminating information about a non-Western crisis event. Using a mixed-method approach, we provide extensive discussion about the way in which crisis discourse functions on TikTok and the way audiences make sense of these crises. While our primary empirical work reported here is a quantitative content analysis, the discussion made heavy use of multimodal discourse on TikTok, considering visual data, audio, as well as text. In the future, we will develop a more systematic approach to studying the semiotic phenomena occurring between commentary and the videos themselves. We recognize the heaviess the explosion still has on the Lebanese people, and the dire economic and political situation the country is currently battling. To remember the lives lost as a result of the explosion, the martyrs are listed here: https://tinyurl.com/beirutmartyrs.

REFERENCES


Examining Social Media Policy and Records Management in Massachusetts Municipal Governments

Kriesberg, Adam  Simmons University, USA | adam.kriesberg@simmons.edu

ABSTRACT
This paper reports on an exploratory analysis of the social media policies of municipal governments in the Commonwealth of Massachusetts. With a strong Public Records law and language clearly indicating that social media posts are government records, Massachusetts provides a framing for research into municipal policy on social media use, retention, preservation, and access. Of the 351 municipalities in the Commonwealth, just 87 have publicly accessible Social Media policies. These policies indicate that municipal governments take their responsibilities around social media records management seriously, they do not offer many specifics around how they will engage directly with posts from privately-owned social media platforms. Implications of these findings suggest that the digital preservation community must continue to develop tools and methods to preserve social media records the support broader efforts around government transparency and accountability, as well as advocate for platforms to include features to support responsible public sector social media use.

KEYWORDS
Government records management, information policy, social media policy, digital preservation, social media archiving

INTRODUCTION
Governments have long faced challenges in information management brought about by changes in recordkeeping technology. Over the course of the 20th century and into the 21st, these challenges have primarily focused on the opportunities and affordances of the internet, and the new ways public sector institutions create, manage, disseminate, and preserve information for various constituencies. Governments at all levels and around the world have taken advantage of the emergence of social media platforms such as Facebook, Twitter, and Instagram to connect directly with constituents. The affordances of these platforms have made their use particularly valuable at the local level, where governments and public sector entities such as local fire departments, school systems, or offices of Public Works can get their message out directly to local constituencies that follow municipal accounts.

Much of the current research on social media preservation has focused on efforts undertaken by researchers and the US Federal Government. This paper extends the scope of these efforts by analyzing a group of government Social Media policies at the municipal level in Massachusetts and considering the records management and preservation implications of current social media management practice. The results of this study suggest that many city and town governments do not provide details on how they manage and retain social media records, nor do they maintain a social media policy articulating their use and terms of engagement with these platforms.

This paper is motivated by the following research questions:

- How do local governments manage and preserve social media records?
- What topics do social media policies for municipal governments in Massachusetts address, and what do they omit?
- How does state records management law affect records policy at the local level?

The remainder of this paper proceeds in five sections, beginning with a literature review examining social media use, management, and preservation in the public sector. Following an explanation of the methods used in this study are the results of an analysis of 351 municipal websites for cities and towns in Massachusetts. The discussion section considers the implications of these results, and a final conclusion suggests potential avenues for additional work to advance this avenue of research.

LITERATURE REVIEW
Social media platforms are used widely across many parts of contemporary society, including by governments around the world who take advantage of the affordances of these software environments to connect directly with citizens. The ways in which politicians and other government actors use social media has been the subject of numerous research studies (e.g. Kalsnes et al., 2017; Kavanaugh et al., 2012; McCammon, 2020; Netshakhuma, 2019), although preserving materials from these platforms has proven to be difficult (e.g. Breuer et al., 2020; Thomson & Kilbride, 2015). As dynamic digital environments resulting the creation of vast amounts of user-generated content as well as trace data, social media platforms continue to be of interest to scholars and other...
Archivists and digital preservation professionals have articulated the existential challenges of managing electronic records for decades. Margaret Hedstrom named electronic records as “one of the greatest challenges facing the profession” in 1991, as even then these materials were entrenched in many areas of society including (notably for this study) across the public sector (Hedstrom, 1991). Yet many of the issues raised in this article persist today. Social media records exemplify the current state of digital preservation challenges, as they are created on privately controlled platforms and hard to interpret outside of these contexts. Furthermore, they are not discrete records but rather living digital objects that can be simultaneously engaged with over time by platform users while being subject to records management laws and policies.

More recent research from the digital preservation and records management communities have pointed out some of the drawbacks of current records management practice in organizations. Duranti (2010) highlighted the inherent problems with a strategy employed by many organizations that “print and file” digital records or scan paper documents for retention in a repository. These approaches often result from a lack of clear, consistent policy and standards around digital records management. The “print and file” philosophy for electronic records management was widely utilized by the National Archives and Records Administration (NARA) from the 1980s through the 2000s, as electronic records became the single largest set of records produced by the federal government (Johnston et al., 2019). This has now largely been abandoned in favor of the capstone approach, which seeks to apply archival concepts of appraisal to target the collection of only those individuals in an agency who’s emails are understood to be more representative of the organization as a whole (Noonan, 2016).

Subsequent work from the records management community has explored other ways in which digital environments force information professionals to question some assumptions about how to manage electronic records (e.g. Kallberg, 2013; Lemieux, 2016; Seymour, 2017). The importance of public sector records management is reinforced by the idea that these materials have significant value and represent a unique opportunity for governments to ensure transparency and accountability in government (Shepherd, 2006).

Clifford Lynch issued a call to action for digital curation professionals around the unique challenges of managing digital records from algorithmically-driven social media platforms (Lynch, 2017). The role of APIs in extracting and preserving social media data is complex and forces the community to confront what custody of digital records means in a digital environment where “the record” remains on platform even though it is curated and described in a repository (Acker & Kriesberg, 2019). A series of business and policy decisions at Twitter have altered the ability for some academic researchers to use Twitter as a source of data for research (Ledford, 2023). Changes such as these would certainly have an impact on preservation efforts as well, should repositories be unable or unwilling to pay for API access.

The increasingly widespread use of social media records for research across disciplines has in turn led to more focus being paid to social media records by digital preservation practitioners. A number of prominent social media archiving projects have launched in recent years, beginning with the lauded but unsuccessful Twitter archive at the Library of Congress (Bruns & Weller, 2016; Fondren & Menard McCune, 2018; Zimmer, 2015). The social science repository Inter-University Center for Political and Social Research (ICPSR) has launched the “Social Media Data @ ICPSR) project, known as SOMAR, which seeks to preserve social media datasets used in academic research contexts (Hemphill et al., 2021, 2018). Other projects based in academic libraries, such as SocialFeedManager, have made innovative use of APIs to extract and preserve social media data (Littman et al., 2018; Social Feed Manager, 2018). Finally, the Documenting the Now project has been working on issues related to social media curation and preservation since it was launched in 2016. The project maintains a repository of curated Twitter datasets (Documenting the Now, 2017; Galarza, 2018; Kalt & Scott, 2020).

Techniques to archive and preserve social media content continue to spread throughout the digital curation community. While some advocate treating social media sites like other web pages and using web archiving tools (e.g. Anderson, 2020), others have examined the potential of social media data archiving software such as ArchiveSocial, Pagefreezer, and Smarsh (Borji et al., 2022). Borji and colleagues compared these three popular commercial tools that preserve social media and found that while each offer a range of features for archiving these dynamic records including automatically archiving posts, scheduling and keeping deleted records, and the provision of digital signatures (Borji et al., 2022). Without ongoing, direct comparison between these tools, the differences in their products will remain difficult to ascertain.

While formal efforts to curate and manage social media data continue to develop, governments have faced immediate needs stemming from records created on social media platforms for years. The end of the Obama
Administration saw the first time social media records were collected by the NARA with limited engagement data and incomplete documentation available for future users of the materials (Acker & Kriesberg, 2017). Following the departure of Donald Trump from office and the ban he received on Twitter, various archival efforts worked to collect and preserve tweets from his @realDonaldTrump account (Kriesberg & Acker, 2022). As members of Congress worked to track down these tweets among other Presidential records, the Archivist of the United States acknowledged that while NARA had collected some data from Twitter it could not ensure the completeness of its holdings (Ferriero, 2022). Amidst these conversations, the company ArchiveSocial has contracted with NARA to manage preservation and transfer of social media records of both the Obama and Trump administrations (Ingros, 2021). These examples illustrate the hurdles faced by US federal agencies seeking to preserve social media data and ensure its ongoing availability. At more local levels of government, such as those described in this paper, limited resources make this work that much more challenging for town clerks, records managers, and municipal archivists.

This paper contributes to the growing body of research on managing and preserving social media records, adding a focus on municipal governments as institutions which are legal obligated to keep track of records created on social platforms. While these organizations may not have the robust archives and digital preservation infrastructure of university repositories or federal agencies, they have clear mandates to directly engage with the challenges inherent in social media preservation. As illustrated in the next section, the Public Records Law and related policy in Massachusetts make it well-suited for a statewide analysis of social media management policy.

**Public Records Law in Massachusetts**

The legal definition of public records varies widely around the world and across levels of government. Within the United States, some states have been explicit in describing different media and commenting on their status within the existing records framework. In Massachusetts specifically, municipal records are regulated under the jurisdiction of the state’s Public Records Law and Municipal Records Retention Schedule. Current law defines a “public record” as “All books, papers, maps, photographs, recorded tapes, financial statements, statistical tabulations, or other documentary materials or data, regardless of physical form or characteristics, made or received by a governmental entity” (Galvin, 2022, p. 45). While additional language in the law reduces some expectations for towns with populations under 20,000 people, based on this definition government social media posts should be understood as public records and subject to relevant regulations related to retention and preservation.

In addition, the state’s Executive Office of Technology Services and Security maintains a “Social Media Legal Guidance Toolkit” containing specific guidance on municipal social media use. This document is full of interesting and meaningful steps municipalities can take to protect, preserve, and provide access to their social media information. Municipalities and other government entities are advised to create and/or update policies related to social media use. These can include Privacy Policies, Terms of Use for government websites, Accessibility Policies that acknowledges the use of social media platforms, and standalone policies for Social Media use and commenting. Each of these policies should identify the ways in which a government entity plans to use social media, how it complies with records law, and how it handles comments from other platform users. This toolkit provides clear and consistent guidance to government entities in Massachusetts seeking to use social media sites (Executive Office of Technology Services and Security, 2023). However, additional language in the toolkit reveals a lack of understanding of digital preservation techniques to apply to this complex records environment. After acknowledging that “while third party social media providers will most likely save your content for some period of time, they generally will not save it indefinitely,” the toolkit suggests taking periodic “snapshots” of content to meet Public Records Law obligations. This is not the only approach to social media records preservation, nor does it capture the unique features and types of user engagement that define each popular platform.

**METHODS**

This project examined the websites of 351 municipalities in Massachusetts to understand municipal use of and regulation around social media platforms. The list of cities and towns was derived from the Secretary of the Commonwealth’s website (Secretary of the Commonwealth of Massachusetts, n.d.), modified only to exclude municipalities which no longer exist (primarily due to annexation). Analysis was performed in Spring 2022 and reflects the publicly available information for each municipality available at that time.

From the working list of cities and towns, each local government website was searched and analyzed across a number of attributes. After determining if the municipality maintained an active social media presence on popular social media platforms (typically Facebook, Twitter, or Instagram), the next step involved searching and reading through the municipal website for a publicly-available Social Media Policy. While some policies were clearly linked through the site navigation or menus, other policies were more difficult to locate; these tended to be policies published as PDFs and linked to download from a webpage as opposed to a dedicated page on the website for the policy in question. Dates of adoption and any updates were noted, where present.
Each publicly available social media policy was further categorized across three characteristics of interest: whether the policy specifically references the Massachusetts Public Records law or another records management statute, whether the policy directly states that social media content should be retrievable by the public, and whether the policy specifies that a given municipal government has a commercial contract with a third-party social media digital archiving subscription-based service.

RESULTS
From the largest city in Massachusetts, Boston (pop. 675,647) to the smallest town, Gosnold (pop. 70), municipal governments across the commonwealth exhibit a broad range of approaches to social media use and policy. While relatively few municipalities in Massachusetts have publicly available social media policies, many municipalities maintain accounts on one or more social media platform. In total, 249 cities and towns had at least one social media account discoverable either through government websites or via Google search as of May 2022. This figure represents 71% of municipalities in the Commonwealth. Despite this, many of these local governments do not have publicly-available social media policies on their websites, as shown in Figure 1 below. Of the 351 municipalities in Massachusetts, only 87 (25%) have publicly-accessible policies which could be found on their city or town website. The policies with dates of adoption (n=76) included in their published form demonstrate that these policies were adopted between 2012-2021, coinciding with the rise in prominence of popular social media platforms like Facebook, Twitter, and Instagram. All of the 87 municipalities with social media policies use at least one platform, leaving 162 active on sites like Twitter and Facebook without publicly available policy outlining their use of these digital tools. These municipalities engage with citizens and post information about their communities but without the policy infrastructure recommended in the “Social Media Legal Guidance Toolkit.” As a result, it is not clear if, or how, these municipalities are managing social media records, and if they are in compliance with state Public Records Law.

Figure 1. Municipalities in Massachusetts with Social Media Policies

In terms of the analyzed attributes of these publicly available policies, a majority (72%) directly reference Massachusetts Public Records Law when defining the scope and mandate behind social media policy development. Only 18% of the policies examined in this project mention ongoing access to social media posts or digital preservation efforts being undertaken by the given city or town. These results are illustrated in Figure 2 below.
Of the 351 municipalities in Massachusetts, this project discovered just one website confirming that the town utilizes a third-party social media preservation and management service. The town of Westford (population 24,643), located approximately 30 miles northwest of Boston, employs a service called Pagefreezer to archive and provide access to Facebook and Twitter posts (Town of Westford, 2023). A screenshot of the town of Westford’s website, seen in Figure 3 below, illustrates how the community provides access to older posts from Facebook and Twitter accounts associated with the town government, Library, Fire Department, Police Department, and other municipal agencies. While the explanatory text does not mention Pagefreezer directly, each icon next to an account links to a hosted Pagefreezer page. Of all the cities and towns in Massachusetts, this was the only “Social Media Archiving” page which clearly indicated that a community made use of third party preservation services to fulfill their obligations under Massachusetts’ records law. If other communities use these services, they manage the records internally and refer to them as needed based on public records requests.

The 87 municipal social media policies vary in their approach to regulating social media use in municipal governments. Many policies directly acknowledge the fact that social media posts are considered public records under Massachusetts law, including Southborough whose policy states “Official Town Social media sites will contain communications sent to or received by Town employees or officials, and are thus considered Public Records...
under Massachusetts law. Department Heads shall retain a copy of all social media content in accordance with Public Records Retention Schedules” (Town of Southborough, 2018). The primary topics covered in the policies relate to other issues related to social media, such as the relationship of the municipal government to the platform’s Terms of Service, the approach taken to comments on government posts, content review of municipal posts, and the ways in which local governments understand the First Amendment as it applies to social media sites. These are all important questions that demand the attention of government officials actively using social media, but do not speak to the retention and preservation concerns that arise in the space between Public Records Law and social media management in practice.

Looking more closely at these Social Media policies, some patterns emerge upon comparison. A number of sentences and clauses appear in more than one policy, often related to records retention and access. For example, Lunenburg, Merrimac, Plainfield, Provincetown, Topsfield, Truro, Upton, and West Boylston specify that social media content “must be able to be managed, stored and retrieved…” under state records law (Town of Lunenburg, 2017; Town of Merrimac, 2017; Town of Plainfield, 2017; Town of Provincetown, 2018; Town of Topsfield, 2019; Town of Truro, 2018; Town of Upton, 2012; Town of West Boylston, 2012), further specifying that e-discovery law may apply as well, should the town government be party to a lawsuit in which social media posts play a role. Other shared language across policies in Boston and Rutland demonstrates the efforts of these municipalities to balance the context of the post while prioritizing access into the future, noting that social media records should be managed “in a format that preserves the integrity of the original record and is easily accessible…” (City of Boston, 2014; Town of Rutland, 2015). While both of these examples demonstrate the commitments of municipal governments to responsibly and legally managing social media records, they do not offer specific insight into how records will be maintained over the long term.

Other policies similarly articulate social media retention mandates but do not make it clear how they plan to maintain access to these records over time. The City of Cambridge’s Social Media Policy includes the following clause related to retention: “Any Content maintained in a Social Media format…may be a record subject to public disclosure….The department site administrator will maintain records in accordance with Massachusetts public records and record retention laws, rules, regulations, and policies” (City of Cambridge, 2013). What is absent from this clause is how these records will be maintained, whether using internal documentation, screenshots, third party apps, through reliance on the continued existence of the platforms themselves, or other means.

At least five municipalities (Fairhaven, Merrimac, Plainfield, Upton, West Boylston) incorporate language related to digital records retention for social media posts adapted from the Massachusetts Social Media Legal Guidance Toolkit (Executive Office of Technology Services and Security, 2023). The following text appears, with some variation, in the Social Media policies for these towns:

Note that while third party social media providers will most likely save your content for some period of time, they generally will not save it indefinitely. To the extent their policies are inconsistent with Public Records Retention Schedules, the Town or department should retain copies of social media posts such as by printing or otherwise storing periodic “snapshots” of the social media sites. (Town of Fairhaven, 2015; Town of Merrimac, 2017; Town of Plainfield, 2017; Town of Upton, 2012; Town of West Boylston, 2012)

This language is notable for a number of reasons. It suggests that these municipal governments have done their research when crafting local Social Media policies and consulted the advice and best practices made available at the state level. Given the potential legal risk for public sector institutions if they do not adhere to records retention schedules, this approach makes sense. However, the specific advice offered here reflects the challenging current state of social media digital preservation and a return to earlier eras of records management practice. Social media posts generated by governments are public records under the control of privately operated platforms. Their dynamic nature and unique embeddedness in networked platforms suggest a need for new approaches to digital preservation and archiving in these areas.

The publicly available social media policies from Massachusetts municipal governments show a set of public sector institutions grappling with the particulars of how to comply with public records laws in a rapidly evolving digital environment. The challenges for public sector entities operating on privately operated social platforms require that they improvise and employ whatever methods they can to meet their statutory obligations. Without clear procedures and policies from the platforms themselves defining their relationships to government agencies using their sites, these inconsistent approaches are likely to persist. Still, for the many municipalities in Massachusetts operating social media accounts without publicly available policies, taking smaller actions such as drafting and posting policies governing social media use could reduce risk, increase transparency, and set expectations for constituents and other users encountering government accounts online.
DISCUSSION
Municipalities use social media for the same reasons many private citizens, corporations, and other organizations engage on these platforms: to connect directly with followers and communicate via easily accessible channels. However, unlike other type of social media users, local governments are bound by public records laws to manage these records in ways which promote transparency, accessibility, and evidence of government activity. As the results in the previous section show, a majority of the local governments using social media in Massachusetts do not have policies governing their use which they share with constituents. This suggests that there is much work to be done in local government to meet their obligations under the law to manage social media records alongside other government records produced in the pursuit of a public mission, to inform citizen of government activities, and to engage directly with constituents.

How many municipalities in Massachusetts would be prepared to respond to a records request or inquiry under the Commonwealth’s Public Records Law? Based on the policies examined in this paper, some governments might struggle to locate social media content that is not still available on the platform in question or has not been screenshotted. Many social media sites including Twitter and Facebook allow users to download their data from the platform for local management or storage, however little evidence of this practice was seen in the available policies for Massachusetts municipal governments. Information on collecting data from Facebook, Twitter, and other platforms is more widely shared in the social science research community than in government, as multiple research methods books provide information on how to harvest data from social media sites (Flick, 2018; McCormick et al., 2017). This feature of social media platforms was absent from state guidance despite being a valuable, low-cost, and available option to extract some platform data and retain it in formats that municipal archives may be able to manage.

The official guidance from Massachusetts’ Executive Office of Technology Services and Security includes screenshotted as a potential method for preserving social media posts. While this may be a short-term strategy for retaining content from social media platforms, it represents a step backwards in terms of digital preservation practice, recalling Duranti’s (2010) critique of “print and file” as a records management strategy. Social media posts are complex digital objects; using screenshots to capture these records flattens them and fails to account for key features which make these platforms so distinct, including ongoing engagement information, embedded media, lists of followers, and the nature of the social feed itself.

While only one municipality (Westford) was found to share links to third party social media archiving content, more local governments across Massachusetts may be utilizing these services. For its part, ArchiveSocial maintains individual pages on its corporate website outlining the specifics of all 50 state records laws and identifying how its software can help organizations comply with these regulations. The emergence of software providers into this space has not been studied or examined by the archival or digital preservation community and should be the subject of future research into social media archiving. How do these companies work with platforms to preserve posts? How do they leverage API access and what records are they storing on computing infrastructure they control? A recent study by Borji et al. (2022) compared features directly from the public documentation ArchiveSocial, Pagefreezer and Smarsh share online (ArchiveSocial, 2023; Pagefreezer Software Inc, 2023; Smarsh, Inc, 2023). These three products remain among the most popular offering social media archiving services today, but changes to platforms are likely to result in ongoing changes to this nascent preservation services landscape.

The ongoing product and policy changes across social media platforms have the potential to significantly affect the ways in which local governments produce and manage records on social media platforms. One recent example, the changes made by Twitter to its API, may affect some preservation practices being employed by government or apps they use to comply with records laws (Benton, 2023; Fung, 2023; Ledford, 2023). These changes may affect the commercial social media archiving services as well, with both loss of functionality and increase in cost as potential outcomes of the latest round of updates by Twitter.

This study was exploratory in nature and focused on Massachusetts due to the public records legal infrastructure and bounded nature of municipalities in the state. While this narrow scope is a limitation of the project, future work can address this through broader examinations of social media records policy across the United State and internationally at different levels of government. An additional limitation of the present study is that it focused on standalone social media policies in Massachusetts municipal governments, not larger records management policies or schedules. The intention behind this was to focus on how governments directly addressed the challenges of managing social media records, and future work in this area should seek to understand social media records management as part of larger information management requirements for different levels of government.

CONCLUSION
This study examined the ways in which city and town governments in Massachusetts manage social media records, as illustrated by their publicly available social media policies. Few municipalities that use social media have such
policies, and those that do exist provide little specificity around how social media records are actually managed and retained. This situation represents a risk for these governments if they should be unable to fulfill a public records request, and it represents a further risk for the public as social media posts show what the government shares with citizens, when they share, and how other platform users interact with public sector content. If one of the popular social media platforms were to go dark, would municipal governments have access to backup copies of posts or would they be left, like the vast majority of users in such a hypothetical scenario, without any documentation or evidence of what they posted on the site, who replied, how many accounts followed theirs, and what the overall experience was like using one of these sites in an era where millions of eyeballs were pointed at robust social feeds?

Social media archiving is still in its infancy. While multiple stakeholder communities have interests in ensuring that social media records remain available into the future and can remain viable outside of the platforms on which they were created, few projects have demonstrated an ability to do this work at scale. The existence of third-party commercial software vendors developing software to address this problem and allow a variety of public and private sector organizations to comply with records and information management law speaks to the urgent need in information-intensive organizations for solutions to this challenge. Further work on this topic is needed to understand the shift in practice happening across the public sector for social media records.

The Public Records Law in Massachusetts contains clear, strong language mandating social media records be treated like any other government record. However, the dynamic nature of social media posts means that they resist digital preservation techniques that have become standard practice for static media such as digital photographs, PDFs, documents, or data files. Currently, records managers and archivists seeking to preserve social media posts have few options, each of which have their strengths and limitations. In the absence of widely accepted standards for social media digital preservation, municipalities are left to figure things out on their own, using screenshots, downloads, and potentially third-party services. Because state public records law requires social media to be retained, this will continue to be an issue until such standards emerge. While the current study was limited to Massachusetts, these challenges are not unique to one state, or even to government. A lack of social media preservation approaches is an ongoing concern for the digital preservation and archival communities, as well as for researchers in disciplines that may want to examine these materials in the future. The risks associated with losing access to social media records threaten to obscure our view of current events in the years to come, when historians will seek to analyze our times using all available records. If they disappear from the web, social media records will contribute to a digital dark age resulting from inconsistent web archiving practice that dates all the way back to the earliest days of the internet (Brand, 1999; Milligan, 2016).

As the social media landscape continues to shift along with the fortunes of the companies that develop and operate these platforms, digital preservationists, archivists, and records managers will need to stay informed about how social media records are created and stored. Practitioners working in these areas should seek to be a part of conversations about what archiving for social media should look like, and how records may be able to remain legible outside of their platforms of creation. As information professionals with an eye towards future use by people who have yet to be born, it is our job to articulate our perspective and push for mechanisms to preserve social media records so people in the future will be able to look back at the internet as it was and understand how vastly different types of users, from celebrities to small town Public Works Departments used these platforms.

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Sharing Qualitative Interview Data in Dialogue with Research Participants

Kvale, Live Håndlykken
University of Oslo, Norway | kvalel@ub.uio.no

Pharo, Nils
OsloMet- Oslo Metropolitan University, Norway | nilsp@oslomet.no

Darch, Peter
University of Illinois at Urbana-Champaign, USA | pdarch@illinois.edu

ABSTRACT
Research data sharing is embedded in policies, guidelines and requirements commonly promoted by research funding organizations that demand data to be “as open as possible, as closed as necessary” and FAIR. This paper discusses the challenges of balancing privacy protection with data sharing in a PhD project involving long-tail, small-sized qualitative human subjects’ data. Based on experiences and feedback from project participants, we argue that privacy protection is about respecting the participants and their self-image. This can be achieved through dialogue and involvement of the participants building on the principles of shared stewardship. Further, we suggest that de-identification and plain language consent materials are better at protecting privacy than anonymisation, which in a digital data environment is difficult to achieve and not necessarily a sensible approach for qualitative data, where the gold is in the details. The literature indicates that it matters to participants whether data are reused for research or other purposes, and that they trust the institutions. This supports our claim that research data services must find better solutions for restricted sharing when necessary.

KEYWORDS
Data Sharing, Research Ethics, Privacy, Qualitative Research, Research into Practice

INTRODUCTION
Open research data and sharing of research data is a key pillar of Open Science, promoting transparency and trust in scientific institutions and the advance of scientific research (UNESCO, 2021). Institutional and international policies for open science increasingly require datasets collected for the purpose of research to be made available “as open as possible, as closed as necessary” (European Commission, 2016), with the aspiration of making them FAIR (Findable, Accessible, Interoperable, and Reusable) (Wilkinson et al., 2016).

Researchers conducting human subjects’ research must abide by research ethics guidelines, national and international data legislation (Ursin & Bentzen, 2021), and by university and funding agency policies (The Norwegian National Research Ethics Committees, 2014). For instance, the Belmont Principles that govern human subjects’ research draw attention to 1) respecting human subjects, by use of informed consent and protecting privacy; 2) protecting research subjects from the risk of harm; and 3) addressing issues of justice (U.S. Department of Health, Education, and Welfare, 1979). However, each of these three imperatives is made more complicated by opening human subjects’ data: 1) human subjects may struggle to imagine how data about them could be used in new contexts, undermining their ability to give truly informed consent for reuse (Wilbanks, 2014); 2) their data could be combined with other available datasets to generate new insights about them that could be used for harmful purposes (Ohm, 2014); 3) marginalized groups of people may be more liable to harms from misuse of data about them (Carroll et al., 2020).

Balancing the realization of the benefits of Open Science with adherence to ethical and legal standards is a “problem of many hands,” that require action by many research data curation stakeholders and at all stages of the research lifecycle. Decisions taken early on in a research project have significant implications for subsequent possibilities for sharing and for privacy protection. For instance, researchers need to design and carry out data collection processes with sharing in mind, choosing metadata schema and creating documentation that will enhance reusability of the dataset, while carefully minimizing the data they collect to enhance privacy protections (Tibor, 2021, p. 54). However, little training currently exists for social science researchers about how to approach these topics effectively. Data management plans, increasingly required by funding agency, have the potential to help researchers in designing and carrying-out data collection, but only if requirements for these plans are well-formulated and effectively enforced. A third key group of stakeholders is research support service providers, for instance in university libraries and disciplinary data repositories, who can provide consultational and informational services, but who require training and resources to provide adequate support to researchers.

This paper builds on the first author’s PhD project, a study of 24 expert stakeholders involved in research data curation in Norway (L. Kvale, 2022), to explore the challenges in making social scientific human subjects’ data as open as possible while respecting study participants’ privacy. The study data were collected through a modified Delphi study, comprising interviews (n=48) and surveys (n=24). The first author aimed for these data to be made as open as possible in line with open science expectations from domestic science funding agencies (The Research

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Council of Norway, 2020), while working within domestic and international ethical and legal constraints, such as the European Union’s General Data Protection Regulation (GDPR) and Norway’s Personal Data Act and research ethical guidelines (GDPR, 2016; The Norwegian Personal Data Act, 2018; The Norwegian National Research Ethics Committees, 2014).

It is this tension we explore through addressing the following question:

**Can sharing of non-sensitive de-identified human subjects’ data be practiced while respecting the research participants’ right to privacy?**

Drawing from analysis of feedback from participants, we provide experienced-based recommendations for researchers and data management professionals to handle the difficulties involved in balancing opening data with respecting privacy. There is no one size fits all for translating policies for open science into research practice. The challenges researchers encounter when dealing with human subjects data, have until recently not been addressed in the literature on research data management. De-identification describes the removal of identifiers that are either linkable or directly identifiable. De-identified interview transcripts could have value for reuse for instance, in teaching research data curation to information management professionals, to facilitate future research in the area of scholarly communication, and historically as a documentation of strategies and decisions in the digitalisation of research, or simply for machine learning purposes.

Our study is relevant for research support service providers struggling to balance expectations and requirements of sharing with protection of privacy and research ethical norms, providing a case of how this can be solved. It is also relevant to researchers, in particular researchers conducting research in Europe or collaborating with researchers in a European context, as an example of an approach to how open sharing of interview transcripts and personal privacy is perceived amongst expert stakeholders of data sharing. We recognize that while general norms for privacy and research ethics have a global scope, they are perceived and implemented in quite different ways. Subsequently knowledge of these differences is crucial for international research collaborations.

**PREVIOUS RESEARCH**

Research participants’ attitudes towards open data sharing has not yet been explored extensively. A study based on interviews with qualitative researchers, Institutional Review Board members and data curators in the US revealed that researchers are the least knowledgeable and are often unfamiliar with the concept of sharing qualitative data in a repository (Mozersky, Walsh, et al., 2020). Several countries have traditions of sharing of qualitative data via restricted access repositories with different standards for de-identification. However following the argument of open science as a way to foster public trust in research (DuBois et al., 2018; UNESCO, 2021) it would benefit science to share more qualitative data openly with the consent of the research participants.

Current studies of data sharing and reuse explore restrictions on sharing and highlight how the type of reuse matters to research participants (Hardy et al., 2016; Mozersky, Parsons, et al., 2020; Shah et al., 2021). Mozersky, Parson and colleagues (2020) find that the majority of the research participants were positive to sharing of qualitative data given that the sharing and reuse is limited to research purposes and that their identity is concealed. Shah and colleagues find similar attitudes towards sharing and reuse of health data; the research context matters to the participants (Shah et al., 2021). Hardy and colleagues (2016), on the other hand, argue that sharing and reuse of the data collected would be unethical as the conditions for access to the participants were that certain issues would not be investigated even if the data could have provided the possibility. This is echoed by researchers expressing concerns that it would be unethical to share qualitative data collected in a relation of trust without an element of informed consent (DuBois et al., 2018). While researchers refer to the relation of trust between researchers and participants, the participants generally trust institutions rather than the individual researchers (Guillemin et al., 2018).

Within the scholarship of human computer interaction, privacy by design is used to describe how technology can be designed in compliance with privacy (Hoepman, 2021). This way of thinking privacy embedded in the methods and data collection is also useful when designing and conducting research projects. It does however require awareness of different perceptions of privacy. Gürses group privacy by design in three categories according to how privacy is understood: 1) hard privacy approaching privacy as confidentiality, 2) soft privacy addressing privacy as control, and 3) contextual privacy addressing privacy as a practise where negotiations of social boundaries are taking place (Gürses, 2014). Later privacy by compliance has been added, referring to how GDPR has led organizations to aim at compliance with the corresponding jurisdiction rather than providing individuals with control over their data (Fiebig et al., 2022). The conflict between GDPR and data sharing initiatives within health research has been adressed by Ursin and Bentzen (2021) who call for harmonization of data protections standards to allow global sharing of research data.
In qualitative research, member checking is sometimes used as a technique to validate results by either returning interview transcripts or analysis of the data to the participant for comments, corrections and verification (Creswell & Miller, 2000; Forbat & Henderson, 2005). Karhulathi (2022) propose using member-checking for sharing qualitative data, using co-curation as a term to describe how member-checking allows participants to edit transcripts as part of preparing them for open sharing. While there are studies on how participants approach transcripts when asked to review these for errors (Birt et al., 2016; Carlson, 2014; Forbat & Henderson, 2005), the authors are not familiar with literature addressing participants’ experience of member checking for publication. Also Huma and Joyce highlight the lack of expertise amongst researchers and ethical comities on how to proceed with sharing of qualitative data while safeguarding research participants (Huma & Joyce, 2022). A synonym for co-curation is shared stewardship, a concept drawing from studies of indigenous data sovereignty, that embodies the data subjects rights and interest in their material (First Archivist Circle, 2007; Leopold, 2019). Within research data management, indigenous communities have developed the CARE principles to address their interest and rights over data governance and reuse (Carroll et al., 2020), within which shared stewardship conceptually embeds the practice of shared control and governance.

METHOD

This paper describes the process of sharing data from a Delphi study, which is characterised by using experts on a particular topic as participants and collecting data in multiple rounds focusing on solving an issue or developing a policy (Ziglio, 1996). A Delphi study is designed to find agreements and common understandings amongst involved stakeholders. In a rapidly developing domain such as that of data sharing, the Delphi method offers a way of systematically collecting solution-oriented opinions. A Delphi study typically contain three sequential phases: 1) the exploration phase, 2) the evaluation phase, and 3) the concluding phase (Ziglio, 1996). In each phase data are collected and analyzed and the intermediate results are used in the development of the next phase of data collection.

Participants were drawn from four stakeholder groups involved in research data sharing: policymakers, infrastructure providers, research support staff, and researchers. 24 participants took part in the study, which makes it similar in size to other Delphi studies in library and information studies (Lund, 2020).

The data collection took place in three phases (Figure 1), where the first and last phase involved conducting interviews (n=48.) First phase interviews were about one hour long, while last phase interviews lasted approximately 30 minutes. At the recruitment stage, participants were informed of plans to make interviews openly-available in a public repository. The interviews were transcribed by the first author, yielding 313 pages of transcripts. During transcription, the first author de-identified participants by removing directly identifiable information such as names and workplace. Nevertheless, most of the participants remained identifiable as they in many cases represent the only domain expert with their background and experience. Transcripts were sent back to the participants for verification, and participants were also asked to mark sequences of the interview they did not want openly shared (Birt et al., 2016). These sequences were included in data analysis but removed from the published transcripts, extra care have been taken to conceal the participants identity where quotes from marked sequences are included in this and other publications from the study.

![Figure 1. The research design (L. Kvale & Pharo, 2021)](image)
Following interviews, participants were given the opportunity to indicate their consent for sharing their data openly. Feedback on a draft version of the consent form given to participants was solicited from the Norwegian National Privacy Advisors’ Services (NSD/SIKT) which had no objections or comments on the form. In this consent form, the participants were also asked how they felt about participating in the study (L. Kvale, 2021). 21 participants granted permission to share all or parts of their data, while three participants did not respond to the consent form so their data were not shared.

The aim of sharing de-identified data and the review of transcripts were discussed with the participants multiple times throughout the study, and multiple participants expressed interest in, and opinions on, these topics. Initially, the plan was to anonymize the data. As the first round of interviews were transcribed, it became evident that the data could not be anonymized, even with directly identifiable information removed. Information about stakeholders’ roles, selection criteria, and participants’ expressed opinions and experience made it likely that some participants could be identified readily. When reading the transcripts, the first author could recognize participants based on their language and metaphors or by descriptions of their work with research data.

True anonymity is difficult to achieve, and may not always be the most appropriate approach for privacy protection; instead, an approach that focuses on what needs to be protected and how context shapes human subjects’ privacy expectations is preferred (Barocas & Nissenbaum, 2014). The first author followed this approach by informing participants about the aim to share data in an open repository, and allowing them to review their data and select what to share openly.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Experience as participant</td>
<td>Referring to own experience as research subject.</td>
</tr>
<tr>
<td>Reflections</td>
<td>Sharing of thoughts or reflections on the method used in the project.</td>
</tr>
<tr>
<td>My data sharing</td>
<td>Thoughts or experiences with the data sharing in the project.</td>
</tr>
</tbody>
</table>

Table 1. Examples of methods related qualitative codes used in the analysis of the interviews

This paper builds on the discussions of methods in the first author’s PhD thesis (L. Kvale, 2022). The findings are derived from different parts of the study including the interviews, material retracted from sharing in the interview transcripts, the first author’s notes taken after each interview, and comments provided by the participants in the consent form for data sharing. This material has been structured and analysed qualitatively by exploratory thematic coding (Saldaña, 2016) during the first three phases of the study (Figure 1.), followed by thematic grouping (S. Kvale, 2007) and meaning synthetization as part of the integrated analysis (Creswell & Plano Clark, 2018) after data collection was completed (Figure 1, phase 4).

In the paper, quotes from each participant have been assigned one of the following pseudonyms, suggested as gender-neutral by Google: Andrea, Leigh, Ashley, Frankie, Jackie, Parker, Sam, Linden, Bobby, Chris, Dylan. In some cases, pseudonyms have been associated with professional roles; in other cases, they have not where the risk of reidentification was judged to be too high.

FINDINGS
The findings raise awareness about how different research participants experience issues related to privacy in diverse ways, and how researchers need to address these differences as part of privacy protection and ethical considerations regarding data sharing. We have categorised our findings into two parts: 1) how participants control their self-presentation through reviewing the de-identified data, and 2) how the participants experience data sharing.

Control over self-presentation by reviewing de-identified data
When reviewing their transcript, each participant could select parts of the interview that were not to be published in the open dataset. Analysis of what participants requested removed from the transcripts before publishing show two tendencies, concealments of a) relational conflicts, or b) personal identity.

Concealments of relational conflicts or criticism of organisations
Participants requesting removal of text containing descriptions of conflicts in collaborations or criticisms of their own organisations. For instance:

“We collaborate with [other research support services at the university] and there are different cultures, different attitudes towards different things, and when there is a need for distribution of responsibility it is typically different perspectives on who should do what and who should be responsible for what. So, this can occasionally be quite demanding.” (Leigh, research support)
The quote from Leigh refers to the challenges of collaborating with other research support services in the university, a challenge echoed by several other interviewees. However, this participant did not want others to know they had discussed these challenges due to concerns it could negatively affect an existing collaboration.

Two other interviewees, Ashley and Frankie, requested removal of text that could be perceived as damaging to their own, fragile organizations, as illustrated here:

“Right now, we are just trying to promote our self and our services, we are in a situation where we need to make sure we as organisation are still relevant”. (Ashley)

“I would ask you to be quiet about these things for a while as I do not yet know to what extend this is public knowledge” (Frankie)

Both quotations describe organizations in limbo, discussing dilemmas in making their services relevant to users and describing changes that are not yet formalized. Frankie’s quotation could reflect negatively on them for speaking out of turn by revealing confidential details about their organization, while Ashley expressed concerns about publicly underestimating the value of their organization in a competitive environment.

These three quotes describe different types of tensions in the organizations where the participants work. Removing these details from the published data obscures part of the tension within organizations regarding directions and responsibility for data management services and tools. In all three quotes the participants opened up to the interviewer and shared their thoughts in confidence, based on trust between the interviewer and interviewee. This closeness places an ethical responsibility on the interviewer, which is fulfilled by sharing these quotes with as little concealment of personal identity

The second tendency was several participants’ requests to hide their identity further by removal of specific information regarding their work. This tendency included terms such as, “university library,” “data curation,” and “language researcher.” The possibility of identification was something the participants showed understanding of, as the researcher Andrea points out:

“If people know that you came to this institute for an interview with people who created a DMP, people who know that I am here on a fellowship, they will find out that these are my answers. But others will not know it.” (Andrea, researcher)

Jackie, a high-profile researcher, removed multiple details about their research practice that could make them easily identifiable. Still, enough details remain for someone with close knowledge of the domain to potentially identify Jackie.

Parker, another researcher, revealed a reluctance to comply with privacy requirements at an earlier point in their research career (L. Kvale & Darch, 2022). Revealing Parker’s identity could potentially cause harm to their reputation as researcher. Parker requested many of the details which could identify their identity to be removed from the transcripts. A combination of details reported in published articles, combined with the information retained in the transcript, could, however, still make Parker identifiable. The text Parker removed, along with dialogue with the first author, indicated that Parker did not wish to be identified in the open dataset. In this case, the first author decided not to publish the interview transcripts at all, despite Parker’s consent to publication, to protect Parker’s dignity and integrity.

In the published transcripts, several other study participants are likely to be identifiable by someone with knowledge of their research. Further, knowledge of selection criteria for study participants, as described in existing publications(L. H. Kvale, 2022), could also contribute toward identification of participants.

Participants’ experiences of sharing de-identified data

During the final round of interviews, several participants shared their opinions about their experiences of reviewing their first round interview transcripts and sharing their data. These opinions were noted in the first author’s interview notes. This section first addresses how participants described the experience of reading their transcripts before considering participants’ and perceptions relating to sharing the study data. Participants diverged in how they experienced the process of making their data open. Some expressed that reviewing their own words made them feel vulnerable, while others appreciated the possibility to review transcripts. 13 participants did not remove any text but consented to publishing the transcript in full.

Personal emotional experiences

Having one’s conversation laid out in text gives a sensation of exposure. One participant, Linden, mentioned how they felt “so stupid” when reading their incomplete sentences. In her notes, the first author describes being surprised about Linden’s reaction:
“I was surprised that Linden, of high status, position and with extensive research background experienced [reading their transcript] so harshly. I assumed that my participants are all aware of being intelligent, still reading themself on paper is experienced by Linden so brutally. Linden described a real emotional breakdown at ‘sounding so incoherent.’” (notes from interview with Linden, policymaker)

This sentiment was echoed in several second-round interviews:

“After the interview, they talk about the discomfort of reading themself orally on paper, with lines of reasoning with no clear start or ending” (notes from interview with Sam, researcher)

Other participants highlighted the burdensome workload of reviewing their transcripts, including the time taken correcting grammatical errors and understanding sentence fragments. One of the researchers suggested that more elaboration of the text in the transcripts would have been useful to increase readability of the interview transcripts:

“One recommendation for later projects is to modify transcripts so that they consist of complete sentences; this would not reduce the truth content in the reporting… and would probably increase the understanding and ensure more unambiguous interpretation.” (Sam, researcher) ([author], 2022 p 90)

In this case the transcripts were verbatim, including filler words, false starts, incomplete phrases and off-topic comments. Editing the transcripts so that each sentence had a start and an end would increase readability for the participants when going through the text.

Chris points to how the review of transcripts is overwhelming for a research participant:

“As participants we can all say: now this is getting too demanding. That is a right the participant has, and in that way all informants have absolute security. But on the other side take qualitative methods and informants, if every quote has to be approved by the informant. Then the informant is interfering with the analysis in a way that would interfere with the research quality. So, something will have to rely on trust to the researchers understanding of the issues explored, and I don’t think it has to be that difficult” (Chris, Researcher)

Chris was themself considering dropping out of the study as they perceived the workload in participating high, at the same time as they did not consider themself an expert. Both one of the policymakers, Billie, and researcher Criss address how privacy protection and mutual trust is important in regard to requirement of participants. This trust also entails the protection from unwanted negative consequences, when participants express uncertainty or feel they don’t really have reflected enough on a topic. In a broad yet specialised topic such as data sharing, inducing the voice of multiple stakeholders were important to include the opinions of researchers “who do not think of data management plans 24/7” (Parker).

Context related emotions

The research support staff Bobby and Dylan described feeling hesitant about publishing their transcripts, Bobby points to how research as context makes them think differently about their statements. Awareness of how their statements are part of a dataset to be coded, analysed and discussed in publications makes Bobby more sceptical to sharing the transcripts in full. They again find this experience useful in their work with data management services. For some, this was their first hands-on encounter with qualitative research, and expressed that their experiences as research participant would making them more cautious in advising anonymisation as strategy for researchers to share qualitative interview data in the future. The self-image the research participants felt embedded in interviews as research data, also increased awareness on the importance of consent and dialogue with participants around sharing for ethical reasons. It also provided awareness on the relation of mutual trust between researcher and participant, by first-hand experience. This was shared by research support staff both in the context of the second interview and elaborated on in the consent form for data sharing:

“And this was quite an interesting experience for my own sake, when I went through the interview and thought – do I stand for this? Do I want this removed?” (quote from the interview with Bobby, research support staff)

“Dylan also shared thoughts of why they might not want to share the transcripts. The fact that they make several claims regarding issues they might not know that much about, things that come up in the conversations but which they haven’t actually reflected on.” (Notes from interview with Dylan, research support staff)

“It is interesting to be in the information position and relate to one’s own statements. Even if the information I have provided is in no way sensitive or provoking, I feel some hesitation in accepting publication of the interview material, even in de-identified form. This is interesting and will be a useful experience to carry along with in the work with support services for those working with qualitative data”. (comment in the consent form from Bobby, research support staff) (L. Kvale, 2022, p. 91).
Bobby also addresses how they experience contextual differences from expressing something in their private sphere, awareness of the data being qualitatively analysed and deiminated in publications makes them hesitant about publishing the transcripts in full. For Bobby the control of what information to share in which context is a central part of their privacy perception:

“When we discussed anonymizing and sharing the research data, as soon as you are an embedded part of the analyzed material, in a way you get categories to yourself, then I feel much more skepticism toward getting this published. Even if I could have said many of the same things in my private Facebook account or in presentation, but something about being part of a study makes it different.” (Bobby, research support)

Elliott addresses how the experience of being a research participant provided a new perspective on data sharing:

“Interesting theme and interesting question, which initiated reflections and ideas. Considering my work, participating in the study felt relevant and useful.” (Elliott, research support)

This aspect of participating in a research study was shared also Bobby and Dylan who like Elliott work in research support services advising researchers on data sharing as part of their job. Sitting in the research participant chair made them more aware of how sharing is perceived from the participant’s side of the table. As research support services, research participants are not part of their sphere, still they are likely to advice researchers on how to best balance privacy and data sharing in research.

DISCUSSION

To live up to the ideals of Open Science and at the same time securing research participants’ privacy and integrity is challenging when data are collected using qualitative interviews (de Koning et al., 2019; Mozersky, Parsons, et al., 2020). We find that anonymization of interviews within a small community of domain experts would require the removal of significant amounts of useful contextual information, in addition to modifications of expressions that make individuals identifiable. For qualitative data this approach could easily ruin the data quality and hence the value of the shared data.

Removing context and details in qualitative data is likely to lower the quality of the data shared for future qualitative analysis. We have studied stakeholders involved in data sharing curation and demonstrated how removing details about their practices has revealed the complexity of creating anonymous qualitative data. Anonymizing data is often presented to qualitative researchers as an option for making it possible to archive and share qualitative data openly (Huma & Joyce, 2022; Mozersky, Parsons, et al., 2020), this was not perceived as a realistic possibility in this material.

Anonymous data can be shared without conflicting with the GRDP requirements. Still research ethical requirements for research on human subjects would apply (The Norwegian National Research Ethics Committees, 2014). Scholars have previously argued that sharing of human subjects data from health research is not compliant with GDPR (Ursin & Bentzen, 2021). Analysis of the interviews from the current project made it clear that identification of participants would be possible even if directly identifiable information such as names and affiliation were de-identified.

The debate regarding anonymity shows that it is hard to achieve, and not always the appropriate approach to privacy (Barocas & Nissenbaum, 2014). Gürses identifies multiple different approaches to privacy (Gurses, 2014), highlighting how privacy are different things to different people, and that GDPR has introduced a compliance approach to privacy which does not aim at providing individuals with control of their data (Fiebig et al., 2022). According to Nissenbaum and Barocas, it is important to discuss what privacy is protecting, and the context in which human subjects data are managed, rather than focusing on finding solutions to ensure anonymity. Our study shows it is possible to re-identify research participants in qualitative interviews, either by close knowledge of the domain investigated or by access to additional data. As qualitative researchers we continuously strive to balance details with confidence. Open sharing in a repository while guaranteeing participants anonymity in the interview transcripts is often not possible. Therefore, the first author pursued a different strategy of consent through dialogue and review of the data with each participant building on the principles of privacy in context (Nissenbaum, 2010).

To balance sharing and privacy without focusing on anonymity, the first author selected a strategy of informing participants and allowing them to review and select what to share. This, we believe, is a fruitful way in reaching the goal of making research data “as open as possible, as closed as necessary”. Member-checking and the relation between researchers and participants can be used as an asset to achieve data sharing (Karhulahti, 2022) and enable shared stewardship. It does, however, raise some new challenges. The findings show that reviewing transcripts is not as straightforward as it can appear, further the removal of elements in the text can affect adepts’ attempts at reanalysing the material, and, finally, the usage of context and quotes in publications can come in conflict with aims at protecting the participants identity.
Soundness, transparency and accessibility are important Open Science principles, but, as we have shown, they are not easy to support in qualitative research (Huma & Joyce, 2022). Huma and Joyce argue that the contextual dependency of qualitative data “warrants a rethink of whether and how such data can ever be reused in secondary analyses” (Huma & Joyce, 2022). We will, on the other hand, argue that transparency with respect to how conclusions have been made is important and that secondary use of data might be of a different nature. Omitting details from the interview transcripts weaken the data quality and affects potential re-analysis of the material. Transparency may be strengthened by indicating where text is removed. We recommend that the researchers review the request for omitting text carefully and expand on what is omitted where necessary.

The time and context of qualitative interview data may also be relevant, so that issues that are considered sensitive may change over time. Qualitative interview data may thus be released at a later date. On the other hand, data may also become more sensitive with time so that researchers’ knowledge of the context and ethical training is essential for evaluating what is the correct approach (de Koning et al., 2019). Un-sharing published data is difficult, caution from the researchers side is therefore essential to maintain participants trust and willingness to participate in research.

How research participants experience sharing their data is important. The vulnerability participants felt when reading their own transcripts is relevant for personal privacy and integrity. Making participants “feel stupid” is a negative consequence, which, according to general research ethical norms should be avoided. In this study participants were resourceful adults and experts on research data sharing, we therefore considered the study to be conducted in an ethical and responsible way. In contexts including vulnerable participants we would not recommend the reviewing of complete transcripts as a strategy to share data openly, neither would we recommend it for transcripts where potential sensitive issues are investigated.

Some participants in our study emphasize the workload of reading and deciding on what to share in the transcripts. The literature on member-checking also address the presumption that participants have time and capacity to read through the transcribed text (Carlson, 2014). To reduce the workload and exposure transcribing with complete sentences is one option. An alternative is to write extensive summaries of each interview for participants to verify and share as open data, while the complete transcripts remain closed.

Qualitative interview data have the qualities of observational data and are unique and irreproducible and thus valuable data to keep (Borgman, 2015). Their potential future value include historical research and longitudinal studies documenting changes in societies. The general hesitance multiple participants express towards data sharing illustrate that the ideal “as open as possible and as closed as necessary” in the context of qualitative interview data is not easily fulfilled, but require options for restricted access sharing. Because how and what data are used matters to research participants (Hardy et al., 2016; Shah et al., 2021), we call for broader exploration of qualitative data sharing with predefined purposes. Involving research participants in a dialogue on how to share data require extra work from both researchers and participants, but may be of great value to the research community as well as society, in general. Within archival studies, shared stewardship is used as a concept to describe involvement and dialogue with the population from who the material originates (First Archivist Circle, 2007). Applying this concept to research data management can contribute to the acknowledgement of the participants as stakeholder. Shared stewardship would call for dialogue with and involvement of participants in research, and would help researchers arrive at the right approach to privacy in each project. We therefore recommend further studies on shared stewardship and sharing of human subjects data which includes the view of research participants.

For sharing qualitative human subjects data, it is necessary for research data services to provide guidance for researchers on how to balance sharing of data with respect for the participants. While clear and explicit consent for data sharing makes open sharing of human subjects’ research data possible (The Research Council of Norway, 2021), each case will require individual assessments of what is ethical.

CONCLUSION

Identification and self-image are two different aspects of research participants’ privacy. Identification often receives more attention but protecting the participants’ self-image is equally or possibly more important to research participants. Our findings show how anonymisation can be impossible to achieve in interview transcripts, without losing value. Anonymising participants is particularly difficult when conducting qualitative research within a small community (Haugen & Skilbrei, 2021). Rather, protection of participants’ privacy can be achieved through protection of their self-image. This corresponds with the fundamental ethical guidelines for research to respect the people who participate in research, and further that “researchers shall seek to ensure that their activities produce good consequences and that any adverse consequences are within the limits of acceptability” (The Norwegian National Research Ethics Committees, 2014).
The exposure participants felt when reading their own transcripts is an important addition to the debate of personal privacy from a research data management perspective, leading to the question of whether there can be too much sharing and too much transparency? We argue that transparency and dialogue with the participants is important both for privacy protection and research quality. However, dialogue involves listening to the participants’ wishes and adapting to their requests. Shared stewardship is a concept from archive sciences embodying the participants’ rights and interest in their own material, and ensuring shared stewardship is relevant to research data sharing. The research data sharing community could by learning from indigenous communities by using shared stewardship to empower the data subjects.

De-identification and plain language consent forms are better strategies for protecting privacy than anonymisation, which is increasingly difficult to achieve. Protection of self-image and “good consequence” (The Norwegian National Research Ethics Committees, 2014) according to general research ethical guidelines, are important perspectives in research data sharing. However, open data sharing exposes human subjects to further risks as their data is available to all members of society, for whom ethical norms of the research community may not apply. Therefore, data sharing services should address the sharing of human subjects’ data with care, and set their own ideals of openness aside when necessary. By sharing experiences gained in the sharing of qualitative human subjects’ research data, we wish to illustrate how there is not a one-size-fits-all solution for privacy protection, but rather a need for a respectful and reflective dialogue.

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Welding Instructors’ Perspectives on Using AI Technology in Welding Training

Lassiter, Tina
University of Texas at Austin, USA | tinablissiter@utexas.edu

Collier, Chelsea
University of Texas at Austin, USA | chelseacollier@utexas.edu

Fleischmann, Kenneth R.
University of Texas at Austin, USA | kfleisch@ischool.utexas.edu

Greenberg, Sherri R.
University of Texas at Austin, USA | srgreenberg@ austin.utexas.edu

ABSTRACT
The welding industry in the U.S. faces a serious shortage of skilled welders. The goal of this paper is to explore welding instructors’ attitudes toward applications of Augmented Reality (AR) and Virtual Reality (VR) as well as artificial intelligence (AI) in welding training. Such approaches could allow future welders to acquire welding skills faster and in a safer work environment. Also, the welding industry could attract a more diverse group of workers. This paper builds on previous literature and studies researching the use of AR, VR, and AI in welding and in other comparable industries. The paper reports findings from interviews with eight welding instructors at a community college to obtain insights regarding how they believe AR, VR, and AI could be used in welding training. The paper provides implications for using AR, VR, and AI to attract and retain the next generation of welders.

KEYWORDS
User-centered design, Welding technology, Smart hand tools, Qualitative field research, Thematic analysis

INTRODUCTION
One of the challenges to revitalizing the manufacturing sector in the U.S. is that the U.S. is currently experiencing a serious shortage of welders (Akundi et al., 2022; American Welding Society, 2021; Chan et al., 2022; Ipsita et al., 2022). Welding plays a vital economic and societal role, as it is critical for constructing buildings, manufacturing vehicles, and transmitting energy (Kah & Martikainen, 2012). Welding is costly (Akundi et al., 2022; Chakradhar et al., 2022; Chan et al., 2022), dangerous, and presents potential health risks (Hill et al., 2022). Also, there are not enough new welders to replace welders who retire or leave the profession (U.S. Bureau of Labor Statistics, 2022).

Increasing automation threatens to eliminate jobs for skilled trade workers (Holm & Lorenz, 2022). Concerns about new technologies replacing skilled trade workers go back to the 18th Century (Pynchon, 2014). In the 1930s, John Maynard Keynes popularized the term “technological unemployment”, meaning “unemployment due to our discovery of means of economizing the use of labor outrunning the pace at which we can find new uses of labor” (Keynes, 1930, p. 3). This term is now often used to describe the effects of automation on the job market (Holm & Lorenz, 2022; Howcroft & Taylor, 2022). Many economists and technologists believe that the prospect that artificial intelligence (AI) might displace human workers could have serious consequences for the socio-economic landscape (Deranty & Corbin, 2022; Tyson & Zysman, 2022).

The aim of our research is to suggest ways to recruit and retain more welders with the help of AI instead of replacing them through automation. Through our study, we would like to explore how AI could potentially improve welding training to augment welding skills, and make the training more attractive, safer, and accessible. We seek to add to the current literature on the use of AI in welding by combining previous research with insights from welding instructors to propose a more comprehensive approach. By including the voices of welding instructors (most of them welders with extensive experience), we hope to provide deeper insights into the field and find possible solutions that incorporate the needs of current and future welders. A combination of different approaches and the use of AI may allow a larger group of potential workers to enter the welding trade (including those with accessibility issues), and would also make them more likely to remain on the job due to a safer and healthier work environment and improved job satisfaction (Hill et al., 2022).

In this paper, we first review the relevant literatures on welding training, the use of Augmented Reality (AR) and Virtual Reality (VR) in welding training, and the use of AI in welding training. Next, we share the results of an exploratory interview study conducted with eight welding instructors at a local community college in 2022. We found that the welding instructors we interviewed were overall very open to using AI technology in welding training, and they had many creative ideas about ways AI could assist students in their training. Through our study, we explore welding teaching methods currently used by the instructors, how AR and VR could be used in training in general and in welding training in particular, and how other AI technology could be helpful for welding training. Based on the findings of this research, we suggest that further research should explore how AI can be leveraged to improve training for welders and perhaps other skilled trade workers.
**BACKGROUND**

**Welding training**

Welding is part of the vocational training at community colleges. Welding training is a combination of teaching practical welding skills and soft skills. Good technical skills are the basis for being a good welder. Good technical skills alone, however, do not guarantee success. For example, Gauthier (2020) convened a focus group of ten engineering and manufacturing employers to understand what skills and knowledge they view as critical for community college welding programs to impart. Based on the perspectives provided by employers, Gauthier concludes that social competency is viewed as critical by employers, including communication, teamwork, and ethics. Similarly, Hora et al. (2018) mention welding as an example of where an apprenticeship could provide useful additional teaching including “how professional welders talk with clients, interact with other welders, and troubleshoot welding problems” (p. 35) and thus learning ways of “reasoning, communicating, interacting, and being” (p. 35). These examples demonstrate the need for skills outside the technical welding skills. As welding apprenticeships are not common in the United States, vocational training often includes these kinds of soft skills in the teaching at vocational teaching facilities like a community college.

**AR/VR training**

There is a large body of literature on how AR and VR can improve vocational training in general, including industries like assembly, automobile, engineering, or maintenance (see Chiang et al., 2022). Several previous studies have, in particular, researched how welding training could be advanced through the introduction of AR or VR (Agrawal & Pillai, 2020; Akundi et al., 2022; Chan et al., 2022; Devagiri et al., 2022; Ipsita et al., 2022; Papakostas et al., 2022). The detailed and very technical literature review of Devagiri et al. (2022) describes different AR techniques and models to demonstrate how AR and VR could be used in various industries. Chen et al. (2022) conducted an extensive literature review of papers related to AR and VR used in vocational welding training of welders to improve psychomotor skills. Their article is a valuable resource to provide instructors with AR/VR tool choices and methods used in vocational training and hopefully improve future interventions using AR and VR. As the authors illustrated, this might serve as a model for other industries.

Experiments with AR/VR in welding demonstrate that approaches using AR and/or VR can improve welding results (Akundi et al., 2022, Shankhwar et al., 2022, Stone et al., 2011). A welding study conducted with high school students in India demonstrated that the introduction of AR in welding training was beneficial (Agrawal & Pillai, 2020). As a result of the project, high school students learned through a mobile AR welding application in a safe and accessible way. Following testing in three schools, experts found the results promising. In another experimental study, researchers administered skills tests to two groups of Mechanical Engineering students after they completed training in either traditional welding or a combination of AR and traditional welding (Akundi et al., 2022). One group received three training sessions with traditional welding methods; the other group received three sessions with AR and then traditional welding. The class with AR welding training achieved significantly better results; the training was less costly, and the enrollment for classes increased because of the safer environment due to the use of the technology. The improved results could, however, also be due to the group receiving additional instruction time by adding AR training to the traditional training. Papakostas et al. (2022) conducted a separate study, exploring user acceptance of an AR welding simulator by using the Technology Acceptance Model (TAM), which questioned 200 trainees about their use of the AR welding simulator system for engineers. The trainees thought the AR training was useful. In another extensive study, the researchers designed a VR learning system, the VRWeldLearner, to provide an easy to use and low-cost way “to transfer skills to the real-world environment” (Ipsita et al., 2022, p.2). This user study that included 24 participants demonstrated that the approach was successful. The researchers recommend using the system for welding novices and in non-welding environments to “promote interest and welding education for choosing the trade as a career choice” (Ipsita et al., 2022, p. 19).

A particularly creative study experimented with a robotic arm that gave haptic force feedback to the participant while welding in a virtual environment (Ye et al., 2023). This approach was unique but may have additional cost implications, as robotic arms are quite expensive at present. A pilot study in Japan involved the development of a wearable device that provided tactile feedback through vibration. This information supplemented the virtual training (Chikai et al., 2020). However, the study involved to only three participants and is thus very limited. To date, the program has not been tested with a larger population.

Another study involving agriculture students led to less promising results (Wells & Miller, 2020). Participants completed a training session with either traditional welding or a mix of traditional and AR welding training. Results showed there were no significant differences between welds produced with AR training and without, but the authors of the study believed that their study should be replicated (Wells & Miller, 2020, p. 166). Over 70% of the participants had previous welding experience and the training session was less than one hour which might have diminished the validity of the results.
AI Technology
Besides AR/VR applications, Deranty and Corbin (2022) found that the use of AI through sensors could decrease training time, increase the quality of work, and make the job environment safer and more accessible (see Deranty & Corbin, 2022). Sensor technology exists in various forms (Wang et al., 2020). Few studies, however, have researched how such technologies can improve welding training and/or address health and safety as well as accessibility concerns associated with welding.

Quality of Work
One of the studies that researched how AI may improve the quality of welding training through sensors is a study where sensors measured wrist-hand motion skills and showed that focusing on these movements can improve the quality of the welds and could be used in welding training with success (Pribadi & Shinoda, 2022). An interesting new study uses welding tools augmented with a multisensory user interface. These tools use extended reality in welding training to provide real-time feedback without needing the constant supervision of a welding instructor. The study produced successful results, although it pointed out that so far it has only limited applications (Lee et al., 2023).

Safety and Health
Hill et al. (2022) demonstrate that different dangers in trades such as welding can cause occupational hazards and lead to health problems which should be addressed. Currently, only a few studies have directly researched the use of AI to address safety and health concerns in the welding industry and welding training. Studies that do examine how AI could address safety and health issues, often relate to other professional areas, such as construction and rarely reference training (Nath et al., 2017, Yang et al., 2020).

Yang et al. (2020) suggested that the construction industry could ensure proper protection of workers through the use of AI by applying sensors to Personal Protective Equipment (PPE) and connecting these sensors to hand tools (Yang et al., 2020). The paper introduces an automated PPE-tool-checking system prototype that would send signals like sound and vibration to the tool and also apply an emergency stop. Such an approach warrants further review and could apply to welding training.

Nath et al. (2017) demonstrated how the construction industry can use wearable mobile sensors to identify ergonomic risks for construction workers (Nath et al., 2017). They do not connect their proposed method to the use of smart hand tools (tools that use embedded sensors, edge intelligence, and the Internet of Things). The ideas presented in the article, however, could serve as an inspiration to develop smart hand tools that can alert workers to ergonomic risks, and thus, try to mitigate work-related injuries. As Nath et al. suggest, this can serve as a raw model for other occupations that are prone to work-related ergonomic risks because of awkward positions. Using a welding torch can also cause specific strains and injuries, so this approach could also benefit welders.

Ideas from other industries include predicting tool wear, e.g. of a milling tool (He et al., 2022) or a cutting tool (Korkmaz et al., 2022), to notice when a tool is not in good condition and could potentially hurt the user of the tool. This would increase workplace safety and make the working environment less hazardous which also could benefit welders and welding students.

Accessibility
Accessibility in this context refers to physical limitations. Sight, hearing, tremors, or other physical limitations may prevent people from entering the welding trade.

Accessibility is an important but understudied topic. Some literature explores how AI can make work more accessible. Abril-Jimenez et al. (2022) address how smart technology can support the needs of ageing workers. While the article focuses on office workers and AI tools that promote a healthy living style, we can apply its lessons. The article explicitly mentions training and skills acquisition as a benefit of technology for ageing workers. The most relevant study for our research is a study of how accessibility can be improved for deaf welders (Hill et al., 2023).

Our review of the literature revealed an opportunity for additional studies regarding accessibility barriers such as sight, hearing, or other physical limitations, and how AI may address these barriers to increase accessibility.

RESEARCH QUESTIONS
The three main research questions guided our research on instructors’ perspectives on welding training and the role that computing technologies can play in welding training.

- What are the goals of welding training from the perspective of welding instructors?
- What are welding instructors’ perspectives on using AR/VR technology in welding training?
- What are welding instructors’ perspectives on using AI technology in welding training?
METHODS
This paper reports findings from a larger interdisciplinary project focusing on designing smart hand tools that can benefit skilled workers such as welders. That project is in turn one of the core research projects for Good Systems, a UT Grand Challenge (Fleischmann, 2020; Fleischmann et al., 2019), an interdisciplinary project at the University of Texas at Austin focusing on defining, building, and evaluating ethical human-AI partnerships. Researchers from the School of Information, the LBJ School of Public Affairs, the Walker Department of Mechanical Engineering, and the Chandra Family Department of Electrical and Computer Engineering are collaborating to develop solutions that can leverage AI to enhance skilled trades by upskilling workers and improving their work conditions instead of replacing them. This study about welding training builds on prior studies by our team focusing on engineering students who build race cars (Hill et al., 2022) and deaf welders (Hill et al., 2023), but reports findings from a new research site, a local community college with a welding program. It has been approved by the Institutional Review Board of the University of Texas at Austin.

The first two authors attended multiple class meetings for three introductory courses at two teaching locations of a local community college in the fall of 2022. Class instructors taught Tungsten Inert Gas welding (TIG), Metal Inert Gas welding (MIG), and Shielded Metal Arc welding, also called Stick welding. The first two authors conducted in-field observation and took field notes during periods of instruction as well as during the students’ work time at their individual workstations. The field observations helped researchers to create focused interview questions and to gain a deeper understanding of welding processes. After the initial observations, the same researchers interviewed eight welding instructors from the community college (about half of the welding faculty) over a period of two months (November to December 2022). The interview questions (see Table 1), developed by all four authors, focused on instruction, technology use in welding in general, and how smart hand tools (including VR/AR applications) could be applied.

| Background Information | 1. How long have you been a welder?  
2. Do you specialize in a specific kind of welding? If so, which kind?  
3. How long have you been teaching people how to weld?  
4. How long have you been an instructor at [local community college]?  
5. Why is being a welding instructor important to you? |
|-----------------------------------------------|
| Instruction Insights | 6. Can you tell me about your process for teaching students how to weld?  
7. What do you enjoy about teaching students how to weld?  
8. What challenges do you face when teaching students how to weld? |
| Critical Incident: Best Experience | 9. Can you tell me about one of your best experiences in teaching students to weld?  
10. What were you trying to teach them?  
11. Why was this a good experience?  
12. Did this experience impact your teaching moving forward? |
| Critical Incident: Difficult Experience | 13. Can you tell me about a time when it was difficult to teach students how to weld?  
14. What were you trying to teach them?  
15. Why was it challenging to teach this to them?  
16. Did you make any changes to your teaching process as a result?  
17. Has this changed during the period that you have been teaching? |
| Critical Incident: Use of Technology | 18. Can you think of a specific technology or resource you’ve used in the past that made it easier to teach students how to weld? |
| Teaching Goals | 19. What do you want students to learn in your classes?  
20. Are you preparing students to obtain certifications, and if so, which ones?  
21. What careers are you preparing students for?  
22. Can you give some examples of jobs that your students got after graduation from the welding program? |
| Perspectives on Smart Hand Tools/VR and AR | 23. In this project, we are designing smart hand tools, or hand tools with embedded sensors and intelligence that will be able to provide feedback to the user. Can you imagine how this “smart hand tool” could be used and applied?  
24. What functionalities would you want this smart hand tool to have?  
25. Are there any particular welding techniques or aspects of the welding training process where a smart hand tool would be particularly useful? |
26. Are there other technologies you could imagine incorporating into a smart hand tool?
27. Do you think it would be helpful to display any information in the welding helmet? What kinds of information could be displayed and when would it be useful?
28. Do you think virtual reality should have any role in the welding training process?

Wrap-up

29. Is there anything I haven’t asked about that you think would be helpful to know?
30. Do you have any questions for us?

Table 1. Interview questions

The interviewed welding instructors have very different welding and teaching experiences from each other as can be seen in Table 2. Most of the instructors are generalists and teach multiple welding techniques and facets of welding.

<table>
<thead>
<tr>
<th>Welding and Teaching experience</th>
<th>Years of experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of welding experience</td>
<td>7 – 50 years</td>
</tr>
<tr>
<td>Range of teaching experience</td>
<td>1 ½ - 32 years</td>
</tr>
<tr>
<td>Range of teaching experience at the local community college</td>
<td>1 ½ -30 years</td>
</tr>
</tbody>
</table>

Table 2: Welding and teaching experience of instructors

The first two authors conducted the interviews via Zoom Audio, with each interview lasting 25-55 minutes. They recorded the interviews through Zoom and transcribed them using an online transcription service (Rev.com). They coded the resulting transcriptions using tables in Word and individually created a first round of codes and themes. These two authors then compared their results and discussed the codes and themes with the third and fourth authors. Following this discussion, the first two authors merged codes and created new common themes. The basis for the coding process was reflective thematic analysis (Braun & Clarke, 2012), which allows for capturing the various lived experiences of the welding instructors to gain insights through common patterns and themes. The researchers continuously adjusted the codes over time and also discussed them with other researchers to refine them.

Throughout the following sections, to protect the identities of our participating welding instructors, we refer to our eight participants using the anonymized labels P1-P8.

FINDINGS

Three themes emerged from the interviews: “Goals of Welding Training,” “Instructors’ Perspectives on Using AR/VR Technology in Welding Training,” and “Instructors’ Perspectives on Using AI Technology in Welding Training.” This section provides an overview of the finding related to each theme, as well as example quotes.

Goals of Welding Training

The instructors aim to prepare the next generation of welders and are proud of their profession. P3 pointed out the importance “to hone their skills so that they can become a professional welder”. Several instructors share a deep appreciation of the welding profession (“honorable trade”, “lost art” – both P3, “trades are vital” - P2). They enjoy sharing their knowledge, enjoy seeing confidence build up in the students (P7) and hope to see them “gainfully employed as a welder” (P3). They aim to give back to the community to “help the future welders ... be more knowledgeable about their job” (P8). P6 expressed that he aims to “get the next generation better, ... trying to raise the standard of what welding is in this area” (P6).

The field observations and the interviews showed that welding requires significant practice and patience. Most instructors therefore concentrate on hands-on experience and try to provide individualized training to teach practical skills. As one instructor put it “Welders don’t live in theory, welders live in results” (P6). The majority divides the time into 20% theory/demonstrations and 80% hands-on practice; some instructors provide slightly more theory instruction (30%/70%). Teaching is often focused on the individual student. P4 noted that they “tend to lecture each student individually based on their needs and what they’re struggling with” and that “Welding is one of those things where it is not a one size fits everybody”. P3 pointed out “There is not one approach to presenting ... information to students”, that it is a “multifaceted approach” and that “students process the information differently”. Another one remarked that “The challenge is getting through, getting into their brain and figuring out each student individually … each person is gonna learn slightly different” (P6).

Instructors mentioned the diminishing interest in the trades and the lack of skills of students. Many students lose interest after a few classes because they do not seem to advance quickly enough and lack the patience demanded of the job. They mentioned that there is a “huge lack of people with qualified skills” (P6). One instructor pointed out that 10-15 years ago, the students were “more sincere about the direction they were going” (P3). Another explained
that some of the students, especially following the Covid-19 Pandemic “don't like going through that process of being not good at first”, “don't like the discouragement” and thus “they'll drop it quicker than they've ever done before” (P8). It is mentioned that “there can be a lot of frustration with the initial learning curve of just the hand-eye coordination elements that are required with welding” (P2). Another remarked that “developing those muscle memory, hand-eye coordination skills, ... can be difficult” (P2). As one instructor put it, another contributing factor is that some students have “never touched any tool in their life” (P1), which is dissimilar to some of the instructors’ own personal experience (P4). Instructors point out that students can feel intimidated by tools that feel foreign to them (P1). It is remarked that understanding welding “takes work and practice” (P8). Another instructor noticed a “huge lack of people with qualified skills” once he got into industry (P6).

The instructors’ insights show that the steep learning curve and the need for good hand-eye coordination can be frustrating for students who would prefer quicker success. They also reveal that attracting and retaining students has become more difficult over time.

Instructors additionally stressed the need for teaching the students soft skills to be compatible in the job market. The instructors emphasized that they aim to teach the students more than just direct welding skills. The instructors mentioned people skills (P3), soft skills (P1 and P7), teaching them to be an “honorable person” (P3), showing them how to have a good work ethic (P4), to be a “well-rounded individual” (P7), or to think logically about things (P1). This underlines that, for most of the welding instructors, their teaching goes beyond teaching technical skills.

**Instructors’ Perspectives on Using AR/VR Technology in Welding Training**

In interviewing the welding instructors, we were surprised to discover that the community college owns an expensive virtual welder, but the instructors at the community college are not actively using it for training purposes. Welding instructors believed that the virtual welder was not useful for their instructions and mentioned that it is mostly used for public demonstrations. They provided different explanations for why it is not useful, such as a lack of accuracy or it not being realistic enough, pointing out that “it’s not that accurate” or “it’s like a video game, but it’s not realistic” (P1). One instructor voiced the opinion that one needs to have the real-life experience because “you gotta get in and feel the fire” (P3). Another one confirmed this by saying “there’s a lot of value in ... actually doing welding where you’re getting burned and there’s sparks falling on you” (P1). P8 pointed out the “we’re not wanting to do that [virtual reality] as a replacement of actual welding. It is not quite the same”. In contrast, most of the instructors we interviewed reacted positively to the idea that a virtual welder could be useful in training. Even though they sometimes had not used virtual welding tools themselves, they considered that it “might be a good teaching resource” (P2). Even the instructor who did find it inaccurate and unrealistic (P1, see above) found that they “could see it being used as a teaching aid” (P1). The novelty of AI applications or interfaces was also seen as an advantage. One instructor remarked that especially the “newer generation people who are more apt to look at something that has more ... AI or more of an interface where they can play with it and they can understand it that way, I think it’d be a great application in that essence” (P4). One instructor would like to see virtual reality in “the three entry level classes, intro to Stick, intro to TIG, intro to MIG ... It would get them in the goldilocks zone faster, and then they could build their higher-level skills on top of that once they have honed it faster through that spot.” (P6). Instructor P6 saw benefits in using VR in intro level classes also for safety reasons, “Cause they wouldn’t beburn themselves right off the bat. They have less debris flying around. They’re not breathing fumes from toxic materials or any of that other stuff to get the skills” (P6). They stressed, however, the limited usefulness of VR by pointing out that “virtual reality absolutely has its place”, but that “they’re not gonna get past a certain point” (P6). Another instructor pointed out that they have been an advocate for developing welding games for children, “just getting kids interested in very young ages about trades. ... I could see how games and automation could do that. They have had hand and hand coordination. They can’t play the games that they’re playing without it. Now, it’s just turning that eye and hand coordination into a marketable skill.” (P8).

Another beneficial aspect of AR/VR welding was cost. P4 mentioned that “... we’ve watched metal prices and just steel, quadruple” and added “If they would be start working through that in virtual reality setting and then to go to the real thing would be a cost saving aspect” (P4).

Several instructors identified YouTube videos as an effective tool to teach welding (P3, P4, P5, P6). These videos are not directly related to AR/VR but this shows that the instructors are open to more digital approaches.

Thus, the instructors’ perspectives on AR/VR are quite mixed. They had access to an expensive VR simulator but chose not to use it. In contrast, they did use less expensive technologies such as YouTube videos in their instruction. Overall, the instructors felt that AR/VR could potentially serve as a useful tool but not as a complete substitute for traditional training.
Instructors’ Perspectives on Using AI Technology in Welding Training

In general, the instructors reacted favorably to introducing new technology. One mentioned that though they “haven’t really leaned on many technologies” they are “open to them” (P2). Instructors saw AI technology as potentially beneficial in different ways such as letting students achieve higher quality in less time, addressing safety and health concerns, and making the profession more accessible.

Reaching a higher quality of welds quicker can improve the welding training overall. The instructors had many ideas on how welding tools could be improved with sensors and alerts to achieve higher quality welds.

Most welding instructors mentioned measurements of travel speed, angle and arc length (P1, P2) as useful measurements and feedback, suggesting that either a visual interface in the hood or audio signals (P2, P4, P7) could mark the acceptable values, or as one instructor put it “the goldilocks zone” (P6). P1 remarked “having things in the sensor that tells the welder when they’ve gone out of their parameters of their welding specification would be useful when they’ve exceeded... their ... travel speed or gone below travel speed”. Displays in the welding helmet could include color indications, like green or red signals (P2), or as one instructor suggested, with sliding bar graphs (P6).

One instructor, however, saw the danger of this potentially as being too distracting (P3). P4 stressed how the quality control by having measure available right away could be useful, “Being able to have something where you could put on the glove and you could be able to touch certain areas of a part and have that pull up and dimensions real quick depending on ... what kind of technology you could stuff into a smart tool, that might be a thing” (P4). Another instructor mentioned that it would be useful to learn how much pressure to apply (P5). P1 suggests how this could be integrated into the teaching process. “I think that the welder would have to tell the teaching aid... how long the weld is and what size of weld that they’re supposed to make”. P6 added that “Even the say entry level kind of person, if you can get them on board with it telling ’em shorten your arc length or it’s telling ’em you need to move faster and it’s building up what they’re seeing and it’s a heads-up display ... If they have a heads-up display that’s telling ’em that in real time, it will absolutely make them a better welder, and it’ll make ’em a better welder faster.” (P2).

The interviews revealed that sensors alerting welders to the right parameters either visually or through audio cues are seen as a useful addition to improve welding students’ outputs as long as they are not distracting the welder.

The welding instructors also saw benefits of AI application with regard to safety and health. P7 pointed out that “welding and metal working is inherently dangerous”. Our field observation showed that the welders’ workplaces are hazardous with sparks emerging from the welding tool. There was also a danger of eye damage as a result of staring directly into the flame unprotected. P3 found it important that their students would “be able to complete the job in a safe ... environment.” Another instructor addressed health concerns, in particular health risks related to poor air quality and noise in the workspace and thought technology might be able to help. They suggested building an air quality sensor into the welding helmet to alert the welder if the air quality became poor or having an alert when the decibels reached a certain threshold indicating that the welder should wear earplugs (P7). They also addressed safety issues regarding the risk of blinding, suggesting that it would be beneficial to have sensors that could tell what shade is needed while welding (P7). AI could help provide advanced safety features to achieve the suggested goals.

Additionally, instructors were interested in using AI to overcome accessibility barriers. We define accessibility in this context as a state of overcoming barriers for people with physical limitations. Instructors pointed out that many welders who are currently having a difficult time entering the trade have specific physical limitations. One instructor made us aware of the difficulties faced by welders with tremors. “If you have motor issues especially the ones you see with ADD, ADHD, or kids that tremor. ... It is very hard to work past some of the physical issues.” (P8). Two instructors mentioned age (P1, P8) and having age-related visual impairment. “We had an older student who has maybe some visual things going” (P1). “With my older welders, I think it’s just seeing in general”. (P8). One instructor specifically remarked that “we’re all physically build different from tall to lean, to short and stocky, to tall ... and a lot of those things, believe it or not, they can hinder you or they can help you significantly in this field. ... some people don’t have that mechanical aptitude, some people can’t see that well, some people can’t hear that good. Some have physical limitations. ...” (P5), pointing out that “if we can create some technology to level that field, then that’d be awesome.” (P5).

Thus, the interviews revealed that there are issues related to accessibility. If the problem of accessibility could be addressed with AI-enhancements this could potentially decrease barriers, increase inclusivity, and encourage more people to enter the field of welding.

DISCUSSION

The literature reflects many of the points raised by the instructors, though to varying degrees and not always related to welding. There are specific studies addressing welding issues and general studies of how to use AI for hand tools in other parts of the industry that can be applied equally for welding. The topic most discussed in the literature about welding and new technology is welding and AR/VR. Much less can be found about AI-enhanced welding tools.
addressing safety and health issues or accessibility. Most of the studies we found focused on a single approach (either AR/VR solutions, or sensors) without providing a holistic view of welding training.

**Welding training goals**

An important aspect we learned regarding welding instruction is that welding training goes beyond just teaching practical welding skills, as the interviews with the instructors emphasized. The instructors stressed that they do not want to just teach their students technical skills, but to also provide students with a well-rounded education that includes soft skills to make them competitive on the job market. Similarly, literature examining vocational training confirms that soft skills are important for skilled workers (Hora et al., 2018). Employers find social competency an important skill in addition to technical skills (Gauthier, 2020).

Additionally, the instructors mentioned that students acquire skills in many different ways and that there is not just one path to success. Some explained how they varied their teaching styles to accommodate the individual needs of students. This emphasizes the need for teaching that does not provide one solution for all but allows for different approaches. Individualized teaching enables instructors to adapt to different situations and needs.

Hence, the best way to incorporate advanced technology in welding training could be to combine AR/VR teaching with traditional teaching by a person to allow individualization. Training should also ensure that the traditional welding teaching provides soft skills instruction as well as hard skills to prepare the students for their future workplace. We therefore recommend integrating AI in welding training without neglecting traditional teaching methods, in particular regarding soft skills, provided by welding instructors.

**AR/VR training**

Our interview findings align in many ways with the prior literature. Overall, the studies in the welding context as well as our interviews with the welding instructors seem to confirm that AR/VR training could be beneficial for vocational training (Akundi et al., 2022, Stone et al., 2011).

Even though we discovered that the instructors were hesitant to use VR technology, they also stated that these interventions could be a useful addition to the training. This might appear as a contradiction at first but can be explained. The instructors interviewed for our study saw a benefit of using AR or VR as an additional learning tool, but they also want to stress that nothing replaces reality.

Based on the instructors’ perspectives, we conclude that it might be best to introduce AR/VR training early in a student’s schooling, preferably in secondary education, or as a complement to traditional training methods. Our research suggests that AR/VR training cannot and should not replace traditional welding training, and that more advanced students who excel at AR/VR training should move to the real welding environment. The most beneficial use of AR/VR seems to be at the entry phase.

It is important to note that the VR welding machine that was available but not used at the training location was a high-priced machine. Our initial exploration supports the creation of low-cost and mobile solutions that may be easily used by each student. This supports previous studies (Agrawal & Pillai, 2020). Such solutions improve the affordability of AR/VR techniques and may make it financially available to a broader audience.

As the interviews with the welding instructors have shown, the instructors believe that AR/VR solutions can only help with teaching up to a certain point. They stress how virtual or augmented realities cannot replace a working environment with sparks, flames, and sound. The interviewed instructors, however, all had practically no experience with applying AR/VR methods in their teaching and were discussing potential use.

Further studies should examine to what extent and in what ways AR/VR technology could best be integrated into welding teaching. Several of the prior studies examining the use of AR/VR did not conduct long-term observations or experiments and covered very specific circumstances. One study examined mechanical engineering students (Akundi et al., 2022), another high school students in India (Agrawal & Pillai, 2020), and a third one engineers (Papakostas et al., 2022). Conducting additional research and longer experiments with various demographic groups may provide a more complete picture of how an integration of these technologies would be most beneficial.

**AI Technology in Welding training**

The interviewed instructors were open to adding AI to hand tools to improve welding quality and address other occurring issues. The interviews with the instructors confirmed the danger and health hazards of the welding industry as well as the problem of accessibility, and they were excited about AI’s potential application to make welding safer and more accessible in addition to providing higher quality instruction.

Our literature review showed that there is not much research on how to improve welding tools with AI. However, we found multiple studies relating to other industries like the construction industry (Nath et al., 2017, Yang et al., 2020), that we can apply to welding. Many of the studies relating to other industries address issues the welding
instructors mentioned in the interviews, like using sensors to indicate key measures for high quality welds (Pribadi & Shinoda, 2022), or sensors that make welders aware of dangerous working conditions (He et al., 2022, Korkmaz et al., 2022). Such ideas could be implemented into the welding training to make the welding training safer and allow students to achieve higher quality results quicker. This approach would hopefully attract and retain more students.

The application of AI to accessibility is important yet understudied. We recommend that researchers consider exploring how AI can improve accessibility.

LIMITATIONS AND FUTURE RESEARCH
Our study is an exploratory study and thus limited. The current interview study interviewed instructors at just one community college in one city. Different locations and environments could lead to different results. More interviews and surveys in varying places could also provide more and better insights. It would be worth studying whether various demographic backgrounds related to gender, race/ethnicity, socio-economic backgrounds, location, and previous experiences/exposure to technology would lead to different results. These aspects could potentially have an influence on the successful introduction of AI and AR/VR technologies. Conducting interviews with a wider range of instructors at a wider range of community colleges nationwide or even worldwide could provide a more complete picture.

The study is also limited in that researchers only conducted interviews with instructors and not with students or employers. In addition to gaining insights into how instructors feel about welding training, it would be useful to complement these insights with information gathered from welding students as well as companies employing welding students after they graduate. Combining different perspectives would allow for a more complete picture of how AI could support future welding training. As a next step, our project will explore students’ perceptions, attitudes and beliefs about welding and the use of technology and particularly smart hand tools in welding. In the future, the team will conduct interviews with students from the same welding program to complement the information gained from the instructors. Through this future study we aim to add the perspective of welding students to our research on improving welding instruction.

Another limitation is that the instructors we interviewed do not have experience using AI in their teaching. In future studies, it could be insightful to conduct user research on integrating AI-enhanced teaching techniques into the welding training and then interview instructors and other stakeholders about the experience.

CONCLUSION
Based on these preliminary results, we suggest that one promising approach would be to enhance traditional welding training with a multi-layered and holistic approach. For younger students and beginning students, we suggest using low-cost AR training tools to provide a safer, less costly, and easy to use tool. Such a tool can introduce beginning welders or students who are not sure yet whether they would want to become a welder to the welding trade. It can offer an easily accessible tool to test a student’s welding technique. The same tool could also help to accompany traditional training for beginning welders to provide more practice opportunities. A novice welder could even practice at home without any welding equipment with such tools.

In real-world training, we find sensor-based welding tools to be potentially highly effective to train welding students quicker and safer. Further research to discover ways in which these sensors could provide information, would be useful. The current research discusses examples worth reviewing but mostly lacks an in-depth analysis or testing of such approaches. More work is needed to explore how such approaches could assist beginning welders.

Equally, we suggest the need for further research related to ways accessibility issues could be addressed by the welding profession. There is a need for further research that can explore how additional AI technology could help accommodate students with a broader range of skills and abilities, which could both expand and broaden participation in the welding profession.

Our study indicates that the use of new technology, combined with traditional welding instruction, may yield benefits. While AR/VR training can be useful, the responses in our study support that hands-on guidance through experienced instructors in the real world with heat, dust, and all other elements of the daily welding work environment should not be replaced or substantially reduced. As the instructors in our study pointed out, there is no substitute for the real experience. There are also many ways students acquire the required skills. Personal instruction accompanied with soft skills instruction may best to prepare future welders for their careers. AI has the potential to support the creation of an inclusive and effective environment for welding training when it is designed to align with the needs and values of welding instructors and students.

The information we collected through our literature review and qualitative research shows how the use of technology in vocational training, in particular AI/AR and VR, has the potential to make a difference in the real
world. Implementing Smart Technology in in addition to traditional training can attract and retain skilled trade workers and thus benefit industries like welding who currently face serious labor shortages.

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In a Perfect World: Exploring the Desires and Realities for Digitized Historical Image Archives.

Late, Elina  
Tampere University, Finland | Elina.Late@tuni.fi
Ruotsalainen, Hille  
Tampere University, Finland | Hille.Ruotsalainen@tuni.fi
Kumpulainen, Sanna  
Tampere University, Finland | Sanna.Kumpulainen@tuni.fi

ABSTRACT
The primary goal of this paper is to explore users' desires for digitized historical image collections, examining their desires based on different use purposes and information interaction activities. In addition, we investigate the image attributes that users wish to search from the collection. To accomplish this, we conducted 21 qualitative interviews with active users of a digitized historical photograph archive. Our findings suggest that users' desires relate to three contexts: tools, collection, and socio-organizational issues. Moreover, our results indicate that users require support for various information interaction activities, not just searching. We found that users' desires vary based on their specific use purposes, and that users prioritize conceptual access points that can already mostly be generated through automated annotation methods. Ultimately, this study contributes to a better understanding of users' real-life image needs and offers implications for improving access to digital image collections.

KEYWORDS
Cultural heritage collections, digital archives, digital images, image archives, information behavior, information interaction, information needs, user studies

INTRODUCTION
The digitization of cultural heritage collections has significantly improved user access to materials, including historical image archives that have been increasingly converted into digital format. However, little is known about information behaviors related to the use of historical images, as existing research on digital collections has focused primarily on textual materials (Chassanoff, 2018). This lack of research has resulted in a limited understanding of how digitized historical image collections are utilized, how well they meet user needs, and what users expect from these collections. Previous studies have revealed that image searching can be challenging due to its reliance on textual descriptions (Roberts, 2001). Yet, creating textual descriptions is resource consuming and challenging as the meaning of an image always depends on the viewer. Thus, the same image may have varying interpretations.

For designing sustainable digital collections, it is important to understand the real-world information behaviors related to the use of the collections (Borgman, 2003). Otherwise, some crucial aspects of work practices that shape the use could get ignored. It has been argued that research on this area lacks qualitative approaches to truly understand the image needs and uses (Cho et al., 2022; Matusiak, 2017). Providing contents openly online is not enough if they cannot be found, accessed, interoperated, and reused, as suggested by the FAIR principles (Wilkinson, et al. 2016).

The aim of this paper is to provide new knowledge about the desires users with different use purposes have for digitized image collection and the relations of their desires to different information interaction activities. Further, we investigate the attributes users wish to search from the collection. Our research questions are:

RQ1: What do users desire from a digitized historical image archive?
RQ2: In which information interaction activities do the desires relate to?
RQ3: How do desires vary across different use purposes?
RQ4: Which image attributes users want to search from the collection?

Our analysis is based on 21 qualitative interviews with experienced users of digitized image collection containing approximately 160,000 historical images from the early 20th century. This collection was not originally intended for public use but for providing illustration for the propaganda organization during the Second World War in Finland. After its digitation in 2013, the collection has been a popular source of image data for, e.g., genealogists, other hobbyists, journalists, and history researchers.

The paper is structured as follows; First, we provide background about digitized image archives and their uses and possibilities. Next, we present our research setting, including data collection and analyses. After this, we present our findings followed by discussion and conclusions.

BACKGROUND
Image Archives and Their Uses
Digitized image archives are collections of, for example, photographs originally produced in analog format and later digitized. Historical photographs are cultural heritage documenting our past visually. They are used for various
purposes and by various stakeholders including scholars, educators, the public, and commercial actors. However, there is a lack of understanding of how and why digitized image archives are used as most of the earlier studies focusing on cultural heritage collections study textual materials as image use has been mainly studied from the perspective of searching.

Information interactions arise out of nothing, but rather are triggered by either leisure or work-related tasks (Järvelin et al., 2015; Toms, 2011; Vakkari, 2001). Earlier studies have analyzed the image use for illustration and information (e.g., McCay-Peet & Toms, 2009). Digital archives are popular sources for collecting images to illustrate publications, social media posts, etc. One example of the use of images for information is their use as research data. Indeed, images are important primary sources for historical research, and images are used for verification, documentation, or corroboration (Chassanoff, 2018). Beaudoin (2014) studied image use among archaeologists, architects, art historians, and artists. She discovered that images were used for various purposes such as for knowledge creation, conceptual modelling, inspiration, cognitive recall, critical thinking, communication, emotion, engagement, marketing, proof, social connection, translation, and trust. In her study, the image use varied between user groups; those in archaeology and art history used images most often for knowledge creation for their lecture presentations and for research and publications as those in architecture and art used images for research and design creation.

Various studies show that although images are visual data they are mostly searched textually (e.g. Matusiak, 2017, 2006; Ménard & Khashman, 2014). Kumpulainen and Ruotsalainen (2022) studied the search tactics used for finding images from digital wartime photograph archive in the context of serious leisure. Based on a survey data they showed that keyword searching was the main tactic used along with filtering and browsing. Further, the study by Late, Ruotsalainen, and Kumpulainen (2023) indicates that keyword searching alone is not often an appropriate search tactic but must be accompanied by other tactics such as filtering and browsing. However, using the image archives comes with many difficulties in terms of discoverability, copyright, size, and quality (Beaudoin & Brady, 2011). Late, Ruotsalainen and Kumpulainen (2023) show that the incompleteness of metadata is the major barrier to the use of a digital image archive. Beyond historical images, literature review by Cho et al. (2022) revealed obstacles in image searching that were related to semantic problems, content-based issues, technical limitations, issues of aboutness, inclusivity issues, search skills, and cognitive overload.

Image Needs and Supporting Them

There is much to be improved in providing images for the users. According to Chassanoff (2018) historians desire original descriptive information, such as captions, keywords, subject headings, original medium, and the size of the images. More generally, earlier studies have outlined key requirements for digital libraries to be easy to learn and to use and deliver reliable search results (Kani-Zabihi, Ghinea & Chen, 2006; Kimani et al., 2009). Matusiak’s (2019) study focusing on community archives shows that users value developed interfaces, high quality of objects, good metadata, contextual information, and wide coverage. The design of the systems, as well as the terminology used, should be clear, consistent, and easy to understand (Thong, Hong, Tam, 2002). Other studies have shown that users desire, for example, visual-based interfaces to support faceted searching (Suominen, Viljanen & Hyvönen, 2007) of which a map-based search is only an example (McIntosh & Bainbridge, 2011).

Previous research has also examined the specific attributes that users search from the images. For example, McCay-Peet and Toms (2009) investigated the types of image attributes used by historians and journalists when selecting images for their work. They analyzed both conceptual and descriptive image attributes, drawing on earlier frameworks developed by Jörgensen (1998), Laine-Hernandez and Westman (2006), and Shatford (1986). Participants ranked attributes such as person/animal/object and event/action (conceptual), as well as viewer response and visual elements (descriptive), as the most important. Interestingly, no significant differences were found in attribute types based on whether the images were being used for information or illustration purposes. The authors recommend further research to explore the relationship between image needs and work tasks, with the aim of developing image retrieval systems that truly meet the needs of users.

User tagging and content-based image retrieval (CBIR) have revolutionized the way accessing and interacting with images, by providing cost-effective and high-density access points. CBIR techniques have already enabled recognition of people, objects, events, and landscapes in images, while newer methods can even identify photographic arrangements, such as distance between objects or camera or orientation, and recognize main characters. Other possibilities are, for example, reverse image search or finding similar images to those already found. (Seker, et al. 2021) However, Beaudoin’s (2016) study revealed that while CBIR was found useful by users interested in formal characteristics like color, shape, composition, and texture, it did not benefit users interested in known-items, themes, or locations. Archaeologists and art historians in the study preferred text-based retrieval of images over CBIR methods, underscoring the importance of user studies in determining real-life user needs.
Moreover, limited resources may prevent cultural heritage collections from adopting novel methods for digital archives.

**RESEARCH SETTING**

**Case Image Archive**

This study explores the use of a digital collection comprising approximately 160,000 unique photographs captured during the Second World War in Finland, between 1939 and 1945. The collection, provided by the Finnish Defence Forces, is available in print as well as digital format and features images depicting various aspects of the war. These include life on the home front, events and operations at the front, the war industry, leisure time at the front, damages caused by bombings, and the evacuation of Finnish Karelia. Most of the photographs were taken by wartime Information Company photographers and were used for wartime propaganda. While the majority of the photographs are in black and white, a small number of color photographs and videos are also included. The collection was published online in 2013 and is openly accessible to users in both Finnish and English via http://sa-kuva.fi/.

The digital images can be accessed using an online search interface that includes keyword search, advanced search with Boolean operators, and browsing options. Users can also filter the images based on predefined stages of the war (Winter War, Continuation War, Lapland War), specific date information, and color images and videos. The search results display 15 thumbnail images per page, and users can click on a thumbnail to view a larger image, access related metadata, and download the image. Users can also submit additional information about the image to the archive at this stage. Guidelines, terms of use, and a description of the archive are provided.

Textual metadata, created by photographers during wartime, forms the basis of the search. This metadata includes the name of the photographer, location, and subject or event depicted in the image. However, due to the chaotic wartime conditions, metadata is partly incomplete, and some photographers were unable to provide detailed descriptions. The metadata may also contain spelling errors and mistakes regarding the date and location. The metadata has not been edited or proofread and is primarily in Finnish, with some in Swedish.

**Data Collection**

The data for this study was obtained through semi-structured interviews conducted with 21 active users having experience over several years of the digital collection. The participants were selected to represent a range of roles (as presented in Table 1), including researchers (using images for research purposes), amateurs (using images for serious leisure activities such as genealogy and scale model building), journalists/writers (using images for illustration), and information specialists (searching images for their clients and for museum collections). The interviewees were selected through a combination of contacts provided by the research team and outreach to organizations known to use the archive. Each interviewee was also asked if they knew of anyone else (colleagues, etc.) who would be suitable for the interview. The goal was to gather a diverse range of experiences with the collection.

The interviews were conducted online using the conference tool Zoom during November 2021 and April 2022 until saturation was reached. All interviews were video recorded, and the video files were fully transcribed for analysis purposes. The average length of each interview was 37 minutes, resulting in a total of 12 hours and 48 minutes of audio data. Prior to the data collection, informed consents were obtained from all interviewees.

<table>
<thead>
<tr>
<th>Number of participants</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
</tr>
<tr>
<td>26-70 years (mean 47.5 years)</td>
</tr>
<tr>
<td>Work organization</td>
</tr>
<tr>
<td>University (10), private company (5), cultural heritage organization (3), retired (3)</td>
</tr>
<tr>
<td>Work role</td>
</tr>
<tr>
<td>Academic scholar (10), professional writer (4), amateur (4), information specialist (3)</td>
</tr>
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</table>

**Table 1. Profile of the participants.**

During the interviews, participants were asked a series of questions from the interview guide including background information such as their status, research field, and age. To explore their experiences with the image collection, a variation of the critical incident technique (Flanagan, 1954) was employed, where interviewees were asked to describe how they had used the collection, including searching, selecting, and saving images from the archive for one specific task. In addition, each interviewee was asked “What would be the perfect world searching engine like? What could you do with it?” to collect participants’ desires for the system. However, interviews did not necessarily follow the order of the questions in the guide, but the guide was used as a checklist to keep track of the interview. Also, before the interview, the interviewees were told shortly about automatic annotation methods to give them information about possibilities for developing the system. This, however, guided the thinking of the interviewees toward desires for the search engine and possibilities of automatic annotation. Also, it should be noted that participants could express their desires for the system at any point during the interview.
Data Analyses
To analyze the interview data, a combination of Atlas.ti software, Microsoft Excel, and SPSS were used. Firstly, the interview transcripts were uploaded into Atlas.ti and read through multiple times to identify instances where participants expressed their desires for the image collection. By using the concept of desire, we refer to the expectations, aspirations and needs that users have regarding their utilization of the collection. A total of 271 instances were identified from the data. Quotations expressing these desires were then extracted and entered into an Excel spreadsheet for further analysis.

For providing an answer to RQ1 (What do users desire from a digitized historical image archive?), desires were categorized according to their context utilizing categories provided by Kumpulainen and Late (2022). In this specific study, the contexts of tools, collection, and socio-organizational issues were utilized. Next, the subcategories (total of 19) for the contexts were coded data-driven. Regarding the RQ2 (In which information interaction activities do the desires relate?), the information interaction activities provided by Järvelin et al. (2015) were coded for identifying the activity the desire was related to. The theoretical model by Järvelin et al. (2015) is based on the idea of task-based information interaction (TBII) to assess how the information interactions contribute to the goals of task performance. Activities of searching/selecting, working with items, and synthesizing/reporting were applied in the coding. Searching and selecting activities were combined since an earlier study had shown these activities to be overlapping (Late & Kumpulainen, 2022). As all desires were not related to any specific activity an additional category “general” was formed. The context of desires and information activities the desires were related to were cross-tabulated and the Fisher’s exact test was run with SPSS software to test for statistical independence between the categorical variables.

To address RQ3 (How do desires vary across different use purposes?), we analyzed the primary use purpose of the digital collection for each interviewee. We identified the primary use purpose from the interviewees’ descriptions, following the categorization used by Fidel (1997) and McCay-Peet & Toms (2009) for information (users who looked for specific information from the images, such as research data) and for illustration (users who looked for images for illustrating publications). We also included an additional category, information mediating, for those who looked for images for their clients or for building collections. However, it is important to note that these were the users' primary use types. Users looking for images primarily for information could also use the images later for illustration, and users looking for images for illustration may have gained new information from the images and metadata that affected their searching behavior. To study the differences between different uses of the collection (RQ3), we cross-tabulated the context of desires with the primary use type. We used Fisher’s exact test with SPSS software to test the statistical independence between the categorical variables.

Finally, to providing an answer to RQ4 (Which image attributes do users want to search from the collection?) image attributes the users expressed they wanted to search from the collection were coded from the original data. Although we did not ask directly about image attribute needs during the interviews, participants expressed their needs while describing their research problems and image search habits, resulting in 173 expressions. The attributes were categorized either as conceptual (image of/about) or descriptive (image is) following the categorization used by McCay-Peet and Toms (2009). Attribute subtypes were formed data-driven but later standardized with subtypes used by McCay-Peet and Toms (2009) when possible. Illustrative quotes from the data were chosen and loosely translated from Finnish to English.

RESULTS
Desires
Interviewees’ desires for the digitized historical image collection were related to either the tools (N=174, 64.2%), the collection (N=82, 30.3%) or the socio-organizational issues (N=15, 5.5%). Most desires were related to searching/selecting activity (N=182, 67.2%), while desires supporting working with items (N=52, 19.2%) and synthesizing/reporting (N=13, 4.8%) activities were less common. A subset of desires that did not relate to any specific activity was classified as general (N=24, 8.9%). The results of Fisher’s exact test (p < .001) indicate a significant association between the context of desires and the activities they were associated with. Generally, desires related to tools were predominantly associated with searching/selecting activity. For desires related to the collection, over half were related to searching and selecting, while some were related to working with items activity. Socio-organizational desires were mostly associated with general issues and not tied to specific activities.

Users’ desires related to tools supporting searching/selecting (see Table 2) concerned most often possibilities for content-based recognition that could help them to identify various attributes they wanted to search from the collection.
I think I would benefit a lot from AI-based automatic character recognition that would identify dogs, other animals, people, etc. This would very likely show images that I have missed, and it would open up my research results and bring new points of view already in the search phase. At least it would make it faster. (P1, researcher)

Participants expressed a desire for more advanced search options, such as recommendation systems and map-based searches. Some also hoped for a system that would facilitate serendipitous discoveries by allowing them to stumble upon unintended images from the collection. Additionally, they sought an improved interface that would enable personalization, visualization of search results, and easy browsing. Researchers, in particular, desired various tools to aid them with working with items, such as the ability to further analyze outputs from the system, zoom in on images, and access analysis tools for their own collection retrieved from the system. For synthesizing and reporting users wished for functionalities that support image sharing.

<table>
<thead>
<tr>
<th>Supported activity</th>
<th>Desire</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Searching/selecting</strong> (78.7%)</td>
<td>Content-based recognition</td>
<td>Automatically identify desired contents from the images</td>
</tr>
<tr>
<td></td>
<td>Improved search options</td>
<td>Recommendation system, search based on a map, voice search, search supporting serendipity</td>
</tr>
<tr>
<td></td>
<td>Improved interface</td>
<td>Personalization, visualization of results, easy browsing</td>
</tr>
<tr>
<td><strong>Working with items</strong> (17.8%)</td>
<td>Outputs from the system</td>
<td>Downloading multiple images at once, downloading image metadata to spreadsheets</td>
</tr>
<tr>
<td></td>
<td>Zoomability</td>
<td>Ability to zoom and see full-size images easily</td>
</tr>
<tr>
<td></td>
<td>Analysis tools</td>
<td>Tools for analysing the search results based on metadata</td>
</tr>
<tr>
<td><strong>Synthesizing/reporting</strong> (3.4%)</td>
<td>Easy sharing</td>
<td>Sharing images in social media</td>
</tr>
</tbody>
</table>

Table 2. Desires in the context of tools according to information interaction activities. (N=174)

In the context of the collection (see Table 3) desires supporting searching/selecting were about improving and increasing the metadata, that users wanted to be curated and formalized. However, at the same time, they wanted to preserve the original captions within the images. Participants requested also clear guidelines and support for searching the contents and accessing all the images in the collection. This was related to the decisions to remove some images from the collection because of sensitive content. Regarding the working with items, participants expressed a need for high-quality digitization of the images, including capturing the backsides that could contain valuable supplementary information.

Definitely the backsides of the photos should be integrated before someone makes up that we have the photos digitized and that is enough. I haven’t even once made research without browsing the originals (P5, research)

In addition, participants expressed a desire to link contextual data, such as information about the events and individuals depicted in the images. Concerning synthesizing and reporting, participants emphasized the importance of trustworthy metadata, as they did not want to publish images with inaccurate information. Published images also needed to be of high quality and have clear licenses. Participants expressed a general desire to expand the collection beyond the wartime period and include images from other non-digitized collections.
<table>
<thead>
<tr>
<th>Supported activity</th>
<th>Desire</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Searching/selecting (54.9%)</td>
<td>Improved metadata</td>
<td>More curated metadata, original captions</td>
</tr>
<tr>
<td></td>
<td>Guidelines/support</td>
<td>Clear guidelines for searching, information about the collection</td>
</tr>
<tr>
<td></td>
<td>Access all contents</td>
<td>Access to censored images</td>
</tr>
<tr>
<td>Working with items (24.4%)</td>
<td>Good quality digitation</td>
<td>Good quality images, digitation of the backsides of the images</td>
</tr>
<tr>
<td></td>
<td>Contextual information</td>
<td>Linking additional information related to images</td>
</tr>
<tr>
<td>Synthesizing/reporting (4.9%)</td>
<td>Trustworthy metadata</td>
<td>Correct metadata that readers of the publications can trust</td>
</tr>
<tr>
<td></td>
<td>Good quality digitation</td>
<td>Images that can be published</td>
</tr>
<tr>
<td></td>
<td>Clear licenses</td>
<td>Clear licenses and guidelines for publishing</td>
</tr>
<tr>
<td>General (15.9%)</td>
<td>More images</td>
<td>More images before and after the wartime, integrating images from other collections</td>
</tr>
</tbody>
</table>

Table 3. Desires in the context of the collection according to information interaction activities. (N=82)

Only a few desires were related to socio-organizational issues (Table 4). Researchers using the collection expressed a need for new quantitative research methods capable of handling large sets of historical images. Related to reporting activity participants hoped for ethical standards for publishing of the images. This was especially related to inexperienced users and their lack of information about the collection and its origins. General desires were about possibilities to correct and produce image metadata for the collection collectively. One participant also wished for more visibility for the collection.

> For many photos, there is specific information out there [that is not integrated into the collection]. Mostly about the vehicles, persons or places (P17, amateur)

<table>
<thead>
<tr>
<th>Supported activity</th>
<th>Desire</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with items (6.7%)</td>
<td>Research methods</td>
<td>Developing new research methods for historical research</td>
</tr>
<tr>
<td>Synthesizing/reporting (20.0%)</td>
<td>Ethical use</td>
<td>Publishing images ethically</td>
</tr>
<tr>
<td>General (73.3%)</td>
<td>Ability to correct metadata</td>
<td>Resources to integrate corrections delivered by users to the collection</td>
</tr>
<tr>
<td></td>
<td>Visibility</td>
<td>More visibility for the collection</td>
</tr>
</tbody>
</table>

Table 4. Desires in the socio-organizational context according to information interaction activities. (N=15)

**Differences Across Primary Use Purposes**

The study found that participants used the collection for various purposes, including finding images for information (N=12), illustration (N=6), or information mediating (N=3). The purpose of use was closely linked to the user's work role, with the majority of researchers and amateurs using the images for information (81.8% and 71%, respectively), while professional writers primarily used images for illustration purposes (100%). Information specialists mainly used the collection for information mediating (78.7%) or for information (21.3%).

In Table 5, the differences between participants using the collection for different purposes were examined in relation to the context of their desires (The results of the Fisher’s exact test (p = .033) indicate a significant association between the variables). Participants using images primarily for information or illustration purposes expressed more desires for tools as those using the collection for mediating information had more desires for the collection and socio-organizational issues.
Context of desires

<table>
<thead>
<tr>
<th>Primary use type</th>
<th>Tools</th>
<th>Collection</th>
<th>Soc-org.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information (n=152)</td>
<td>67.8</td>
<td>28.3</td>
<td>3.9</td>
<td>100</td>
</tr>
<tr>
<td>Illustration (n=75)</td>
<td>68.0</td>
<td>28.0</td>
<td>4.0</td>
<td>100</td>
</tr>
<tr>
<td>Information mediating (n=44)</td>
<td>45.5</td>
<td>40.9</td>
<td>13.6</td>
<td>100</td>
</tr>
<tr>
<td>Total (N=271)</td>
<td>64.2</td>
<td>30.3</td>
<td>5.5</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5. Share (%) of desires in different contexts across use purposes.

Desired Image Attributes

Our analyses showed that users were intrigued by the prospect of automated content recognition for images. To delve deeper, we studied the attribute types and subtypes that users wanted to identify from the image collection. Our analysis included a total of 173 attribute expressions, many of them overlapping. Conceptual attributes, which refer to images about something, comprised the majority (77.5%) of the expressions, while descriptive attributes, which describe what the image is, accounted for the remaining 22.5%. Table 6 below displays the various attribute types and their corresponding subtypes, along with examples.

<table>
<thead>
<tr>
<th>Attribute type</th>
<th>Attribute subtypes</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual (about)</td>
<td>Person/animal/object</td>
<td>Humans, animals, vehicles, buildings, smoke/no smoke</td>
</tr>
<tr>
<td>Descriptive (is)</td>
<td>Composition</td>
<td>Distance between people, posture, number of objects/people in the image, direction of activity</td>
</tr>
<tr>
<td></td>
<td>External relation</td>
<td>Images belonging to the same series, information about publication forums of images</td>
</tr>
<tr>
<td></td>
<td>Color/color value</td>
<td>Black and white, color codes</td>
</tr>
<tr>
<td></td>
<td>Image type/Visual elements</td>
<td>Image genre, orientation (landscape/portrait)</td>
</tr>
</tbody>
</table>

Table 6. Attribute types and subtypes expressed by the interviewees. (N=173)

The majority of conceptual attributes related to identifying specific persons, objects, or animals within the images. Users expressed a desire to search for images featuring humans, dogs, vehicles, buildings, and more. Additionally, attributes of persons and objects were frequently mentioned, with a particular emphasis on recognizing individual people.

In the ideal world, there would be a face or shape recognition system that would enable to identify the persons and search them (P3, information specialist)

Furthermore, users expressed a desire to search for images of specific troops, buildings, or brands. They were also interested in finding images based on characteristics such as gender, age, nationality, and role (such as children or soldiers), as well as images taken in certain locations or milieus, such as towns, forests, or indoor/outdoor settings. The ability to search for certain activities and events, such as battles, Christmas, or parties, was also highly desired. An interesting observation was the propaganda nature of the image collection, with users expressing a desire to determine whether the photographs were staged or based on real events. Additionally, participants expressed interest in images featuring expressions and emotions, such as people who appeared tired, serious, or happy, as well as images depicting temporal attributes, such as time of day or season.

I study the history of emotions and it would be interesting to see how for example gender and certain emotions are correlated in the photos. Or age for example. Or can we find the same facial expressions from men and women? (P15, researcher)
Regarding descriptive attributes, users expressed the most interest in descriptive information about the images, such as the date and name of the photographer. Some users were also intrigued by image composition, including factors such as the distance between people, their posture, and the number of objects or people in the image. Additionally, the direction of activity depicted in the image was important, particularly for those seeking images for use in illustrations.

*For example, searching soldiers skiing from left to right. For illustration, it is very important to get the direction right.* (P7, professional writer)

Moreover, participants expressed a desire to understand the external relation of the images, such as images belonging to the same photo series or those published in certain forums. Additionally, users expressed a need to identify the color and image type, as well as other visual elements present in the images.

Furthermore, we examined whether there were any significant differences in desired attribute types among users in different work roles or with different intended use purposes. However, no significant differences in desired attribute types were found. It is possible that there may be differences in subtypes, but due to the relatively small size of our data set, we were unable to conduct a thorough analysis on this front.

**DISCUSSION**

The objective of our study was to analyze users’ desires for digitized historical image archives, with a focus on the information interaction activities related to those desires and the intended purpose of image use. Additionally, we examined the image attributes that users sought to search from the collection. Our findings shed light on the contextual factors surrounding user desires and provide insight into the types of support that users require at various stages of their information interaction process. Ideally, image archives should offer a wide range of access points to their contents and provide comprehensive support to users throughout their entire information interaction process.

With respect to RQ1 (What do the users desire from a digitized historical image archive?), our analyses show that user desires were related to the contexts of tools, collection, and socio-organizational issues. We utilized the model by Kumpulainen and Late (2022) that was originally created for studying the context of barriers in information interaction. This model turned out to be useful also for recognizing the contexts of user desires. Desires connected with tools were the most frequent in our data, relating, for example, to the automatic annotation of the images, providing improved search options, and developing the interface. Interviewees were intrigued by the possibilities CBIR techniques can offer, such as automatic character recognition. This finding conflicted with the results by Beaudoin (2016) who argued that scholars in archaeology and art history were not interested in CBIR systems but wanted to rely on textual descriptions. However, it is likely that during the six years between the studies, technology has developed and users are more familiar with the supports AI can offer. Furthermore, the tasks behind the image use may also differ between the studies. In addition, as already shown in earlier studies users desire visual search systems such as map-based searching, as the location is an important attribute in images (Suominen, Välijänen & Hyvönen, 2007). Digital services should also support serendipity, which is important in historians’ research process (Martin & Quan-Haase, 2013). Desires related to the *collection* discussed, for example, improving the image metadata and the quality of digitization. Indeed, metadata of historical images has been shown to be a major barrier to image searching (Late et al., 2023). *Socio-organizational* desires were infrequently expressed in our data but brought out important views for the development. One of the issues was the need for new research methods in the historical domain using images as research data.

Regarding the second research question (In which information interaction activities do the desires relate to?) our analyses indicated the association between the context of desires and information interactions identified according to Järvelin et al. (2015). For example, desires for *tools* were typically related to *searching/selecting* activity as desires for the *collection* mixed between *searching/selecting* and *working with items* activities. *Socio-organizational* desires were mostly related to general issues, not associated with specific activities. According to our findings, most desires were related to *searching/selecting* activity. However, this is partly due to our data collection method as the interviewees were asked to describe their ideal world image search engine. However, the finding is not very surprising as information interactions with the collections become less frequent towards the end of the interaction process (Late & Kumpulainen, 2021). It is also obvious that users expect similar functionalities that are provided by commercial search engines such as Google. Thus, it may be disappointing for them to realize the shortcomings of cultural heritage collections that have limited budgets for their development. Despite the limitation in our data collection, some desires related to *working with items* and *synthesizing/reporting* activities were raised. For example, researchers desired outputs from the system to be further analyzed. As the majority of the earlier studies have focused on image searching, we argue that future studies should take the whole information interaction process into account to better understand the information behavior and user needs.
The third research question was about analyzing the desires across primary use purposes, namely for illustration, for information, and for information mediating. The results showed that user desires varied between those participants using the collection for information/illustration and information mediating. Also, earlier research has shown variation in image use according to the user’s task and profession (Beaudoin, 2014). These observations underline the importance of task-based research settings and confirm that the task behind the user behavior triggers what users want from the system. However, detecting the purpose of use might be challenging as in real-life users have various needs within a single task (Byström & Kumpulainen, 2022). Their use purpose may also change along the process and images that were originally searched, for example, for illustration may be used for information mediating and/or for information. Therefore, we analyzed participants’ primary purposes, and this limitation may decrease the reliability of the results.

Our last research question focused on the image attributes users want to search from the collection. The majority of the identified attributes were conceptual according to categorization by McCay-Peet and Toms (2009). However, we did not study the importance of the attribute types or their sub-types. Yet, it seems that the frequency of expressed attributes relates to their importance since three out of the four most frequent attribute subtypes were the most highly ranked attribute types also in the study by McCay-Peet and Toms (2009). When comparing the attribute subtypes with the categorization used by McCay-Peet and Toms (2009) we found two new subtypes: attributes of persons/objects (conceptual) and composition (descriptive). As McCay-Peet and Toms (2009), we did not find significant differences in attribute types according to the use purposes.

We used a qualitative interview method to collect critical incidents of digitized image archive use. However, the case system under the study (and its limitations) affects the realities and desires of the participants and we collected only ex post facto accounts of the users’ experiences. To fully understand the user desires beyond the service level there is a need for more realistic research settings, such as longitudinal ethnographic research to capture real-life information interactions beyond a single system. However, our results provide several practical implications for developing historical image archives. Users desire various tools to help them in using the system and utilizing the images. Although many of the tools are designed for supporting searching, it is vital to recognize that image searching is not only about locating the desired images from the collection, but they are used also as a method for analyzing the data. For the moment, our case image archive gives no means for analyzing one’s own subcollections collected from the system. Users conducting, for example, computational humanities research may want to collect multiple images at once and export outputs of the image metadata from the system. So far, all this needs to be done manually. However, there have been arguments that digital humanities researchers would benefit more from providing a palette-style selection of tools with proper interoperability functions, rather than direct pipelines for workflows (Koolen et al., 2020).

Automatic content recognition and annotation have much to offer for historical collections with limited metadata. Our findings provide concrete examples of the image attributes that users desire to search from the collection, most of which can be implemented if sufficient resources are allocated to the development of the archive. However, previous experiences have demonstrated that information needs in humanities research can be highly diverse, making it difficult to create a single unified metadata scheme. Therefore, users may require project-specific metadata (Lund et al., 2013). Another practical consideration for development is the digitization process; valuable information on the backsides of images should be included in digital surrogates. Moreover, users expressed a need to identify staged photographs in the collection and verify the authenticity of the images, which is particularly relevant for all visual contents.

Users’ desires included allowing collaborative metadata production (co-created metadata), as they experienced there is unused information about the images available. For now, users can send additional information to the archive, but the problem seems to be, that the archive has no resources to evaluate and integrate the information. Users are not able to annotate content directly. Behind the decision, there might be a fear of integrating false information into the system. One possibility for solving the problem is to provide co-created metadata as layers on top of the original metadata and let the users decide which to use. Developing cultural heritage collections requires both financial and intellectual resources to ensure the continuation of digital curation (Barbuti, 2018). Keeping on track with developments offered by commercial systems is not easy for publicly maintained services but it is crucial to provide access and support for various user groups and different uses of the collection.

CONCLUSION

While the majority of earlier studies have focused on image search practices or on the use of textual digitized cultural heritage data, this study aimed at providing a more holistic view of the desires users have for digitized historical image archives. We based our analysis on qualitative interviews with active users of an archive containing digitized photographs from the Second World War. Our findings shed light on the diverse desires that users have for image collections, as well as the information interaction activities related to these desires. Further, we analyzed the
image attributes users wanted to search from the collection. By doing this, we can better understand user needs and provide implications for improving access points to digital image collections from a human-centered perspective.

Among the key findings are that user desires for the collection are various and support is needed for different information interaction activities, not solely for searching. Our findings suggest that users' desires relate to three contexts: tools, collection, and socio-organizational issues. In particular, desires for tools were the most prevalent, including desires for automatic image annotation. On the image attribute level, our findings highlighted the need for conceptual attributes such as objects, object attributes, location, and events that were often absent from the original image metadata, which was not initially intended for current uses. However, automatic content recognition and annotation offer great potential for historical collections with limited metadata.

Our study raised several intriguing questions for future research, including the need to understand real-life information interactions with image data on a larger scale. While our study addressed some gaps in our knowledge by studying the use of one specific image archive, further research will be necessary to determine how image archives can develop their services to meet various user needs.

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The authors confirm their contribution to the paper as follows: conceptualization: Elina Late, Sanna Kumpulainen; data collection: Hille Ruotsalainen; analysis and interpretation of results: Elina Late, Sanna Kumpulainen; writing — original draft: Elina Late; writing – review and editing: Elina Late, Sanna Kumpulainen.

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Person-Oriented Ontologies Analysis for Digital Humanities Collections from a Metadata Crosswalk Perspective

Liu, Rui  
University of Melbourne, Australia | ruiliu2@student.unimelb.edu.au

McKay, Dana  
RMIT University, Australia | dana.mckay@rmit.edu.au

Buchanan, George  
University of Melbourne, Australia | george.buchanan@unimelb.edu.au

ABSTRACT
Mapping between different representations of similar data is a common challenge in digital humanities (DH). In practical DH collections, the ‘person’ is an essential and centric unit and other parts could link to the ‘person’ to form the knowledge base. However, there is still no general and useful person-oriented ontology in DH community. Many practical DH projects have developed their own ontologies by DH experts, but these ontologies are not interoperable. Therefore, it is important to explore existing biographical ontologies and develop a comprehensive person-oriented ontology for DH.

Using the metadata crosswalk method, we examined the ontologies provided for persons in three DH collections to analyze how they map onto standard ontologies such as FOAF (friend of a friend). This paper uncovers a significant and consistent gap between standard biographical ontologies and those used in practical DH collections, arriving at a set of heterogeneous problems, including different granularities of metadata. Consequently, we propose three key person-oriented ontological types of elements, drawing on this metadata crosswalk: basic biographical elements, relational elements, and explanatory elements (such as career, connected with role and time). This metadata crosswalk provides a foundation for future matching between person-oriented ontologies and facilitates semantic interoperability between DH collections.

KEYWORDS
Person-oriented ontology, Biographical ontology, Digital humanities, Metadata crosswalk

INTRODUCTION
With the increase in quantity and quality of DH collections, interoperability and aggregation among various DH collections could improve the validity and efficiency of DH systems and data. Several DH projects and standards have already aimed to achieve this goal in DH. Ontologies are a fundamental tool in achieving DH data interoperability and DH collection aggregation by using shared definitions and descriptions of metadata (Doerr, 2009; Usiskin, Walde, & Winter, 2019). In the DH field, many ontologies have been proposed for specific domains. Examples include the Committee for Documentation of the International Council of Museums Conceptual Reference Model (CIDOC CRM) for Cultural Heritage; Europeana Data Model (EDM) for Museums; Bibliographic Framework (BIBFRAME) and Library Reference Model (LRMoo) for Bibliographic data; and Dublin Core for all cultural data.

As DH continues to develop, ontologies are expected to represent not only the information about instance description but also the in-depth knowledge of content (Gracy, Zeng, & Skirvin, 2013). Relations and attributes about people are essential knowledge in DH. There are many small-scale DH projects that are based at universities. These projects have typically used proprietary metadata schemes (Salse, Guallar-Delgado, Jornet-Benito, Mateo Bretos, & Silvestre-Canut, 2022). They typically contain datasets about people: e.g., person-oriented collections or event-oriented collections which contain person as a critical element. A user-centered ontology design study of social studies teachers identified ‘people’ as a central category in cultural heritage domain ontology construction (M. C. Pattuelli, 2011b). However, existing ontologies in DH almost always focus on objects (e.g., documents or paintings) as their main items, and have less focus on representing individual people. For example, the cultural heritage object class in EDM, the event class in CIDOC CRM, and the work class in LRMoo.

Moreover, numerous difficult recognition problems with person-oriented data in DH collections need a concise and clear standard to solve them. For example, how to distinguish a person’s role in different events? A person’s roles in different events would change in different temporal and spatial situations, while this person might have an invariable professional role. For example, a professor could be the stage manager in one performing art event. In addition, different terminologies, different granularities, and different expressions in existing ontologies could also lead to some mismatching when linking persons in various DH collections. For example, the same person would have different name expressions in different languages, and even the words’ amount and space position showed various in different databases (McKay, Sanchez, & Parker, 2010).

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Existing biographical ontologies and metadata standards that are commonly adopted could be a reasonable starting point to build a promising person-oriented ontology, but they are scattered in different dimensions which are hard to reuse directly. To some extent, the right person-oriented ontology could model these difficult representation and identification problems, but the DH field lacks a single, comprehensive and precise person-oriented ontology. In this case, we decided to utilize metadata schemas from practical people-centered DH collections to analyze and polish existing biographical ontologies, which is a semantic mapping method.

Metadata crosswalk is a method for analyzing how to transfer metadata from source metadata schemas to target metadata schemas, that contains semantic mapping and metadata conversion (Xu, Hess, & Akerman, 2018). In the digital library and cultural heritage fields, many studies have adopted metadata crosswalk as an essential metadata mapping method to accomplish interoperability among different conceptual models (Barroso, Hartmann, & Ribeiro, 2015; Gaitanou, Andreou, Sicilia, & Garoufallou, 2022; Gaitanou, Bountouri, & Gergatsoulis, 2012). But identification problems in practical data are still remained if only use lexical metadata crosswalk due to lack of enough semantic explanation (Ryan, Zhang, Durward, Matusiak, & Organisciak, 2020), such as the recognition problem about different people in the same names (Katsurai & Ohmukai, 2019). The properties about name could be unified by lexical metadata crosswalk, but people with same names need more semantic relations to be identified.

Mapping similar ontologies and their equivalent elements would increase the practical matching accuracy in DH collections, but it is complex to align all different aspects among multiple ontologies (Jett, Nurmikko-Fuller, Cole, Page, & Downie, 2016; Nurmikko-Fuller et al., 2015). Thus, we developed an ontology-based metadata crosswalk method to find a way to balance availability and accuracy. We use three research questions to analyze existing person-oriented ontologies:

What are the practical problems of existing DH biographical ontologies?
What are the key elements of person-oriented ontologies in DH collections?
How to construct a high-quality person-oriented ontology for DH?

This paper has five main sections to answer these three questions. Firstly, we review the person-oriented ontologies analysis literature. Secondly, we explain the metadata crosswalk method and data source in the methodology section. Thirdly, we present our results on the key elements and gaps about person-oriented ontologies that answer research question 1 and 2. Fourthly, we discuss the essential person-oriented ontology elements and construction methods to answer research question 3. Finally, we conclude our contribution in this paper and suggest avenues for future work.

LITERATURE REVIEW

Ontology, as a subset of taxonomy, goes beyond describing hierarchy and includes relationships between concepts within a specific domain. In the context of the Resource Description Framework (RDF), ontologies provide vocabularies for defining the basic elements of subject, predicate, and object. Building ontologies in DH could help reveal and organize heterogeneous and dynamic cultural information (Usiskin et al., 2019). In this section, we demonstrate the existing biographical ontologies in the DH field and review some related ontology analysis work.

Existing Biographical DH Ontologies

In this section, we illustrate existing biographical DH ontologies that are analyzed in this paper. These ontologies include:

Friend Of A Friend (FOAF): FOAF defines machine-readable webpages of people, organizations, and companies. Terms about people in FOAF can be divided into five categories: basic information, personal information, online accounts, projects and groups, documents and images. In FOAF, foaf:Person is the subclass of foaf:Agent, and foaf:Agent consists of person, group, and physical artifacts. In the DH domain, FOAF is reused frequently to present person-oriented relations because FOAF is simple and widespread enough to represent friends and acquaintance connections among people (C. Pattuelli, 2012).

A Vocabulary for Biographical Information (BIO vocabulary): The BIO vocabulary reused the term foaf:Person, and added event-related classes and properties to describe biographical information about the person. BIO lists detailed types of biographical events, such as Adoption, Divorce, and Retirement. There are three sorts of properties of the event: first, descriptive information of an event, such as date, place, and person’s position in this event; second, the person’s role in an event, such as a parent, partner, employer, or spectator; third, relations between different events, such as following the event and concurrent event. In the DH domain, event-centric ontology mapping is essential to semantic translate DH collections. CIDOC CRM is the most sophisticated ontology reused in many DH projects (Bruseker, Carboni, & Guillem, 2017).

An Extension of CIDOC CRM to the Biographical Domain (BIO CRM): BIO CRM extends CIDOC CRM by using a role-centric method to model a person’s life stories. BIO CRM defines three categories of properties to illustrate
all related elements around the person’s life. Firstly, attributes about a person’s characteristic information, such as name, birthtime, birthplace. BIO CRM defines gender, nationality, and occupation as the subclasses of bioc:Unary_Role. Secondly, relations between the person and other classes. Bio CRM has three key relations: family relations, achievements, and career roles (Leskinen, Tuominen, Heino, & Hyvönen, 2017). BIO CRM use bioc:Binary_Relationship_Role to define family relationships, social relationships, and group relationships. Thirdly, events include a person’s different roles happening in specific times and places. BIO CRM directly adopted the representation of the event in CIDOC CRM, using cidoc:P7_had_participant to link event and person, using cidoc:P4_has_time-span and cidoc:P7_took_place_at to describe place and time of the event separately.

The Person Part of Categories for the Description of Works of Art (CDWA): CDWA was built to describe and catalog different cultural works through a conceptual model. CDWA includes lots of different categories but identifies the minimum core elements. The person is a core type in CDWA, and core sub-elements of person are name, name source, display biography, birth date, death date, nationality, and life roles. In CDWA person-related elements, the relations among persons have also been illustrated, such as the date of life roles, the date, and place of person events, and the type and date of personal relationships. In DH, the most impressive crosswalk is the CDWA metadata crosswalk from the Getty research institute, which contains 14 metadata schemas about culture data, even though the CDWA metadata crosswalks include hierarchical lexical elements but not semantic metadata crosswalks with multiple relationships. Using CDWA as one of our target data is valuable for further interoperability with other ontologies in DH-related fields.

The Person Part of DBpedia ontology: DBpedia ontology is based on, and automatically extracted from Wikipedia person data. Therefore, it has detailed data classes about a person: e.g., different person roles, such as artist, writer, or architect. In DBpedia, even hair color can be defined as a property of a person. Although the DBpedia ontology lacks logical consistency and semantic hierarchy, many DH projects have used it to help identify persons in their own DH collections (C. Pattuelli & Rubinow, 2013).

Previous Work of Biographical DH Ontologies Analysis
Since the development of DH collections, more and more researchers have found potential value in person elements. Some person-oriented ontology mapping studies in DH have revealed the linkable properties of ‘person’. For example, Pattuelli (M. C. Pattuelli, 2011a) has done a systematic vocabulary mapping to investigate equivalent properties among nine person-related ontologies in DH, and divided these properties into their categories: personal information, online presence, as well as social and cognitive properties. Some other studies used the person as a linking trigger to enhance existing databases. DBpedia has an ample storage of person-related data and is updated dynamically by sourcing from Wikipedia. Thus, some studies used DBpedia as a tool to generate robust person datasets, such as a case study of Jazz Artist names (M. C. Pattuelli, 2012). In addition, FOAF is always used to present people connections, which could help explain complex relationships between people (C. Pattuelli, 2012). Langmead et al. (Langmead, Otis, Warren, Weingart, & Zilinski, 2016) tried to combine the six-degree network with FOAF ontology to improve the interoperability and flexibility of people relationship research in DH. Araújo (Araújo, 2016) has built an ontology of the person’s life story, especially for museum, by extending CIDOC CRM with DBpedia and FOAF. Due to some person-related concepts not being contained in CIDOC CRM, properties about gender, names, and person-image relations are extracted from FOAF; properties about religion, profession, education, and spouse are taken from DBpedia (Araújo, 2016).

There is some detailed and in-depth biographical ontology analysis in previous DH works. For example, Hyvönen’s research team has done some Actor ontology analysis about Finland Cultural Linked Data, such as BIO CRM, an event-based biographical ontology extent of CIDOC CRM (Tuominen, Hyvönen, & Leskinen, 2018), and created a data model for person names (Tamper, Leskinen, Tuominen, & Hyvönen, 2020). While this is a significant achievement, names in Finland are limited in form and content both linguistically and by the use of an approved name list for birth certificates. Hyvönen et al. (Hyvönen, Leskinen, Tamper, & Tuominen, 2018) made further contributions in 2018, when they built BIO CRM which clear distinguished attributes, relations, and events. They also presented three cases of applying BIO CRM. Their research demonstrated the validity of event-based biographical models, even though they still face problems when extracting relations from free texts and dealing with larger datasets.

Some studies focus on one aspect of person ontology. For example, GenderedCHContents ontology was built to represent specific elements of gendered concepts in cultural heritage field. It extended the Europeana Data Model by adding more classes and properties about gender (Kyvernitou & Bikakis, 2017). In 2020, Tamper et al. (Tamper et al., 2020) built a detailed data model, especially for the person’s names. In this person name ontology, they used NameUsage to describe some general characteristics of a name, such as a second name given due to marriage or a third name in a different language version. Furthermore, by practical cases analysis, the suffix of name, a person’s vocation, and genealogical research could also help name linking (Tamper et al., 2020).
Finally, there are some socio-technical problems for person metadata in practical DH collections, especially regarding name and gender. We found person’s name varies according to migration, pseudonyms, indigenous names, and legal name changes e.g., divorce or marriage (Sumner, Fensham, Cutter, & Mendelssohn, 2022). Compilers in different datasets would make different decisions about the display name (Cutter, Sumner, & Fensham, 2023). Gender transitions are also an important problem that causes ambiguity about names and creates a situation where the person concerned may not wish to have the two names linked (T. Wagner, 2022). These problems reflect the necessity of biographical ontology because the ontology uses not only name and gender to identify people but also multiple relations about people, such as family relations. Completing and improving person-oriented ontologies would help further understand and represent person metadata in realistic datasets.

METHODOLOGY

In this study, we use the metadata crosswalk as a key method to analyze person-oriented ontologies by mapping person-oriented metadata schemas in DH collections. Through our literature review, we selected BIO CRM, CDWA, FOAF, BIO vocabulary, and DBpedia ontologies as source material. In this section, we introduce the ontology-based metadata crosswalk method and three practical DH collections.

Ontology-Based Metadata Crosswalk

Metadata issue is a socio-technical problem which is always caused by tools, knowledge, organization, and people issues (Khoo & Hall, 2010). Metadata management is a crucial way to determine the granularity and structure of cultural databases. Metadata has different functions such as descriptive metadata, technical metadata, preservation metadata, rights metadata, structural metadata, and mark-up languages (Kartawihardja, Pee, & Zakaria, 2019).

Metadata crosswalk is a method to aggregate different metadata standards and better manage multisource cultural data. The metadata crosswalk is defined as mapping equivalent elements in different metadata schemas to allow systems to interoperable convert data (Chan & Zeng, 2006). Interoperability among multiple DH collections can be achieved through metadata crosswalks (Woodley, 2008). Metadata crosswalk development has different steps in previous works: verification of metadata actual use in datasets, identification of existing ontologies, and definition of metadata crosswalk (Barroso et al., 2015).

Several previous works have demonstrated DH scholars using the metadata crosswalk method to map one dataset’s metadata schema or one ontology to other ontologies. For example, Chen et al. used FRBRoo as a shared ontology to integrate different metadata in two museum collections, and a metadata crosswalk between Dublin Core and FRBRoo was done (Chen & Ke, 2013). Mapping traditional DH metadata standards such as Dublin Core and Encoded Archival Description to CIDOC CRM is also valuable in DH field (Doerr, 2000; Stasinopoulos et al., 2007). However, there is no systematic “ontology to ontology” metadata crosswalk research in DH. Instead, previous work focuses on converting lexical elements to ontology. Chen (Chen, 2015) has done an RDF-based metadata crosswalk to transfer equivalent elements in DC, EAD, and CDWA to RDF format (Chen, 2015). The Library of Congress has done a metadata crosswalk to transition MARC to BIBFRAME (Xu et al., 2018). With the development of semantic DH, there were lots of existing DH ontologies to enhance the semantic explanation in DH collections, and emerging more and more born RDF DH collections (Usiskin et al., 2019). It is complicated to use a traditional metadata crosswalk to satisfy the requirements of DH ontologies mapping (Khoo & Hall, 2010).

Ontologies often have hierarchical classes and different properties and relations among them, only using the “elements to elements” mapping method of metadata crosswalk would not represent the equivalent semantic relationships behind metadata elements.

Thus, we developed an ontology-based metadata crosswalk for the person-oriented ontologies analysis. Ontologies predominantly contain classes, object properties, and data properties. Compared with metadata, ontologies focus more on the content level by defining basic concepts and their relations, but without the description of the data resource (Stasinopoulos et al., 2007). This paper maps different person-related elements in practical DH collections to existing biographical DH ontologies. Our ontology-based metadata crosswalks focused on specific content and descriptive metadata that representing classes and relationships of different concepts related to people. Thus, we not map other administrative or structural metadata, including compliance and versioning data (Wu et al., 2022). In this paper, ontology-based metadata crosswalk construction was undertaken in four steps:

1. Metadata harvest and cleaning from DH collections (semi-automatically by developers)
2. Biographical ontologies selection through literature review
3. Mapping DH collections’ metadata schemas to biographical ontologies (manually by domain experts)
4. Identification and analysis of different elements in ontology-based metadata crosswalk
**Metadata in DH Collections**

Due to the complexity of different existing biographical ontologies, we decided to use practical DH collections to examine and analyze them. For this metadata crosswalk, we selected three mature DH collections with rich person-related properties. We now outline the person-related content of the three collections. We selected these three DH collections very carefully, not only person-oriented collections but also event-oriented collections with person as an important centric item. These collections vary in different levels of DH topics, but all contain rich metadata about a person. These three DH collections are partners of the projects Australian Cultural Data Engine (ACD-Engine) we participated in; thus, we can get access to the whole metadata scheme of them. One of the key purposes of ACD-Engine project is to aggregate different cultural ontologies to broaden the scale and accessibility of cultural collections.

The Australian Live Performance Database (AusStage) is a database about performing arts. As AusStage is an event-oriented database, the person element is represented as a contributor (to an event). AusStage mainly uses three relations to enrich an event, contributors to this event by functions, the event occurring venues, and organizations involved in this event. For each contributor, AusStage contains basic biographical information and related events, people, and organizations. Furthermore, events in AusStage identify their time and place.

Design & Art Australia Online (DAAO) is a biographical dataset of artists. For biographical data, it contains not only some basic metadata, such as name, gender, birth date, and birthplace, but also specific metadata about this dataset, such as detailed roles of different artists, active period, and indigenous information. DAAO also contains other relations about artists which could link to other data, such as the related people, groups, works, exhibitions, collections, and recognitions. For exhibitions, DAAO contains the date and place of the exhibitions.

Digital Archive of Queensland architecture (DAQA) is a biographical archive of the architecture containing architects, firms, projects, articles, and interviews. For architects, the primary biographical data is in the biography text. Relations of architects contain related architects, firms, and projects. Each relation in DAQA could be identified by its date and shown in the timeline of this architect. Project often has date and location information and associated firms and architects.

In conclusion, these three DH collections metadata schemas contain abundant person-related information, which can supply the required fundamental elements to construct an ontology-based metadata crosswalk. We report the details and outcomes of this metadata crosswalk in the result section.

**RESULTS**

This study adopts the ontology-based metadata crosswalk methodology. Specifically, we choose basic elements in ontology to express and indicate equivalent metadata mapping at the semantic level. An ontology comprises individuals, classes, and properties. Classes are interpreted as sets of individuals, and properties mean their relationships. Object properties represent relationships between individuals. Datatype properties link individuals to data values, such as an XML schema data value or an RDF literal. Conceptually, the ontology-based metadata crosswalk only consists of classes, object properties, and datatype properties.

The core class in this paper is ‘person’, even though some different names given to the class. In AusStage, the person is presented as a ‘contributor’ because of its focus on events, while some existing ontologies use ‘Agent’ for both persons and organizations. During constructing this ontology-based metadata crosswalk, we found that person-oriented elements could be divided into three types. Firstly, the basic elements of the person class are always represented as the datatype properties in ontology (see Figure 1). Secondly, relations between the person class and other classes are object properties in ontology (see Figure 2). Thirdly, explanatory elements about biographical data, which means there are further interpretive properties upon unitary properties about the person class (see Figure 3). In order to clarify ontologies from our DH collections and standard ontologies, the elements from standard ontologies all have capitalized initial letters.

We demonstrate the details of these three types in the following sections. Because we choose metadata in DH collections as the starting point to analyze existing ontologies in this metadata crosswalk, all conceptual elements in DH collections metadata schemas are presented in this crosswalk, while only elements that could be mapped onto these schemas in biographical ontologies are selected.

**Basic Elements**

In this paper, the basic elements of person-oriented ontologies are biographical datatype properties, which form the essential person description. In this metadata crosswalk, basic elements mainly contain person ID, name, gender, nationality, role (occupation), place, birth, death, language, biography text, and supplementary information. Through the investigation of different standards, we found extensive heterogeneity between schemas, such as different terms for the same property, different metadata granularity, and different data explanation orientations. Thus, it is necessary to compare and analyze the basic elements in various ontologies.
The name elements in practical DH collections are fine-grained. For example, DH collections often make a clear classification of first name and last name, and they often contain display name and alternative names metadata. However, existing biographical ontologies (other than FOAF) lack detailed concepts to represent different name formats. BIO CRM has an official name and alternative name classes but uses appellation to interpret details about the name component. BIO CRM simply uses strings to represent the main (‘display’) name and alternative names, which could simplify the compilation of large-scale datasets. Practical databases might not contain all alternative names of any given person. In contrast, dividing up name details will help identify more format changes about the same person, thus enhancing the accuracy of name matching in different datasets. More specifically, if one woman’s surname changes because of marriage and is presented as a new display name in another collection, this woman would be matched because the name details of both unmarried and married names are present.

Place elements consist of the current address of the person, which could contain country, state, or suburb. In existing ontologies, BIO and DBpedia only represent state, and BIO CRM uses E53_Place as the umbrella term to represent different geological information containing basic address metadata. CDWA and FOAF lack classes to represent biographical places.

In DH, birth and death are essential biographical elements and they are always represented as specific places and dates. Almost all existing biographical ontologies support the same details for this category except FOAF. In addition, CIDOC CRM represents birth and death as events, using P4_has_time-span and E52_Time-Span to represent date, uses P7_took_place_at and E53_Place to represent place. In order to be more concise, BIO CRM adopted birth_place and birth_time properties instead of the event-oriented representation in practical cases (Leskinen et al., 2017).

Two practical DH collections, DAAO and DAQA, contain biography as an element in their metadata schema. Biography often contains the details of a person’s life story and is represented in text format on the website of DH collections. Even though some known contents are represented in other elements, some working DH collections use unstructured biography text to enrich the basic information about a person. However, in existing biographical ontologies, only BIO vocabulary has a biography class.

In conclusion, for basic elements, different biographical ontologies have different priorities. Through our analysis, BIO CRM is the most completed biographical ontology, which is suitable to represent DH collections. However, we need to add more datatypetype properties to BIO CRM, such as biography and details of the name and place element.

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Figure 1. Basic Elements of Person-Oriented Metadata Crosswalk
Relational Elements
In this study, relational elements refer to object properties that express different relationships between the person and other classes. Through our metadata crosswalk, we found that there are almost consistent relational elements in different DH collections. These three DH collections shared relational elements are relationships between a person with other **persons**, **organizations**, **events**, and **works**. These four elements are contained in almost all the existing biographical ontologies in this paper, even though they might have different terminologies. There are some different elements in the three DH collections that give more possibilities about relational elements in person-oriented ontologies.

Firstly, in AusStage and DAAO, the resource of **collection** is an essential relation of the person because DH collections often do not contain original data but rather knowledge processed by domain experts (Fenlon, 2019). The collection is also emphasized in Digital Library, and Dublin Core defines collection as the aggregation of physical or digital items (Wickett, Renear, & Furner, 2011). In existing biographical ontologies, only BIO CRM reused the E78_Curated_Holding to represent collections. However, the collection plays a vital role in practical DH collections exchanging and sharing, which means DH collections are more referential collections rather than directly holding data (Wickett et al., 2013). Identifying collection in biographical ontology would give more original information about the person from different data sources.

Secondly, in DAAO and DAQA, they contain the relationship between the person and their **recognitions**, which are only contained in DBpedia in existing biographical ontologies. The possible reasons are the applicability of different ontologies, and the award could be one sort of event. Though each ontology has an event class, representing and identifying events is difficult in practical DH collections construction because of their different project objectives. BIO CRM aims to use a person’s different role in the function of an event to link the relationship between person and event and further identify the specific event. Through the three DH collections, we found there might be some types of events that have common modes which need to be identified as a new element.

Thirdly, DAQA uses the **topic** as a relational element about the person element, while the topic is not shown as an independent property in existing biographical ontologies. However, the topic is always a key element in library collections catalogs (Zavalina, 2014). Similarly, the topic is important in DH collections website navigation, and the subject is an essential element in Dublin Core, a metadata standard frequently reused in DH collections.

Finally, the range and border of **production** property and **work** property need to be paid attention to. In existing ontologies, BIO CRM uses E12_Production to represent the activity event of creating a new item. E12_Production is represented as a temporal event rather than an object due to the event-oriented objective of CIDOC CRM. However, in practical DH collections, AusStage uses ‘work’ to represent inherent creation without temporal limits and uses ‘production’ to describe a different version of the work. DAQA uses more detailed production categories such as ‘project’ and ‘publication’, which mirror ‘pastProject’ and ‘document’ in FOAF. Thus, in existing biographical ontologies, it is necessary to add ‘work’ as an essential relational element and to use ‘production’ to represent temporal and special supplemented information about creative work. For example, the **work** is the original script, while a specific copy of this script is a **production** with version identification. Thus, production is a specific performance of that work in specific DH collections.

In conclusion, extracting more relational elements about persons in practical DH collections would extend person-related context in existing biographical ontologies. Constructing a comprehensive and transparent relations network about persons would help DH practitioners map multiple data sources and contents easier and give the end users a better browsing experience because they could gain related knowledge more smoothly.

![Figure 2. Relational Elements of Person-oriented Metadata Crosswalk](image-url)
Explanatory Elements

The final core elements category of this person-oriented metadata crosswalk is explanatory elements, and this is the final part of this crosswalk. In other words, some datatype properties or object properties of the person class need not be restricted in a single link but need more interpreted attributes to enrich their link. For example, we need more descriptions about person-related events. Not only the event itself should be represented, but also represent happening place and date of this event. In practical DH collections, we found it is not enough to represent basic elements and relational elements about person because information about people is changing according to different situations. Some existing DH ontologies have already found this issue and tried to represent these elements to solve it. For example, BIO CRM takes the event as a particular element involving participants in different roles and identifies them with space and time (Tuominen et al., 2018).

However, there are more elements, like events that need to have detailed explanatory information. We found four types of explanatory elements mentioned in our three DH collections and existing biographical ontologies.

Career is the most frequent explanatory element about the person class to represent person’s role in different period, which uses start date, end date and place to add more information. If one person has different occupations in different period and places, it would be easy to see the career changes.

Event is also an important explanatory element and event-related illustrated information consists of event type, function, date, and place. To be more specific, residences, training, and education explanatory elements are mentioned in two DH collections and DBpedia but hardly show detailed events items in other existing DH biographical ontologies. This phenomenon shows that there might be a gap between top-down ontologies and bottom-up database metadata schemas.

We found that the active period of a person appeared in DAAO and DAQA, expressed by a date range. However, it is hard to represent this explanatory element in existing ontologies because there is no straightforward concept in excising ontologies. It could be one kind of event or topic only consisting of temporal explanation.

Finally, the related person is an important explanatory element found in the schemas but not recorded in that way in any DH collection. CDWA applies relationship type and relationship data to represent a person’s relations with other people and groups. BIO CRM gives a specific classification of different social relationships around people to people. These sorts of person’s relationships show the power of ontology.

![Figure 3. Explanatory Elements of Person-Oriented Metadata Crosswalk](image)

DISCUSSION

In answer to RQ1, “What are the practical problems of existing biographical DH ontologies?” We found three key issues of existing biographical ontologies. Firstly, problems caused by heterogeneity between existing ontologies, such as different terms for the same class or property. Secondly, different granularity used to represent the same elements in different standards, especially regarding the time range of events. Thirdly, there is a gap between how
existing biographical DH ontologies and practical DH collections represent the same concepts, such as more detailed representation of creative production in DH collections than found in the schemas.

To answer RQ2, “What are the key elements of person-oriented ontologies in DH collections?” We now discuss the inadequate elements of biographical ontologies.

Even for basic elements, FOAF, BIO vocabulary, and DBpedia each lose important descriptive information about persons. BIO CRM and CDWA were created for cultural data description and comprehensively provide the basic elements about a person. The only consistent difference between basic elements in practical DH collections is the chosen granularity used to represent a person’s name. The fine granularity of name attributes in small-scale DH collections, combined with varying practices, shows that we need to consider how to align representations when working with multiple collections. Since using an ontology-based method provides more possibility of a person matching through diversity links, such as family relationships and specific events, we could consider distinguishing more details about names in person-oriented ontologies to help improve name management problems (McKay et al., 2010).

For relational elements, we found multiple relations among persons and other classes in practical DH collections. This shows that ‘person’ is often the pivotal class for linking knowledge in a collection. However, existing biographical ontologies lack the ability to capture those rich relationships found in the practical DH collections. CIDOC CRM is an event-centric ontology and consists of rich relations about cultural events. BIO CRM has extended that concept by adding comprehensive relational elements around the concept of person. Through the metadata schemas of practical collections, we found recognition could be one special relational element about a person (e.g., receiving an award). Though recognition could be one type of event, it is valuable to represent specific rewards or statuses of people. In addition, just one practical DH collection (DAQA) represented place as a relational element. In existing ontologies, only BIO CRM has the place as a relation of person. This argues against adding place as a relational element in a final model, because place could be contained in other properties. Practical DH collections always have their own small topics, and DAQA used the topic as a relational element. However, there is scant support for the topic in existing DH ontologies. From practical DH collections, we found the topic could be one potential relational element to include in a unifying model.

For explanatory elements, BIO CRM gives a particular explanation of role-centric modeling of events, which can use the person’s different roles in different events to enrich prosopography. Events are also characterized by place, time, and type. One of the practical DH collections also used this method to represent people-related events by using a person’s role as the event function. CDWA uses person’s relationships as an explanatory element that contains type and date of different relations among persons or groups. BIO CRM also targets a person’s social relationships as an important aspect of their life story. In practical DH collections, a person’s career plays an important role, which contains the start date, end date, and place. This type of explanatory elements also be emphasized in some existing biographical ontologies. However, the granularity of events differs in different standards, and there are more detailed events in practical DH collections. As the scope of the event is a complex problem in the DH field (Tuominen et al., 2018), identifying the type of event in person-oriented ontology construction is necessary.

In order to answer RQ3, “How can we construct a high-quality person-oriented ontology about DH?”, we found it would be easier to map complex elements in different ontologies by using the ontology-based metadata crosswalk. All content elements in the three DH collections could be identified as one of the three types in the metadata crosswalk. Thus, we summarize the three types of elements into a person-oriented ontology construction guide (see Figure 4). Through this guide, a DH developer could use the right box to identify datatype properties about a person, use the left box to link other relations, and use supplementary data properties to further enrich a person’s occupation, event, and relations with other people. This also provides a foundation for making different DH schemas interoperable and consolidates the current core concepts into a single guide.
CONCLUSION
In this paper, we contribute a comprehensive and systematic analysis of person-oriented ontologies using the metadata crosswalk method. In past ontology development and application research, the person class has not been a central element in DH ontology construction; collections such as digital libraries mainly focus on the description of documents and collections. Our paper offers a person-oriented ontology analysis which could lead to the person-centric ontology development.

In addition, we developed an ontology-based metadata crosswalk, which consists of basic elements, relational elements, and explanatory elements. We used a conceptual chart to give a summary of these elements. By using our ontology-based metadata crosswalk, DH researchers can easily identify different terms and expressions related to their person-oriented data. Through our analysis, DH researchers and practitioners would gain the prime and first steps for person-oriented ontology construction. Our analysis reduces the gap in current biographical ontological mapping by drawing on the evidence of real-world data formats. Furthermore, there are few previous studies using the ontology-based metadata crosswalk method. Our paper gives an instruction for using ontology property types to improve the semantic ability of the metadata crosswalk method.

Due to the complicated and time-consuming work of evaluating the metadata organization of large-scale DH collections, we have analyzed only three DH collections. More complex issues may be hidden in other DH collections’ data on people. The selected DH collections in this paper focus more on contemporary persons, while many existing DH ontologies focus on cultural heritage. However, today’s contemporary culture is tomorrow’s cultural heritage, so analyzing contemporary people-related metadata elements to improve DH ontologies is still of value for long-term planning. Contemporary culture also presents the issue of living people, who may have preferences and requirements about their representation, such as a requirement not to deadname (publicly describe a person using their former name) in the context of gender transition (T. L. Wagner, Marsh, & Curliss, 2023). Even though some socio-technical problems (such as the transition example noted above) are not addressed, the three key element types identified in this paper provide a concrete foundation towards constructing high-quality person-oriented ontologies that can be interlinked with other sources. In the future, we will choose the most capable and practicable existing biographical ontology to do a more specific analysis and improve on the results in this paper. Mapping data in practical DH collections to evaluate the viability of ontological data in real-time is also planned.

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Negativity Bias During Information Seeking, Processing, and Sensemaking about a Policy Debate: An Eye-tracking Experiment

Liu, Yingtong | Peking University, China | yingtong66@stu.pku.edu.cn
Zhang, Jiajia | Peking University, China | 2000016657@stu.pku.edu.cn
Zhang, Pengyi | Peking University, China | pengyi@pku.edu.cn

ABSTRACT
Negativity bias is the tendency to pay more attention and give more weight to negative information than positive information. This study explored how negativity bias affects information search, processing, and sensemaking when reading news articles on controversial topics. We conducted an eye-tracking experiment with 43 participants who sought and read positive and negative articles about the three-child policy debate. We measured their eye movements, cognitive load, attitude change, and sensemaking outcomes. We found that: (1) negativity bias occurs in both information search and information processing, and the outcomes of sensemaking also tend to show negative changes; (2) reading positive articles increase cognitive load more than reading negative articles; (3) gender and prior attitude have an influence on negativity bias; (4) people use different cognitive strategies when making sense of positive and negative information. This paper contributes to a better understanding of negativity bias in information seeking, processing, and sensemaking, which can help design news systems that adapt to readers' needs, and suggests people view information objectively.

KEYWORDS
Negativity bias; Information seeking; Sensemaking; Attitude change; Three-child policy

INTRODUCTION
We live in an increasingly polarized world, where information is abundant and diverse, but also often negative. Negative news tends to dominate the media coverage of controversial topics, while positive news is seen as less newsworthy (Lengauer, Esser, & Berganza, 2012; Soroka, Fournier, & Nir, 2019). Moreover, audiences tend to be more attracted to and affected by negative information than positive information of equal importance. This phenomenon is known as negativity bias, which refers to negative events having a greater impact than positive events of objectively equal magnitude (Lazarus, 2021; Rozin & Royzman, 2001).

There are several explanations for negativity bias. A range of explanations concerns evolution and they generally follow from the same assumption: the observed asymmetries are a consequence of the asymmetry of positive and negative outcomes (Unkelbach, Alves, & Koch, 2020). The main idea of evolutionary explanations focuses on the threat (Lazarus, 2021; Unkelbach et al., 2020). It’s believed that due to natural selection, organisms that were more sensitive to negative stimuli had a greater chance of surviving threats, increasing their likelihood of passing their genes on to future generations (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Öhman & Mineka, 2001). What’s more, differential similarity (Unkelbach et al., 2020), perceptual salience (Skowronski & Carlston, 1989), and the like also have been proposed to explain negativity bias.

Negativity bias has been widely observed and studied in various fields such as psychology, economics, political science, and communication (Baumeister et al., 2001; Kenney & Kahn, 2002; Klein, 1991; Soroka & McAdams, 2015; Tversky & Kahneman, 1991). There are also studies from the perspective of information behavior. For example, negative information is more likely to be selected (Bachleda et al., 2020; Meffert, Chung, Joiner, Waks, & Garst, 2006), attracts more attention (Fiske, 1980; Pratto & John, 1991) and has a greater effect on cognition (Christenson & Glick, 2018; Grosskopf & Mondak, 1998). Many factors are related to negativity bias, such as gender (Bachleda et al., 2020; Soroka, Gidengil, Fournier, & NIR, 2016), age (Bachleda et al., 2020; Kisley, Wood, & Burrows, 2007), education, personality traits (Bachleda et al., 2020), prior attitude (Knobloch-Westerwick, Mothes, & Polavin, 2017; Li, Li, & Zhang, 2021; van der Meer & Hameleers, 2022). However, very little is known about negativity bias during the whole process of information seeking, processing and sensemaking, and the differences in cognitive processing when reading positive and negative articles.

In this paper, we explore how people seek, process, and make sense of negative information differently from positive information. We review various theoretical accounts and empirical evidence of negativity bias at different stages of information seeking. We also examine the cognitive processes involved in sensemaking when people encounter positive and negative articles. We choose the recently implemented three-child policy in China as the topic under investigation. The policy allows couples to have up to three children, aiming to address the challenges of...
an aging population and a low fertility rate. It has also sparked public controversy and debate since its announcement in May 2021. Our research questions are as follows:

**RQ1.** Does negativity bias occur during information seeking, information processing and sensemaking?

**RQ2.** How do demographic and prior attitude factors influence negativity bias?

**RQ3.** Do people show different cognitive patterns of attention when reading positive and negative articles?

This paper is organized as follows: We first review the literature on negativity bias and information seeking. Then we describe the experiment design, data collection and analysis methods. Finally, we present the findings, discuss their implications and limitations, and conclude the paper.

**LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT**

**Information Seeking, Information Processing and Sensemaking**

**Information seeking**

‘Information seeking behavior is the purposive seeking for information as a consequence of a need to satisfy some goal’ (Wilson, 2000). In the face of information overload, people have to allocate their cognitive resources rationally during information seeking, then biased information consumption occurs. Negative information is more likely to be selected (Bachleda et al., 2020; Meffert et al., 2006). Negativity bias may occur at different stages, including the perceptual process, judgment and retrieval of information from memory. Explanations for negativity bias vary at different stages (Kanouse, 1984). Furthermore, to cope with the uncertainty and threats attributable to news negativity, people tend to seek additional information, and highly negative news will induce more active information seeking behavior than weakly negative news (Park, 2015). Therefore, we propose the following hypotheses:

**H1a.** Negativity bias occurs during information seeking.

**H1a.1.** Participants select more negative articles than positive ones.

**H1a.2.** Participants select negative articles earlier than positive ones.

**H1a.3.** Participants read an individual negative article more often than a positive one.

**Information processing**

Previous research found that negativity bias often occurs during information processing and the negative advantage is reflected from attention, memory, person perception and impression formation, to attribution (Unkelbach et al., 2020). Negative information may be more "attention-grabbing" (Fiske, 1980; Pratto & John, 1991). For example, the experiment negative information interferes more strongly with the primary color naming task than positive information, which supports the attention advantage for negative information (Pratto & John, 1991); during a mock election campaign, voters seek more, spend more time reading, and recall more negative than positive information about political candidates (Meffert et al., 2006). Eye-tracking is a research method that uses an eye-tracker device to track the point of gaze or eye movement of an individual while executing a task (Borys & Plechawska-Wójcik, 2017). It has become a widely-used method to study the attention of a subject while performing various tasks (Kätsyri, Kinnunen, Kusumoto, Oittinen, & Ravaja, 2016; Möller, Baumgartner, Kühne, & Peter, 2021). Therefore, we propose the following hypotheses:

**H1b.** Negativity bias occurs during information processing.

**H1b.1.** Participants spend more time reading an individual negative article than a positive one.

**H1b.2.** The participants’ average fixation duration (AFD) is longer when reading negative articles than positive ones.

**H1b.3.** The participants’ average pupil diameter (APD) is larger when reading negative articles than positive ones.

**Sensemaking**

Sensemaking is the process of forming meaningful representations and utilizing them to develop comprehension, thereby enabling an individual to plan, make decisions, tackle problems, and generally act in an informed manner (Pirolli & Russell, 2011; Zhang & Soergel, 2019). The overall process of sensemaking can be seen as iterations of "information seeking–sensemaking" and may lead to three kinds of outcomes that update the conceptual structure: accretion, tuning or radical restructuring (Zhang & Soergel, 2014). Further, the update of conceptual structure related to a topic may result in a shift in attitude towards it.

Some literature concerning the Court showed the influence of negativity bias on the outcome of sensemaking. For example, disagreement with one or both edicts considerably reduced confidence in the Court, but agreement with both edicts brought only a marginal gain in confidence (Grosskopf & Mondak, 1998); disfavored decisions will have
larger negative effects on legitimacy than favored decisions will have positive effects (Christenson & Glick, 2018). It
seems that the effects of positive and negative information on cognition are asymmetric. One type of negativity
bias is negativity dominance, which means that the evaluations of combinations of negative and positive entities are
typically more negative than the algebraic sum of individual subjective valences (Rozin & Royzman, 2001).
Therefore, we propose the following hypothesis:

H1c. The participants’ attitudes towards the three-child policy change negatively.

Factors Related to Negativity Bias
There was a lot of work illustrating that negativity bias varies across individuals. Specifically, negativity bias was
found to correlate with characteristics such as gender (Bachleda et al., 2020; Soroka et al., 2016), age (Bachleda et
al., 2020; Kisley et al., 2007), education, income, political ideology, the Big 5 personality traits (Bachleda et al.,
2020) and prior attitude (Knobloch-Westerwick et al., 2017; Li et al., 2021; van der Meer & Hameleers, 2022).
Therefore, we propose the following hypothesis:

H2. Negativity bias is associated with gender, education and prior attitude.

According to the “selectivity model”, females are comprehensive information processors and males are selective
information processors, which means that females tend to focus on both subjective and objective product attributes
and respond to subtle cues, while males are inclined to use heuristics processing and miss subtle cues (Darley &
Smith, 1995). Related to negativity bias, while women show less negativity bias when seeking for information
(Bachleda et al., 2020), they pay more attention than men when exposed to negative information (Soroka et al.,
2016). Therefore, we propose the following hypothesis:

H2a. Negativity bias is associated with gender.

H2a.1. Women show less negativity bias in information seeking.

H2a.2. Women show more negativity bias in information processing

There were a few studies discussing the influence of age on negativity bias. Some studies showed a decrease in the
magnitude of negativity bias in adults with advancing age (Carstensen & DeLiema, 2018; Kisley et al., 2007) and it
seemed to be caused by a gradual age-related reduction in responding to negative images (Kisley et al., 2007). Age
is significantly correlated with years of education (Kisley et al., 2007), but only a few studies have examined the
effect of education on negativity bias. Education seems to be negatively associated with negativity bias (Bachleda et
al., 2020). Therefore, we propose the following hypothesis:

H2b. Negativity bias is negatively associated with education.

People with negative attitudes are more likely to seek negative rather than positive news to confirm their negative,
which is called confirmatory negativity bias (van der Meer & Hameleers, 2022). The result is in keeping with
studies on confirmation bias in selective exposure literature, which agree that participants with a negative attitude
had stronger confirmation bias (Knobloch-Westerwick et al., 2017; Li et al., 2021). Therefore, we propose the
following hypothesis:

H2c. Negativity bias is positively associated with prior attitude.

Cognitive Mechanisms in Sensemaking and Material Type
Cognitive mechanisms in sensemaking are the mechanisms that are used in the process and trigger changes in
concept. They can be broadly categorized into two groups: data-driven (bottom-up) and structure-driven/logic-
driven (top-down). Data-driven mechanisms involve identifying patterns of data and building on the patterns of
similarities and differences to create generalized abstractions of knowledge structures. Structure-driven/logic-driven
mechanisms involve making arguments or reaching conclusions with knowledge schemas and logic (Zhang &
Soergel, 2019). In the articles in our study, title, source, time and claim are typical formats of information that show
the structure of the article, while little structured knowledge is available in other parts of the text.

In the field of communication, evidence is usually regarded as “factual statements originating from a source other
than the speaker, objects not created by the speaker, and opinions of persons other than the speaker that are offered
in support of the speaker's claims” and has the function of persuasion. (McCroskey, 1969). According to a review, a
lot of evidence research focus on comparisons of different evidence types (testimonial assertion, factual evidence,
statistics, and the like), but it seems that persuasive effects have no difference across evidence types (Reinard, 1988).
However, there seems to be no literature reported regarding the influence of evidential attitude on the information
processing of different types of evidence. The sections of sample articles in our study include different evidence
types, such as illustrations, statistics, opinions, and facts.
There is no consensus in classifying information format and evidence type in the literature, so we refer to them as material types generally. Therefore, we propose the following hypothesis:

**H3.** Participants focus on different types of materials when reading positive and negative articles.

- **H3a.** The participants’ average fixation duration (AFD) is different when reading the same type of material in positive or negative articles.
- **H3b.** The participants’ average pupil diameter (APD) is different when reading the same type of material in positive or negative articles.

**METHODODOLOGY**

**Participants and Task**

We recruited 50 students from 23 different departments in a major Chinese university as participants, and a total of 43 valid eye movement data were collected in the experiment. Valid subjects included 9 freshmen, 12 sophomores, 6 juniors, 6 seniors, 4 graduate students and 6 doctoral students. There were 13 males and 30 females. All participants had a normal or corrected-to-normal vision and were native Chinese speakers. They received compensation between 60-100 yuan for their participation. Since there is no standard IRB-like procedure required for this kind of research at our institution, we did not go through an IRB application process. However, we made sure that the research followed similar ethical rules to ensure participants’ protection and privacy.

We selected 10 news articles on the three-child policy from various online sources. Five articles supported the three-child policy and five opposed it. The articles were similar in length, readability, and structure. They consisted of 10 types of formats, including title, time, source, introduction, illustration, claim, statistics, opinion, fact and conclusion. Each type of information corresponded to one or more areas of interest (AOIs) that we defined for eye-tracking analysis. The articles were presented in a random order to reduce the order effect (Figure 1). Participants could click on the headlines to view the detailed pages of articles (Figure 2).

**Data Collection and Analysis**

We collected the following data:

1. Pre-experiment questionnaire: we collected the demographic data and assessed prior attitude position and attitude strength concerning the three-child policy through questionnaires. See the section “Measures” for details.

2. Eye movement data: during the experiment, a Tobii Fusion eye tracker (250 Hz) was used to record the participants' eye movements.

3. Final report: after the experiment, the participants would finish a report, including their post attitude towards the three-child policy, their opinions and suggestions. The question asking for suggestions was “Please summarize your understanding of the three-child policy based on the reading material, and give policy suggestions (no less than 250 words)”. 

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**Figure 1. List Page**
The eye-tracking and scale data were analyzed using the ErgoLab platform and IBM SPSS V27.0 software. We calculated several eye movement indicators for each AOI, such as average fixation duration and average pupil diameter. We used SPSS software to analyze the questionnaire data. We analyzed the experimental data using paired-samples T-test, paired-samples Wilcoxon signed rank test, Mann-Whitney U test, independent-samples T-test, one-way ANOVA test and Kruskal-Wallis test.

**Measures**

**Prior attitude**
To assess prior attitude strength, the questionnaire included similar items used in a previous study (Brannon, Tagler, & Eagly, 2007). The subjects indicated on 5-point scales how much knowledge they possessed on the three-child policy, how much they agreed that the three-child policy will help solve the population problem in China, how sure they were of their positions, how likely they were to change their attitudes, and how relevant the policy was to them.

**Negativity bias**
The negativity bias during information seeking, information processing and information are measured by the variables below:

1. The negativity bias during information seeking: number of selected articles (number of selected negative articles - number of selected positive articles), reading order (the average reading order of positive articles - the average reading order of negative articles), times of reading (the average times of reading negative articles - the average times of reading positive articles).

2. The negativity bias during information processing: reading time (the average time spent reading negative articles - the average time spent reading positive articles), AFD (one’s average fixation duration while reading negative articles - average fixation duration while reading positive articles), APD (one’s average pupil diameter while reading negative articles - average pupil diameter while reading positive articles).
3. The negativity bias during sensemaking: attitude change (post attitude – prior attitude).

The two variables related to eye movement are AFD (average fixation duration) and APD (average pupil diameter). Fixation refers to “a relatively stable eye-in-head position within some threshold of dispersion (typically ~2°) over some minimum duration (typically 100-200 mS), and with a velocity below some threshold (typically 15-100 degrees per second)” (Jacob & Karn, 2003). The length of fixation is a metric that is often applied in visual attention analysis and it’s generally believed that long fixation duration is correlated with high cognitive workload and higher cognitive effort (Borys & Plechawska-Wójcik, 2017; Jacob & Karn, 2003). The Pupil size indicates processing load and cognitive resource capacity (Kahneman, 1973). And there is a correlation between pupil response and emotional arousal that larger pupil diameter is associated with greater arousal (Gooding & Jackson, 2003).

**FINDINGS**

**Negativity Bias in Information Seeking**

In total, 29 of the 43 participants (67.4%) showed a negativity bias, seeking for more negative articles than positive articles. One subject selected only negative articles and no positive articles. Therefore, this subject was excluded from subsequent tests and the sample size was reduced to 42 (n=42). Seven participants (16.3%) showed no bias, selecting an equal number of negative and positive articles. Seven participants (16.3%) selected more positive articles than negative articles (Figure 3). We conducted a paired-samples Wilcoxon signed rank test and the results show that there is a significant negativity bias in the number of selected articles (Z = -3.754, p < 0.001). H1a.1 is supported.

![Figure 3. The Difference in the Number of Selected Articles](image)

In terms of reading order, 21 of the 42 participants (50%) showed a negativity bias, reading negative articles earlier than positive articles. Nine participants (21.4%) showed no bias, which meant that the average first reading order on negative articles was equal to that on positive articles. Twelve participants (28.6%) read positive articles earlier than negative articles. The results of the paired-samples T-test show that there is no significant negativity bias in the reading sequence (t = 1.414, p = 0.165). H1a.2 is rejected.

We did not limit the number of times the subjects read an article, so the subjects may read an article more than once and reinforce their ideas. In terms of the average number of times an article is read, 5 of the 42 participants (11.9%) showed a negativity bias, reading an individual negative article more often than a positive one. 33 participants (78.6%) showed no bias and 4 participants (9.5%) read an individual positive article more often than a negative one. We conducted a paired-samples Wilcoxon signed rank test and the results show that there is no significant negativity bias in times of reading (Z = -1.131, p = 0.258). H1a.3 is rejected. Therefore, H1a is partially supported.

**Negativity Bias in Information Processing**

In total, 26 of the 42 participants (61.9%) showed a negativity bias, spending more time reading an individual negative article than a positive one. 16 participants (38.1%) spent more time reading an individual positive article than a negative one (Figure 4). We conducted a paired-samples Wilcoxon signed rank test and the results show that there is a significant negativity bias in reading time (Z=-1.957, p = 0.050). H1b.1 is supported.
In terms of average fixation duration (AFD), 21 of the 42 participants (50%) showed a negativity bias, whose AFD is longer when reading negative articles than positive ones, and 21 participants (28.6%) saw the opposite result. The results of paired-samples T-test show that there is no significant negativity bias in the reading sequence ($t = 0.528$, $p = 0.600$). H1b.2 is rejected.

In terms of average pupil diameter (APD), 12 of the 42 participants (28.6%) showed a negativity bias, whose APD is larger when reading negative articles than positive ones, and 30 participants (71.4%) saw the opposite result. We conducted a paired-samples T-test. Contrary to the hypothesis, there is a significant bias that the participants’ average pupil diameter (APD) is larger when reading positive articles than negative ones ($t = 3.391$, $p = 0.002$), which means that the cognitive load is higher. H1b.3 is rejected. Therefore, H1b is partially supported.

**Negativity Bias in Sensemaking**

In total, 23 of the 43 participants (53.5%) changed their attitude negatively. 16 participants (37.2%) didn’t change their attitude and four participants (9.3%) changed their attitude positively (Table 1). We conducted a paired-samples Wilcoxon signed rank test. The results show that there is a significant negativity bias in attitude change ($Z = -3.290$, $p = 0.001$).

<table>
<thead>
<tr>
<th>Prior attitude</th>
<th>Post attitude</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely disagree</td>
<td>Completely disagree</td>
<td>2(4.65%)</td>
</tr>
<tr>
<td>Disagree</td>
<td>Completely disagree</td>
<td>4(9.30%)</td>
</tr>
<tr>
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</tr>
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<td>1(2.33%)</td>
</tr>
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<td>Completely disagree</td>
<td>1(2.33%)</td>
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</tr>
<tr>
<td>Agree</td>
<td>Agree</td>
<td>1(2.33%)</td>
</tr>
</tbody>
</table>

Table 1. Attitude Change
We consider information seeking to be balanced if the difference between the number of positive and negative articles read is less than or equal to 1, and there are 31 eligible samples. After balanced information seeking, 14 of the 31 participants (45.2%) changed their attitude negatively. 15 participants (48.3%) didn't change their attitude and 2 participants (6.5%) changed their attitude positively. We conducted a paired-samples Wilcoxon signed rank test. The results of paired-samples Wilcoxon signed rank test show that there is a significant negativity bias in attitude change after balanced information seeking (Z = -2.476, p = 0.013). Therefore, H1c is supported.

**Effects of Gender, Education and Prior Attitude**

First, we explored the influence of gender on negativity bias. Mann-Whitney U test and independent-samples T test show that gender has a significant effect on negativity bias in the number of selected articles (U = 94.5, p = 0.007) and APD (t = 2.206, p = 0.033) (Table 2). H2a.1 is partially supported. H2a.2 is partially supported. Both male and female participants selected more negative articles than positive articles, but the difference between the number of negative and positive articles selected by males is larger than by females (Figure 5). The APD of female participants was larger when they read positive articles than negative ones, while there was no significant difference between the APD of male participants when they read positive and negative articles (Figure 6). However, gender does not seem to have any impact on reading order (t = 0.863, p = 0.393), times of reading (U = 195.5, p = 0.851), reading time (U = 205.0, p = 0.667), AFD (t = -0.090, p = 0.928) and attitude change (U = 140.5, p = 0.151). H2a is partially supported.

![Figure 5. The Difference in the Number of Selected Articles Across Gender](image1)

![Figure 6. The Difference in APD Across Gender](image2)
We explored the influence of education on negativity bias. Results of the Kruskal-Wallis test and One-way ANOVA test show that education has no significant effect on negativity bias by any measure: number of selected articles (H = 4.588, p=0.101), reading order (F = 0.800, p = 0.457), times of reading (H = 2.408, p = 0.359), reading time (H = 3.440, p = 0.179), AFD (F = 0.295, p = 0.746), APD (F = 0.757, p = 0.476), attitude change (H = 2.160, p = 0.340). H2b is rejected.

We conducted a Kruskal-Wallis test and a One-way ANOVA test to explore the influence of prior attitude on negativity bias. The results show that prior attitude has a significant effect on negativity bias in attitude change (H = 11.371, p = 0.010) (Table 2). Participants with more positive prior attitudes changed their attitudes more negatively. However, prior attitude does not seem to have any impact on the number of selected articles (H = 1.182, p = 0.757), reading order (F = 0.028, p = 0.994), times of reading (H = 2.444, p = 0.485), reading time (H = 1.181, p = 0.758), AFD (F = 0.174, p = 0.914), APD (F = 1.000, p = 0.403). H2c is partially supported. Therefore, H2 is partially supported.

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<th>P</th>
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<td>Prior attitude</td>
<td>Attitude change</td>
<td>Kruskal-Wallis</td>
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<td>0.00</td>
<td>0.000</td>
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<td>0.707</td>
</tr>
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</table>

Table 2. Summary of significant test results. (*p < 0.05, **p < 0.01)

**The Focus of Attention on Different Material Types**

Focusing on the difference in AFD and APD on participants’ preference for material types in the body of the articles when reading positive and negative articles, we conducted paired-samples T-test and paired-samples Wilcoxon signed rank test. The results show that AFD was longer when participants visited the areas of interest for claims in the negative articles than those in positive articles (Z = -2.069, p = 0.039). What’s more, APD was larger when participants visited the areas of interest for illustrations (t = 4.636, p < 0.001) and opinions (Z = 2.432, p = 0.015) in positive articles than those in negative articles.

**DISCUSSION**

Our findings confirm the existence of negativity bias in information seeking, information processing and sensemaking. People sought more negative articles and spent more time reading individual negative articles. In terms of sensemaking, they changed their attitude negatively. In particular, people with balanced information seeking also changed their attitude negatively, which confirmed the negativity dominance (Rozin & Royzman, 2001). Inconsistent with H1b.3, the participants’ APD is larger when reading positive articles than negative ones, which means that the cognitive load is higher. The explanation may be that positive information can lead to more complex cognitive processes, for example, positive information drives people to search more for explanations (Krull & Dil, 1998; Llu, Karasawa, & Weiner, 1992; Unkelbach et al., 2020).

We also examined the influencing factors of negativity bias. Our findings suggest that in terms of the number of selected articles, the males had a stronger negativity bias. This result can be well explained by the “selectivity model”, in which females are seen as comprehensive information processors and males are seen as selective information processors. In terms of APD during reading, only females had a greater cognitive load when reading positive articles than negative articles, while no such difference was shown among males. However, it seems to be contrary to the conclusions of previous research (Soroka et al., 2016). It is worth mentioning that the three-child policy is a highly gender-related topic, so the findings need to be considered in a limited setting.

Our study also found that people with more positive prior attitudes changed their attitudes more negatively, which is in line with the discovery in selective exposure literature (Knobloch-Westerwick et al., 2017; Li et al., 2021). People
with positive attitudes are more likely to be influenced by negative information, while people with negative attitudes hardly change their attitudes. To some extent, it confirms the powerful effect of negative information.

Findings suggested that AFD was longer when participants visited the areas of interest for claims in the negative articles than those in positive articles, and APD was larger when participants visited the areas of interest for illustrations and opinions in positive articles than those in negative articles. People show different cognitive patterns of attention when reading positive and negative articles. It seems that people pay more attention to the structural feature of articles while reading negative articles, which shows a structure-driven/logic-driven cognitive mechanism. On the contrary, while reading positive articles, people focus more on “data”, which shows a data-driven cognitive mechanism. Negative news often triggers negative emotions, which may lead participants to be more careful and thoughtful about what they read in order to avoid drawing wrong conclusions or overreacting to information. Therefore, the structure-driven/logic-driven cognitive mechanism may help the reader process this information better. On the contrary, people's tendency toward data-driven cognitive mechanisms when reading positive news is probably because these articles often contain emotional content and descriptions that are more likely to elicit empathy and emotional resonance from readers. In addition, positive articles usually don't require much logical analysis or reasoning because their content is likely to be more straightforward and easier to understand and absorb. However, it should be noted that this explanation won't work in all cases, as individuals' cognitive and reading preferences may vary based on individual characteristics.

CONCLUSION AND LIMITATIONS
We conducted an eye-tracking experiment to examine negativity bias during information seeking, processing and sensemaking about a policy debate, namely the three-child policy in China. We found that participants showed a preference for negative articles over positive articles in their selection and reading behavior, and that reading negative articles resulted in lower cognitive load and more negative attitude change than reading positive articles. We also found several influencing factors including gender and prior attitude affected negativity bias, and participants used different cognitive strategies when making sense of positive and negative information.

The findings contribute to a better understanding of negativity bias in the overall process of information seeking, processing and sensemaking, which may help to design news systems that can adapt to the preferences and needs of different users to improve user satisfaction and engagement with news content. Instead of feeding people with contents that people are most likely to click, news services should provide users with information from both positive and negative sides, to reduce the impact of negative bias, and help them better cope with controversial topics and make decisions.

Our study had some limitations to be acknowledged. First of all, our study was conducted in April 2022, when the pandemic was still ongoing and limited our recruitment of participants outside the university, leading to a homogeneous sample of students from the same school. Secondly, the three-child policy was implemented in May 2021 and sparked public debate for about a year before our experiment, which might have influenced the participants' exposure to and processing of the materials related to the policy prior to our experiment. Third, our study used prototype pages and edited materials to present the articles, which might not reflect the actual online news environment that readers encounter. Fourth, negativity bias for one topic cannot be generalized to other topics. Future research could address these limitations by conducting experiments with real news articles and websites after the implementation of the policy, and by measuring emotional responses and neural activity during information seeking, processing and sensemaking. Although our experiment demonstrated the existence of negativity bias in information seeking, processing, and sensemaking of a policy debate, it did not explain how and why negativity bias occurs. Future research can also examine the links between behavior, emotion and cognitive mechanisms of negativity bias, which could provide more insights into how people process positive and negative information.

ACKNOWLEDGMENTS
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What Is a Person? Emerging Interpretations of AI Authorship and Attribution

Moulaison-Sandy, Heather
University of Missouri, USA | moulaisonhe@missouri.edu

ABSTRACT
Recently, the scholarly community has been eagerly exploring how AI-produced content should be integrated into both academic writing and scholarly publishing. This paper investigates the prevailing responses to the introduction of ChatGPT in November 2022 and the interest that has been afforded it by both the academy and the publishing industry. A review of the published literature on aspects of ChatGPT authorship was carried out, finding that government and the publishing industry have unequivocally asserted that large language models (LLMs) like ChatGPT do not possess the traits of a person and are not able to author texts as a result. Other approaches, including practice, have been less vehement. To assess the integration of instructions on referencing ChatGPT using APA, top Google hits in the .edu domain were collected and analyzed over a 6-week period from March 14 to April 18, 2023, a time during which official recommendations of the APA Style were finalized. Findings reveal that librarians were quick to provide guidance, but slow to update that guidance, contributing to the potential for misunderstanding the affordances of and best practices for work with LLMs.

KEYWORDS
Large language models (LLMs); ChatGPT; authorship; attribution; library webpages.

INTRODUCTION
ChatGPT (https://openai.com/) is a large language model (LLM), a type of artificial intelligence (AI) that uses machine learning to function as a “word prediction machine” (North, 2023). Using a corpus of web documents harvested in 2021 as a basis, ChatGPT generates text in response to user prompts. Unlike web search engines that provide websites as hits in response to a query, generative AI tools like ChatGPT do not provide responses based on highly ranked sources; in fact, they do not answer questions. Instead, they pull together text in response to a prompt. In other words, they ghostwrite text based on the combinations of words that appear in their training corpus (Crotty, 2023) to generate “statistically probable outputs” (Chomsky et al., 2023, para 2). These systems function as black boxes, which has the potential to allow them to be anthropomorphized and described as thinking and perceiving when instead they are processing (Ballardini et al., 2019). In using web-based sources as their inputs, LLMs produce texts that often seem to be plausibly-written content, including potentially sonnets, analyses of books, scripts, essays, and others that can be produced in the style of living scholars, politicians, and celebrities (e.g., Houston & Corrado, 2023).

Generative AI is a powerful tool with the potential to revolutionize industry, education, and even society. Concern about the use of text authored by generative AI tools in scholarly publishing and in education surfaced almost immediately after the emergence of ChatGPT (e.g., Dans, 2023) with problems highlighted such as the difficulty in identifying AI-generated text (e.g., Nature, 2023), the emergence of educational deficiencies that will interfere with future scholars’ abilities to reason (e.g., Civil, 2023), and the need to train users to better input their prompts to the LLMs (aka “prompt engineering” (Bridle, 2023)) (e.g., Nield, 2023) to optimize results. LLMs are unquestionably being used by authors, at times unscrupulously. In Science, Thorp (2023) explains that “in a recent study, abstracts created by ChatGPT were submitted to academic reviewers, who only caught 63% of these fakes. That’s a lot of AI-generated text that could find its way into the literature soon” (p. 313).

In computer science and related fields, studying LLMs and other generative AI tools is not new. Evaluation of the efficacy and accuracy of LLMs has been ongoing for tasks such as email auto-complete texts (e.g., Chen et al., 2019; Robertson et al., 2021), deductive coding in qualitative research (Xiao et al., 2023), and helping students learn to write computer code (e.g., Leinonen et al., 2023; MacNeil et al., 2023). The ethics of LLMs (e.g., Abid et al., 2021) and social justice pertaining to AI, including the problem of disparate impact (e.g., Kartal, 2022; O’Neil, 2016) have also been considered. Much less frequent in the literature are studies investigating how LLMs are used in writing. Authorship using generative AI tools like ChatGPT has been studied in a limited capacity from a computer-science perspective (e.g., Draxler et al., 2023, Yuan et al., 2022) and from a policy perspective (e.g., Ballardini et al., 2019). However, given the newness and almost instant ubiquity of ChatGPT, at present the published, peer-reviewed literature does not take into account the freely available and enthusiastically discussed new tool. This paper aims to fill that gap in understanding how authorship is being considered at present in this emerging environment.

Since ChatGPT became widely available in November 2022, there has been interest in citing AI-authored texts. Initial recommendations by APA in January (APA Style, 2023) endorsed their consideration as “Personal.
Communications” (abandoned by mid-March 2023) or “Webpages” (APA Style, 2023; S. Lazer, personal communication, 2023). Later, emails from the APA style guide began recommending they be cited as software (e.g., S. Lazer, personal communication, 2023). During this time period, which coincides with the winter semester in many North American universities, interim guidance was needed for students and instructors alike, as academia began adjusting to the challenges of freely available LLMs and their place in the academy.

APA Style officially came forth with an approach to citing generative AI tools like ChatGPT on April 7, 2023. The final recommendation to cite the text as “Software” (McAdoo, 2023). Since the text is not authored by a “person” nor is it consultable or reproducible, the solution is not without problems. As word continues to trickle down in this evolving information space about the evolution of best practices, research and practice have been particularly eager to arrive at an understanding of the best way to help users engage with the texts, especially in light of the ethical implications that are in the process of being discovered. The current paper examines the literature in this rapidly changing space as it relates to authorship, and it likewise investigates top recommendations for citing generative AI texts using APA as described on library sites in the .edu domain.

As approaches to considering AI authorship unfold, this paper seeks to address the following research question:

RQ: How are recommendations for citing ChatGPT in APA presented on academic library webpages in the .edu domain, and by which institutions?

This paper begins with a review of published resources on the topic of authorship and LLMs, which remain sparse and largely un-peer-reviewed due to the newness of the ChatGPT tool. The research question will then be investigated through an analysis of resources promoted by academic libraries in response to ChatGPT with a focus on citing with the APA style guide.

**REVIEW OF THE LITERATURE**

Focusing on the conversation around generative AI authorship that is emerging in scholarly communication since ChatGPT became available, a range of sources was investigated relating to four topics: intellectual property considerations, errors in generative AI-authored texts, emerging policies in scholarly publishing, and emerging guidance in academic libraries for referencing text created by LLMs.

**Ownership, Copyright, and Plagiarism with LLMs**

On March 16, 2023, the U.S. Copyright Office indicated that content produced through the use of generative AI tools like ChatGPT do not meet the requirements for human authorship needed to secure copyright. This is in alignment with “both copyright and patent laws in Europe [that] have relied upon the concept of author or inventor as a natural person” (Ballardini et al., 2019, p. 118). Although “some systems operate in response to a user’s textual instruction” (U.S. Copyright Office, 2023, p. 2), the prompt supplied by users is not enough input to claim human authorship. Web-based sources used as training documents for these LLMs can be copyright protected. However, the language that emerges from a generative AI tool predicts the next word in the series. The details of the text as well as the authorship of the original corpus documents have been lost, leaving only ownership of the corpus and the generative AI tool itself.

Creatorship and perceptions of creatorship, however, are not one in the same. In one of the first papers (an unreviewed manuscript) to look at the question of perceptions of authorship and ownership as they pertain to generative AI, Draxler and colleagues (2023) conclude that user perceptions of authorship are not straightforward when GPT-3 is being used for postcard authorship. Study participants were less inclined to claim authorship of the generated text when they thought a human ghostwriter had been involved. This distinction between perceptions of ownership when authorship is human or AI reflects the U.S. governments’ definition of plagiarism, which is “the appropriation of another person’s [emphasis added] ideas, processes, results, or words without giving appropriate credit.” (U.S. Code of Federal Regulations, 2023). Users were less inclined to consider their own the content that a human wrote; content authored AI, however, they more readily considered ownership over. Even though LLMs are ghostwriting based on what is likely to be copyright-protected works that are the product of human authorship, perceptions of plagiarism might be less acute if there is an increased perception of agency in the writing of the prompts as reflected in shaping the final product of the LLM (Draxler et al., 2023).

**Accuracy and Hallucinations in LLMs**

One aspect of ChatGPT that emerges with its misuse as a question-answering system is that it (like other LLMs) will yield incorrect information (Chiang, 2023); in the case of ChatGPT, incorrect information is produced roughly 20% of the time (Woodie, 2023). Instances where information is fabricated are called “hallucinations” (Bowman, 2023; Chiang, 2023, Woodie, 2023). ChatGPT is a text transformer; “all it does is guess what the next word in the phrase is … It produces generic, milquetoast output that’s confidently wrong about a lot of things” (Scott, 2023, 7:18). As such, it is not designed to provide factual information in response to prompts, despite the convincing nature of the text produced.
Chiang explains that hallucinations are “compression artifacts … if a compression algorithm is designed to reconstruct text after ninety-nine per cent of the original has been discarded, we should expect that significant portions of what it generates will be entirely fabricated” (Chiang, 2023, para 8). Plausible-sounding reference sources, therefore, need to be confirmed (Chiang, 2023); this is because well-known experts may be cited in the text that is produced, and titles of realistic-sounding resources provided, but both are a function of the content in the corpus. They are not factual, though they sound deceptively convincing.

Hallucinations are not unique to ChatGPT. Google’s Bard (https://bard.google.com/) AI Chatbot (another LLM) had similar problems with putting forth accurate answers to the question of notable discoveries from the James Webb Space Telescope in a test post. Bard inaccurately claimed the telescope was the first to image planets outside of the solar system. The Guardian reported that this was a problem of “the chatbot repeating errors from the information that it absorbs” (Milmo, 2023a, para 9), which is potentially another factor affecting the hallucinations that emerge. Already, in 2016 Microsoft’s AI Twitter bot was provided racist, anti-Semitic, and sexist training data in the form of tweets by Twitter users that it then repeated back; the bot was inactivated after less than a day (Tennery & Cherelus, 2016). As of March 21, 2023, when public access to Bard began to roll out, Google has been actively seeking input from users to correct the inevitable hallucinations and is providing seamless access to Google search results as well (Hsiao & Collins, 2023).

**Authorship and Attribution in Scholarly Publishing**

As of March 14, 2023, a series of editorials had already been published in *Science, Nature,* and *JAMA* (Griffin, 2023), and the arXiv repository (ame5, 2023). All of the sources rejected generative AI tools as authors because authorship carries responsibilities that AI cannot meet. This is similar to the U.S. Copyright Office’s statement of policy (2023). In addition, the journal statements did not support the inclusion of text authored by an LLM. For *Science,* this is because work must be original, and not “plagiarized” via the LLM (Thorp, 2023). *Nature,* instead, focuses on the ethical aspects of participating in scholarly communication that include the importance of transparency and integrity (Nature, 2023). ArXiv, however, sees ChatGPT and other LLMs as one of the many tools that scientists may use in their work, and is permitting its use (ame5, 2023).

One aspect of writing that traditionally has not merited the designation of “author” is that of “editor.” In several of its journals, Elsevier is proposing the use of AI as a ghostwriter to provide language editing support. In this scenario, authors “should only use these technologies to improve readability and language” (Elsevier, 2023). Staiman (2023) expresses a call for LLMs to be used in support of social justice. Because the majority of the world’s researchers are not native speakers of English, and because expression is nonetheless an essential aspect of scholarly communication, opening the use of LLMs to EAL (English as an Additional Language) authors is a way of allowing review to focus on the quality of the work rather than on potential language-related concerns.

The scholarly publishing community’s interpretation is largely in contrast to the guidance provided by OpenAI (2022), which outlines when it is permitted to publish content with attribution to the enterer of the prompt. Those who enter prompts are considered “creators” by OpenAI, and are permitted to publish ChatGPT-generated content as follows:

- The published content is attributed to your name or company.
- The role of AI in formulating the content is clearly disclosed in a way that no reader could possibly miss, and that a typical reader would find sufficiently easy to understand.
- Topics of the content do not violate OpenAI’s Content Policy or Terms of Use, e.g., are not related to political campaigns, adult content, spam, hateful content, content that incites violence, or other uses that may cause social harm.
- We kindly ask that you refrain from sharing outputs that may offend others. (OpenAI, 2022, “Content co-authored”)

In education, however, more tolerance for the extent of use of LLMs has been signaled. The International Baccalaureate (https://www.ibo.org/), an exam indicating preparation for post-secondary education, is allowing students to cite ChatGPT (Milmo, 2023b) giving rise to a Twitterstorm of concerns about how little LLMs are understood. Education overall is eager to understand how best to use LLMs (e.g., Civil, 2023; Dans, 2023).

**Style Guide Interpretations for Citing LLMs**

Even if major journals refuse to publish the ghostwriting of generative AI tools and if the texts are infused with errors, this does not mean that writers, including students, will not be eager to outsource work to authoritative-sounding ghostwriters and to cite that work.

The Modern Language Association style guide (MLA) already declared how to cite artificial intelligence in 2019 (MLA Style, 2019) in its 8th edition; however, the technology was not as advanced then as it is now. In late 2022,
The Atlantic published an article by Stephen Marche entitled “The College Essay Is Dead” in which concern was expressed for the humanities in this new environment. No further update from MLA about the use of text authored by generative AI has been found.

The American Psychological Association’s style guide (APA) was less proactive than MLA regarding AI-generated texts, but since the emergence of ChatGPT, APA has been actively collecting data about its use (S. Lazer, personal communication, March 12, 2023). Initially, APA gave guidance to writers wishing to cite ChatGPT or other generative AI tools via a tweet on January 10, 2023 (APA Style, 2023). In that tweet, it set out recommendations based on two options: 1) if the text is retrievable, it should be referenced as a webpage (i.e., an electronic source), 2) if the text is not retrievable, it should be treated as a personal communication. With the rapid changes to the lay understanding of ChatGPT, APA Style modified its approach by mid-March of the year (S. Lazer, personal communication, March 12, 2023). Information about the revised approach was not immediately captured, however, formally on Twitter or on the APA Style blog, even though both were indicated as places to watch.

After the time that APA published the January 10, 2023, tweet in response to a user’s question, it appears to have been silent on the matter of how to cite ChatGPT and other LLMs until April of this year.

On March 12, 2023, the updated instructions about citing ChatGPT communicated by email were to pivot to capturing as much information as possible from the interaction with ChatGPT and citing it as computer software. That recommendation was the following:

But for paraphrasing, quoting, or providing the full text response from ChatGPT, a reference is needed (following the general format of a software reference, as seen in Section 10.10 of the Publication Manual):

OpenAI. (2023). *ChatGPT* (Feb 13 version) [Large language model]. https://chat.openai.com/chat

Sample citation: (OpenAI, 2023) (Stefanie Lazer, personal communication, March 12, 2023).

On Friday, April 7, 2023, the APA blog for the Style Guide (McAdoo, 2023) posted the approach to citing APA that is endorsed at present: as was the recommendation communicated by email in mid-March, text produced by ChatGPT will be roughly considered Computer Software, but unlike most content created by computer software, ChatGPT text cannot be recreated. Given the complexities of the tools, writers should be explicit about their use of the resource as possible and provide as much information as possible, including in the methodology and as appendixes. The suite of recommendations from the mid-March email held, including mentioning the use of ChatGPT elsewhere if a methodology section was not included in the paper and saving the transcript and recording the prompt, and including them as an appendix if possible, or otherwise making sure they are accessible.

**METHOD**

To address the research question, data from academic library webpages on citing ChatGPT in APA was captured once per week for six weeks from the .edu domain, a domain “intended for accredited U.S. postsecondary institutions” (Educause, 2023, General, para. 1); historically, there are between 7,000 and 8,000 postsecondary institutions in the .edu domain (.edu, 2023). Starting Tuesday, March 14, 2023, and every Tuesday thereafter until April 18, 2023, the search query “chatgpt apa citation site:.edu” was launched in Google. Three pages of results were captured each week and coded in MAXQDA. Google was set not to personalize results in order to provide a more complete set of hits. An analysis of the pages was carried out weekly as a way of assessing changes in the number of pages on the topic and the extent of their contribution.

For each page of results, the academic institution name associated with the library promoting APA reference support was recorded and classified using The Carnegie Classification of Institutions of Higher Education (https://carnegieclassifications.acenet.edu/institutions/). Concurrently, inclusion among Association of American Universities (AAU) was also recorded. Visualizations for the data collected were created using Excel. The data associated with this project is available at [redacted].

**RESULTS**

Over the 6-week period of study, the number of relevant webpages in Google changed, as well as the order of the most highly-ranked pages and the content on those pages themselves (see Table 1). This study focuses primarily on the set of webpages collected weekly, in the aggregate.
<table>
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<tr>
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<tr>
<td>3 (March 28, 2023)</td>
<td>17</td>
</tr>
<tr>
<td>4 (April 4, 2023)</td>
<td>20</td>
</tr>
</tbody>
</table>

Friday, April 7, 2023: APA Style Guidance Formally Issued

<table>
<thead>
<tr>
<th>Week (Date)</th>
<th>Relevant hits in first three pages of Google results</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (April 11, 2023)</td>
<td>21</td>
</tr>
<tr>
<td>6 (April 18, 2023)</td>
<td>23</td>
</tr>
<tr>
<td>Total pages studied</td>
<td>88</td>
</tr>
</tbody>
</table>

Table 1. Google Results by Date for the Search String “chatgpt apa citation site:.edu” with Personalization of Results Turned Off

### Institutional Classifications

Based on the name of the institution associated with the webpages retrieved, the Carnegie institutional classification was recorded. Doctoral Universities were the most common class of institution posting information to its library about using APA to reference ChatGPT. A somewhat unexpected number of Baccalaureate Colleges, Baccalaureate/Associate's Colleges, and Associate’s Colleges were likewise represented among the top three pages of hits. See Figure 1 for the Carnegie classification breakdown.

![Top Results for APA Citation Information by Carnegie Classification](image)

**Figure 1. Institutional Classification, by Week**

Of the doctoral institutions, relatively few Association of American University (AAU) member institutions’ libraries were included among the top hits in the first part of the study. After the APA Style’s official publication of guidance, however, the number of AAU institutions increased. See Figure 2.
Inclusion criteria for the study required pages to address referencing ChatGPT using the APA style guide. The range of information provided on individual webpages, however, varied greatly. Generally, throughout the study over half of the pages indicated in some fashion that recommendations were either interim or were evolving on the part of APA and other style guides. See Figure 3 for a graphical representation of this data.

**Timely and Accurate Guidance**

By the time data collection had begun in mid-March, 2023, the APA was no longer recommending that ChatGPT be treated as an 1) Electronic source or as a 2) Personal communication (S. Lazer, personal communication, March 12, 2023). Nonetheless, some top-ranked pages still recommended these practices. Figure 4 shows the percentage of pages recommending either one or both of these two approaches that were no longer endorsed by the APA at the time, demonstrating the extent to which stale recommendations were propagating the web as highly-ranked sources via Google and contributing to the potential for amplifying misinformation in this space.
Although 1) ChatGPT is a language prediction model and is not a chatbot to supply factual responses, and 2) ChatGPT’s corpus was harvested in 2021, well before the current version of ChatGPT came to prominence, top-ranked library sites have nonetheless asked ChatGPT for guidance in creating APA citations and have published that guidance verbatim. To ask ChatGPT for help with citing itself is a tongue-in-cheek approach to an ostensibly serious topic, that of authorship, attribution, and potentially ownership of intellectual property; it is fundamentally misguided, however, demonstrating a misunderstanding of the capabilities of LLMs and the ways in which they can be used in academia. See Figure 5 for the prevalence of using this approach among top pages. Of interest is that in the final week of the study after the guidelines had been released for over a week, the first page of Google hits included 3 webpages that continued to present this recursive approach, but none of the webpages on the second or third page of hits did. All three webpages on the first page of results had ranked on the first page throughout the period of study, implying that Google is cautious in quickly changing the order of its results.

Updates Relating to the April 7, 2023, Blog Post
The APA Style blog formally published guidance for referencing ChatGPT on Friday, April 7, 2023 (see McAdoo, 2023). On Tuesday of the following week at the time of data collection, none of the pages in the top three pages of hits fully reiterated this information, though one Doctoral University provided a link to McAdoo’s APA Style blog post, and another Doctoral University featured the blog post’s title, “How to cite ChatGPT” in its APA blog roll.
Figure 3 captures out-of-date recommendations throughout the period of study, but since formal guidance was published on April 7, not only should the incorrect recommendations be replaced as quickly as possible after that point, but the most recent and accurate information should be provided and cited from that point onward.

During the final week of study (week 6, April 18, 2023), data was collected 11 days after the publication of the official guidance from APA as posted to the APA Style blog (McAdoo, 2023). Looking closely at the first page of hits from that week, of the 9 working webpages (one page retrieved a 404 error), 3 were from Doctoral Universities, 3 from Master’s Colleges & Universities, and 3 from Associate’s Colleges. See Table 2.

<table>
<thead>
<tr>
<th>Carnegie Classification</th>
<th>Link to April 7 Guidance on the APA Style blog</th>
<th>Explanation of April 7 Guidance from the APA Style blog</th>
<th>Out-of-Date Recommendations (e.g., “personal communications”)</th>
<th>Asking ChatGPT for Citation Guidance</th>
<th>Recommendations as Best Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctoral</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>Save Transcripts: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Save Prompts: 0</td>
</tr>
<tr>
<td>Master’s</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>Save Transcripts: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Save Prompts: 1</td>
</tr>
<tr>
<td>Associate’s</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>Save Transcripts: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Save Prompts: 1</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>Save Transcripts: 2</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Save Prompts: 2</td>
</tr>
</tbody>
</table>

Table 2. Summary of content on the first page of Google hits, April 18, 2023

Table 2 focuses on the first page of results in Google, as they appeared over one week after the formal guidelines were published. This timeframe was chosen because it gives ample time to librarians to become informed about the changes and to address them on the web. In terms of timeliness, only 3 of the 9 pages in the first page of Google hits included the link to the APA Style blog’s post about citing ChatGPT. None explained how to interpret the content, though one did provide the example from the page. Over half of the webpages on the first page of Google hits continued to give out-of-date recommendations, including one Associate’s institution that provided a link to the April 7, 2023 APA Style blog post, as well as links to earlier recommendations on other sites, and then as content provided two different responses from ChatGPT in regards to the question of referencing itself. On that webpage, wording that preceded the ChatGPT-generated text states “ChatGPT suggests” which anthropomorphizes ChatGPT in a way that is consistent with some of the literature consulted.

In terms of accuracy, over half of the webpages on the first page of Google hits included out of data recommendations to cite ChatGPT text as a personal communication. Two webpages recommended the current best practice that users save the transcripts generated and the prompt used to query the system and make them both available. One webpage provided guidance when transcripts were saved; the rest of the webpages were silent on the topic.

**Other Information Provided**

Some highly-ranked pages offered additional insight and guidance on the topic of citing ChatGPT using APA. For example, many pages correctly included recommendations to clearly indicate in the writing project that ChatGPT was used as a source, to include ChatGPT transcripts as an appendix, and to record the prompt used to query ChatGPT. Many pages also cited official APA style guide sources such as the tweet from January 10, 2023 (the recommendations of which regarding electronic sources and personal communications were replaced by the time of data collection (S. Lazer, personal communication, March 12, 2023)). Other libraries cited sources that were less authoritative, including several that linked to a page from the University of Guelph and Scribbr.com. Finally, some pages warned against using ChatGPT as a question-answer system due to the problems of hallucinations where ChatGPT made up not only content but also reference sources.

**DISCUSSION**

ChatGPT is a topic of great interest to the scholarly community, but one that, universally, is not well understood. The way to credit texts produced by ChatGPT and other LLMs has been challenging to address. The APA itself issued interim guidance that it ended up quickly reversing, as APA like publishers and government entities, came to the conclusion that ChatGPT is not a “person” and the text it produces cannot be treated as being intellectually similar to the writings of individuals. This has not deterred academic library sites in the .edu domain from providing guidance on how best to cite ChatGPT or other generative AI tools, and for Google to provide these pages as hits. This is despite the most highly ranked pages on the first three pages of hits often providing inaccurate or out of date information. The newness of the topic, the unfamiliarity on the part of librarians with LLMs and authorship in this space, and the lack of consensus on which Google could develop rankings for its results has created an environment
in which some of the most highly ranked hits, especially during the first part of the study, were not always providing good results.

Over time, the quality of the recommendations provided on the top sites stayed roughly the same. For example, the percentage of top webpages that indicated the space was evolving (Figure 3) remained largely consistent, despite the APA Style guidelines that emerged that solidified the recommendations. Webpages continued to provide outdated guidance even after the April 7, 2023, announcement (see Figure 4 and Table 2). Finally, over time, a positive trend was finding fewer instances of guidance for citing ChatGPT that were provided via a ChatGPT query (see Figure 5); as indicated in Table 2, however, during the final week of the study, all three webpages that asked ChatGPT were found on the first page of Google hits.

One unanticipated finding was the nature of the academic institutions that Google ranked highly. Many were not research-intensive institutions helping to support graduate education and research faculty, but rather were 2 or 4-year institutions of higher education primarily serving undergraduate education and the educators who support these groups. No AAU libraries were listed among the top hits, and during the first few weeks of data capture, there were only slightly more institutions serving graduate populations as ones serving undergraduate populations (week 1: 8 graduate/7 undergraduate; week 2: 9 graduate/6 undergraduate; see Figure 1). Questions remain as to why large, elite research institutions were generally unrepresented in these top-rated hits on Google: were librarians at those institutions cautiously waiting to provide information only after the APA had released definitive guidelines, or conversely, did they assume that researchers would adhere to the guidance provided through their journals, making specifics of providing guidance moot, but leaving it needed at the undergraduate level? An additional possibility is that they understand the potential for problems with accuracy and hallucinations given the functioning of LLMs and presume that researchers at the graduate level will desire full ownership over their own writing, partly as a way to ensure its accuracy.

What Is Not Captured in the Study Results

The review of the literature demonstrates that a good deal of interest has been generated around the question of how like a person ChatGPT is. Publishers and the government, entities fundamentally interested in the creative power of individuals and the rights they have to that intellectual content have dismissed ChatGPT and other LLMs, based on a thorough understanding of how AI works, as being neither like a human in terms of authorship capabilities or creative ones. Other literature is more engaged with interacting with ChatGPT to generate text. These pieces are not always rigorous in their understanding of the nature of LLMs (e.g., Roose, 2023), believing themselves to be in conversation with the AI (Ballardini, 2019). At the beginning of the current study, 40% of library sites engaged with ChatGPT to identify best practices for citing it in APA, an approach that is fundamentally flawed for the reasons described in the results, but that demonstrates nonetheless a certain sophistication on the part of the librarians. These librarians understood that ChatGPT could respond to prompts running a gamut of topics and had created accounts and done the initial legwork demonstrating nonetheless a degree of sophistication.

The results also seem to reflect some of the tensions perceived in the literature in terms of the interest in LLMs accompanied by a lack of knowledge about basics of how they work. Given the variations in the correctness of the recommendations and the thoroughness of the information provided on the webpages, there is a sense that those who understood the technology more robustly preferred not to go on record publicly with guidance or recommendations. Conversely, those who were less sophisticated in their understanding were eager to engage with the technology, for example, by asking ChatGPT about referencing itself (Figure 3). This is consistent with the naïve approach adopted by the New York Times anthropomorphization of Bing’s AI chatbot (Roose, 2023; cited in North, 2023) and other prominent sources that unwittingly personify their interactions with the LLMs, as if they are interacting with humans. Although tongue-in-cheek, the recursive approach adopted by librarians who asked ChatGPT to describe how best to cite itself demonstrates a fundamental misunderstanding of the nature of LLMs as text prediction machines and not as chatbots. This, as well as the out-of-date information posted to pages, information provided by information professionals who claim expertise in this area, had the potential to contribute to the confusion around the nature of LLMs, the quality of their texts, and the place of these texts in the scholarly conversation.

Ultimately, the question of how best to help novice scholars seems to be key. If librarians at institutions with primarily undergraduate populations felt the need to address questions of how to reference ChatGPT, the need must be present. These are the individuals who are most in need of understanding how to ensure they are representing the origin of the intellectual property included in their class papers, which is admirable to see.

Limitations

Limitations to this project include the problem of relying on Google for ranked results, and using a single search string that focuses on ‘APA citation’ within academic libraries in the U.S. Because Google is the dominant search engine, this problem is nonetheless likely replicated by scholars, especially junior scholars, seeking support for their own work citing ChatGPT. Other limitations include the problem of manually coding a large set of documents,
though the use of MAXQDA is intended to help mitigate this to an extent. Finally, this project does not break out webpage content by class of institution in the results. It assumes that practice is concerned with providing accurate and timely information on citing ChatGPT in APA. Some libraries supporting junior scholars, however, might reasonably have priorities that focus on other aspects of the problem, such as working with instructors to assess the applicability of ChatGPT texts to the assignment. In assuming that all libraries should provide the same level of content, a limitation is created that does not account for differences among institutions and their target users.

CONCLUSION
Much more work in understanding authorship, attribution, and ownership remains in the system of scholarly writing practices as they pertain to texts produced by LLMs. Government bodies have led the way in formally designating the writing of LLMs as being the product of algorithms that predict text based on a corpus, and as such are not creating text, nor as machines do they have the intellectual capacity to do so. Publishers have followed this lead, indicating that LLMs are incapable of the intellectual effort required for authorship of an article, for example, and in many cases should not be cited due to the problem of inaccuracies that are introduced. Education, however, shows evidence of being split, with some looking to integrate the tools of the future, and with others focusing on the problematic nature of the content produced, including the hallucinations that stand in the way of accuracy.

Since the release of ChatGPT in November 2022, individuals, including writers for the New York Times and possibly librarians, have become enthralled by the seemingly realistic nature of the interactions and have enjoyed reading the words not as the results of a text prediction model, but rather as being accurate and reflecting thoughts and feelings. Although the entertainment value seems compelling, there is nonetheless a sense that those in the position of being thought leaders in this space have an obligation to be informed about the nature of the interactions before accepting them at face value and perpetuating inaccurate approaches to considering the products of these algorithms.

Noam Chomsky and colleagues (2023) indicate that LLMs “are incapable of distinguishing the possible from the impossible. . . . For this reason, the predictions of machine learning systems will always be superficial and dubious” (para 10). Practice is placed in the difficult position of supporting users in this nebulous and rapidly changing environment. Yet, at the same time, a professional obligation to understand the basics of the technology prior to addressing it publicly remains. Were all librarians reticent to undertake the self-study needed, no pages of guidance would have been found in conjunction with this study, which one might imagine to be worse than inaccurate guidance, if a lack of guidance (either on the APA blog or on a library’s site) could be taken to imply that references are not needed. But, in fact, references are needed. Information professionals are not infallible; many provided information that was up to date and accurate, reflecting best practices that APA itself had not published. Others insisted on the notion that this is a time of interim guidance, which was accurate.

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“How Do You Measure a Relationship?” Assessment and Evaluation Challenges of Knowledge Exchange Activities in Information Work

O’Brien, Heather
University of British Columbia, Vancouver, Canada | h.obrien@ubc.ca

McDavid, Kristina
University of British Columbia, Vancouver, Canada | kristina.medavid@ubc.ca

Yao, Jess
University of British Columbia, Vancouver, Canada | jlfyao@gmail.com

ABSTRACT
Today there is increasing emphasis on knowledge exchange (KE), the movement of knowledge and expertise amongst diverse groups to enhance research uptake, use, and impact in healthcare, government, and community settings. Library and information science (LIS) professionals are central actors in KE through community engagement, scholarly communication, literacy, and cultural heritage initiatives, but (how) is this work formally documented and evaluated? Through interviews with 24 information professionals working in varied settings, we considered how KE activities fit into the current library assessment and evaluation landscape. Using thematic analysis, we identified challenges with placing this work within current assessment practices and evaluation frameworks and showing its value, as well as a desire for alternative, more dynamic assessment and evaluation methods. We discuss these findings with respect to previous research in LIS and KE more broadly to consider professional and organizational implications.

KEYWORDS
Library assessment and evaluation, knowledge exchange, community-engagement, relationship building, information professionals

INTRODUCTION
Today there is increasing emphasis on knowledge translation, mobilization and exchange in healthcare, government, and community settings (Carson & Given, 2021; London School of Economics (LSE), 2023). These terms are sometimes used synonymously and at other times favored by specific disciplines or groups (Shaxson et al., 2012). All emphasize moving research into action, the involvement of multi-sectoral actors in applying research findings (Nutley et al., 2007; Redman et al., 2015; Weiss, 1979), and a desire to show impact. Research impact is defined as “changes in awareness, knowledge and understanding, ideas, attitudes and perceptions, and policy and practice as a result of research” (Morton, 2015, p. 406), and it is guiding university and municipal strategic plans and funding body directives in many countries (e.g., Australian Research Council, 2022; REF, 2021; SSHRC, 2019).

Library and information science (LIS) professionals are entrenched in knowledge translation, mobilization and exchange activities, or what Shaxson et al. (2012) have coined “K*.” This may be most readily observed in scholarly communication and publishing. Librarians interpret and negotiate copyright laws, develop and maintain publishing infrastructures, e.g., institutional repositories, and lead open education initiatives to facilitate access to materials (Burpee & Fernandez, 2014). However, the current emphasis on research impact may mean new roles and responsibilities for LIS professionals. Given et al. (2015) proposed that academic librarians could further support research impact within university settings by aiding researchers in the use of altmetrics, creating accessible translations of scholarly works, and reaching non-academic audiences through new publication venues. In more recent work, we applied Shaxson et al.’s (2012) K* Spectrum Model to three case studies involving librarians and literacy educators working in community and academic settings (O’Brien et al., 2022). The K* Spectrum Model highlights information functions (e.g., making information available and usable), relational functions (e.g., facilitating dialogue amongst diverse constituents), and systems functions (e.g., changing or designing elements in the environment to encourage information sharing), along with the people who support these functions. The model distinguishes information intermediaries, knowledge translators, knowledge brokers, and innovation brokers based on the extent to which they inform versus collaborate with communities, and whether community members are viewed as “knowledge users” or “co-producers.” Although LIS professionals may be more commonly referred to as information intermediaries, we illustrated how they occupy all roles and fulfill all functions in the K* Spectrum, dynamically responding to changes in the local context (O’Brien et al., 2022).

As part of an ongoing project called STOREE (Supporting Transparent and Open Research Engagement and Exchange), we have been gaining an understanding of the current landscape for information professionals with respect to KE. We adopt the term “knowledge exchange” (KE) (rather than translation or mobilization) in this project because “exchange” implies bi-directional communication between researchers and knowledge users (LSE, 2023), and acknowledges that communities create and curate their own knowledge products and sources of expertise (UBC Learning Exchange, 2020). We interviewed 24 information professionals working in varied academic, public,
and non-profit settings about their KE activities. Of specific interest to us was not only how LIS professionals were engaging in this work, but how they were reflecting on it and documenting it within their organizations and communities. In this paper, we share key findings from these interviews related to assessing and evaluating KE, including participants’ challenges with existing LIS assessment and evaluation methods and frameworks, the difficulty of showing value for KE work, and the desire for alternative, more dynamic assessment methods. We discuss these findings with respect to previous research in LIS and KE more broadly to consider professional and organizational implications.

LITERATURE REVIEW

With some exceptions, little research has explored the professional development needs, opportunities and challenges of LIS professionals engaged explicitly in knowledge translation, mobilization and exchange work outside of scholarly communication and publishing (Hall & Ryan, 2021; Van der Graaf et al., 2018). We see this as a fruitful area of inquiry given the potential for LIS professionals to contribute to research impact efforts (Given et al., 2015) and to use KE frameworks to provide a holistic understanding of community-based projects (O’Brien et al., 2022). LIS professionals’ roles in KE – both how they support it and how they engage in it in practice – are connected to the ability to document this type of work and the value placed upon it. In this review of related literature, we examine library assessment and evaluation to provide context for the importance of documentation and valuation.

Library assessment and evaluation

Library assessment pertains to “ongoing improvement of the collection, space, or service” (Connaway et al., 2017, p. 10); evaluation is the accumulation of assessment activities, tools and methods. Evaluation frameworks may be derived from professional associations (e.g., ACRL’s Benchmark: Library Metrics and Trends) or parent institutions (Nitecki et al., 2015). These frameworks help monitor progress towards goals and objectives over time (Connaway et al., 2017) through stated outputs, outcomes, and impacts. Outputs are tangibles that can be produced or delivered, such as publications and reports, and result in outcomes (Kelly & McNicoll, 2011). Outcomes are short- and long-term changes that may be objective, e.g., enhancements to a system, procedure, or policy; subjective, e.g., increased satisfaction and awareness or relationship development; and learning related, e.g., knowledge creation or skills development (Plummer et al., 2020; 2021). Outcomes should lead to impacts, which as “broader and longer-term community and societal changes” (Nelson, 2019, p. 13).

Library assessment work is carried out for two fundamental purposes: “improving” the library (e.g., understanding users’ needs and behaviors, making decisions), and “proving” the library (e.g., advocating for resources, showing accountability, responding to administrative requests or economic and political realities, and demonstrating benefits to constituents and parent institutions) (Doucette, 2016, p. 291). Some argue that the need to both “prove” and “improve” libraries has created a reductionist culture (Urquhart, 2018), where “assessment is the golden bullet that when ‘done’ will achieve evidence, directions, and judgment” (Nitecki et al., 2015, p. 207). Nitecki et al. (2015) contrast this approach with “effective assessment” that leads to meaningful outcomes and impact, arguing that there is currently a disconnect between current practice and “what is desired (i.e., evidence of impact, directions for program improvement, judgment of value)” (p. 207).

Impact comes from showing the effects of library services on individuals’ and communities’ experiences, rather than looking solely at quantitative data (e.g., general patron satisfaction obtained through a survey, number of article downloads from a database) (Oakleaf, 2013). Farell and Mastel (2016) agree, saying that quantitative metrics “tell a portion of the story of libraries’ impact, [but] they do not tell the whole story” (Introduction, para 2). There may be general agreement that multiple (quantitative and qualitative) methods of inquiry are necessary to understand the impact of services and programs over time; however, lack of familiarity with some kinds of data collection approaches may be a barrier for engaging in holistic assessment. Farell and Mastel (2016) surveyed 39 librarians and found that, while the majority were comfortable with quantitative approaches, such as counting the number of people using a space or attending an event, fewer were comfortable with qualitative methods, including interviews and focus groups. Further, community engagement activities may be viewed by as “marketing activities” or part of the “dailyness” of library outreach work (Polger & Okamoto, 2013). As such, they may be disconnected from the mission, goals and objectives of the parent institution, and therefore not captured as contributing value using existing assessment and evaluation frameworks (Farrell & Mastel, 2016).

Demonstrating value

Value has been described in myriad ways, including cultural, educational and financial (Kelly & McNicoll, 2011; Matthews, 2019). The library’s value may be appraised in terms of its collection, e.g., size, scope; the extent to which library resources are used, e.g., number of items circulated; constituents’ attitudes toward the library, e.g., user satisfaction surveys; or its ability to support the desired outcomes of the parent institutions, e.g., student success (Connaway et al., 2017). Value is traditionally thought of in economic terms, where the cost of operating library spaces and services is weighed against the benefits to library users (Missingham, 2021). Economic value is linked
with narratives of accountability and return on investment (ROI) (Missingham, 2021; Nicholson, 2015). For instance, the LibQUAL+ survey, used to assess the quality of academic library facilities, services and resources, may encourage an “audit culture” that treats library patrons as “consumers,” and lacks the ability to show true impact (Urquhart, 2018, p. 122). Further, Clarke et al. (2022) argue that economic value calculations do not account for the invisible labor of library staff.

It has been suggested that the commodification of libraries should be dismissed in favor of social value, which focuses on the significance of libraries to constituents and communities (Missingham, 2021). Social value could result in “transformative” learning experiences for university students (Nicholson, 2015, p. 334), improved social cohesion, enhanced self-efficacy, increased intellectual or social capital, etc. (Matthews, 2019). However, social value outcomes are less tangible, and their collection and use may be disconnected from the transactional, quantitative data typically collected by libraries (Oakleaf, 2010). It has been argued that using qualitative and quantitative metrics in tandem can be used to demonstrate social value (Missingham, 2021). The discourse around KE and research impact may support greater incorporation of social value into library assessment and evaluation.

Research impact recognizes that societal issues do not operate in closed systems where direct cause and effect relationships can be observed between activities and outcomes (Morton, 2021); evaluation is longitudinal; and any change that occurs may have multiple contributing factors, including, but not limited to, a single input like a research study (Morton, 2015). It has been pointed out that “[t]here is little research on how library services lead to value generation in the lives of library users and ultimately in the community itself” (Matthews, 2019, p. 121). Thus, the ability to better capture social value may have implications for how the work of information professionals is prioritized and validated from both institutional and societal points of view.

**The current study**

In Canada, where our research is situated, university strategic plans continue to highlight teaching excellence and research innovation, but also call for diversity and decolonization, local and global community development and sustainability, and public discourse and knowledge exchange (e.g., University of British Columbia, n.d.; York University, 2020). Similarly, cities are including environment and climate, social development, and equity commitments in their long-term planning processes (e.g., City of Toronto, 2023). A recent examination of Canadian and US public library mission statements revealed that, in addition to being places for communities to access multimodal materials that meet their needs, libraries seek to “connect and empower citizens,” provide equitable access to information, and be sites of “transformation” and “enrichment” (Fraser-Arnott, 2021, p. 244). These themes reflect memory institutions’ alignment with the kinds of aforementioned priorities identified by universities and municipalities. Further, some scholars have petitioned for more critical reflection of assessment work (Magnus et al., 2019) and questioned how the “values of the library or librarianship fit into that process” (Doucette, 2016, p. 289). The current study picks up these threads with respect to how library assessment and evaluation are currently practiced, discussed, and being reimagined, and positions this against a backdrop of institutional and societal shifts toward mobilizing knowledge for individual and community impact. In doing so, we demonstrate how the ongoing KE work of information professionals can be supported by interdisciplinary frameworks that advocate for longitudinal, mixed methods approaches. The research questions guiding our inquiry are:

1. (How) are information professionals engaged in knowledge exchange evaluating and assessing their work?
2. What characteristics of KE-related work are being captured by existing evaluation and assessment practices, and what gaps have participants identified?

**METHODS**

**Recruitment and participants**

This study received ethics approval from the Behavioral Research Ethics Board at the University of British Columbia, Vancouver, BC. Information professionals with a Master of Library and Information Studies (MLIS) or equivalent degree were recruited through email listservs of local and national library and archival associations and a national knowledge exchange network between January-May 2020. The goal was to reach LIS professionals working in a range of organizations and roles and learn about the ways in which they were engaging in knowledge exchange (KE) practices. KE was defined broadly in the recruitment notice as:

…the ways in which information professionals help to translate, share, and move information within and between the communities they serve. Information professionals might engage in this work as part of a research team, in relation to open access and scholarly communication initiatives, supporting community archives, adopting or facilitating community-led strategies in the development of library services and programs, connecting libraries and the public in ways that lead to knowledge exchange, and so on.
Interviews were conducted with 25 people. All participants selected a pseudonym for the study to preserve their anonymity. One person withdrew from the study post-interview and the researchers deleted all audio and text-based files associated with their participation.

The remaining 24 participants had a range of professional experience, from one to 25+ years (Mean = 11.5 years). They worked in academic libraries (n=13), non-library university settings (n=4), public libraries (n=3), non-governmental organizations (NGO) and associations (n=2), community archives (n=1), and hospitals (n=1). All participants were fluent in English and interviews were conducted in English. The majority (n=23) of interviewees identified as female. Interviewees resided in one of three Canadian provinces (Alberta, British Columbia, and Ontario), with the majority based in BC (n=17). Participants self-described their areas of professional specialization as encompassing the following areas: community engagement (n=5), medicine and public health (n=4), archives and special collections (n=5), information and public services, including discipline specific liaison work (n=3), open education (n=2), community archives (n=1), knowledge mobilization and research impact (n=2), Indigenous knowledge systems and engagement (n=1), and embedded research facilitation (n=1).

Procedure
The recruitment notice included the researchers’ email contact information. People who were interested in the study reached out to the researchers and were sent the consent form via email for further information. For those who wished to take part, a mutually convenient time was arranged for the interview to take place. The timing of the study coincided with the Covid-19 pandemic, and therefore all interviews – except one that occurred pre-Covid lockdown – were conducted remotely via the telephone or video conferencing software. Participants were asked to read and return a signed copy of the consent form prior to the interview; however, at the beginning of each interview we reviewed the consent form and offered to address any outstanding questions or concerns. Next, participants were asked semi-structured interview questions related to:

- Professional experience, including education, years of professional experience, areas of interest or specializations, and a general description of their workplace, e.g., “large academic library.”
- Examples of knowledge exchange initiatives and projects in which they had been involved, as well as strengths they, as information professionals, brought to this work, and any experienced challenges.
- Reflection on KE competencies with respect to their importance in their work; for example, ability to understand the organizational context and research process, collaborate and co-create knowledge with constituents, and engage in knowledge translation, dissemination and exchange processes and activities.
- Personal and professional opportunities to develop KE competencies, skills, attitudes and expertise, and the potential for working with other individuals and units on knowledge exchange projects.
- Reflections on what is needed for LIS professionals to be successful in KE work.

All interviews lasted approximately 60 minutes. At the conclusion of each interview, participants were thanked for their time and given a chance to ask additional questions about the study. They received a follow-up email with a debriefing form and an electronic gift card valued at $20 CDN.

Audio recordings of interviews were transcribed by members of the research team or a professional transcription service. Author KM reviewed the written transcripts, making some corrections to sections where the audio files had been unclear and caused transcription errors. The corrected interviews were sent to individual participants, who were given an opportunity to review, amend and redact their content. As previously mentioned (“Recruitment and participants”), one person withdrew at this stage, leave 24 transcripts for analysis.

Data analysis
NVivo software was used to support qualitative data analysis. This research used codebook thematic analysis (TA), which used some pre-determined themes and a structured codebook, but allowed for open-ended, organic coding and analytic theme development (Braun, Clarke, Hayfield & Terry, 2019). Codebook TA allowed us to work as a team on data analysis. This enabled us to maintain some structure in the coding process while being open to emergent ideas (Clarke & Braun, 2014).

Our process was both deductive in inductive. Authors HO and KM first independently read through a selection of transcripts and made notes about our observations. We then came together to share our initial impressions and observations. The semi-structured interview questions guided the topics participants discussed with us, but exploring topics from participants’ perspectives brought new and deeper insights. For example, while we anticipated evaluation and assessment would be a thread in the interviews based on our interview questions, participants went beyond describing their current evaluation and assessment practices. Specifically, and without prompting, they spoke about challenges in their practices, including the difficulty in documenting intangible outcomes in their work.
Next, we developed tentative research questions related to evaluation and assessment and moved into generating codes (Clarke & Braun, 2014). The codebook was developed iteratively by authors HO and JY, with JY taking the lead on coding. The codebook contained definitions for each code and examples from the data to illustrate the code. During this process, we reviewed the codes for clarification and expansion, and the codebook was revised accordingly. For example, the code “challenges” was made more granular to include types of challenges, e.g., staff capacity, project duration, staff knowledge and expertise, etc.

We examined the codes and their categories to begin to develop themes. These included a description of challenges with current assessment and evaluation approaches, tensions between what was currently being done and what interviewees wanted to do, or felt would be more meaningful to do, and how the assessment and evaluation space could evolve. These “prototype” themes were revised and refined to look at the alignment of coded data within themes and in relation to other themes (Braun et al. 2019). Finally, the themes were revisited with respect to the initial research questions and the reviewed literature and are presented below as “Challenges with existing assessment and evaluation approaches,” “Showing the value of KE-related work,” and “Doing evaluation differently.”

FINDINGS
Interviewees described the use of multiple methods in their own practice and workplaces. Much of what they shared aligns with library assessment and evaluation at a general level. For example, they discussed gathering and maintaining statistics for: numbers of interactions, consultations, and people attending events and workshops; resource adoption rates; web and social media analytics; open rates on newsletters and emails; database vendor supplied statistics; and user surveys. Qualitative data was also mentioned, including verbal and written feedback from constituents. These verbal or written accounts often described the significance of a service or program; one interviewee referred to them as “impact stories” (“Lindsey,” Public Library).

Quantitative data was gathered through formal channels. For example, using feedback forms at events to gather input from attendees or surveys and focus groups to evaluate program outcomes. One interviewee’s organization implemented a micro survey tool into their website to capture quick feedback about specific digital resources (“Nina,” NGO). Qualitative data was typically captured informally. A few people mentioned receiving unsolicited feedback through emails (e.g., “Ann,” Community Archives) or noting when resources they had created were used and adapted by others (e.g., “Fiona,” Academic Librarian). However, some interviewees engaged in conscious documentation efforts, such taking photos at events and sharing these via social media (“Dana,” Academic Library; “Lisa,” Academic Library) or archiving materials from events (“Tara,” Archivist).

When it came to discussing current methods and tools, participants shared challenges on multiple levels. First, existing library assessment and evaluation models and methods were inadequate for capturing the nuances of relational KE-related work (Theme 1). As a result, participants experienced a disconnect in terms of how they were expected to document and evaluate their work, and what they truly wished to capture (Theme 2). In the following sections, we elaborate on these challenges and tensions, along with some of the personal and organizational barriers to “doing things differently” in this space (Theme 3).

Challenges with existing assessment and evaluation approaches
A few participants recognized that quantitative data was easy to collect and could provide a snapshot of the reach of a program, service or event, or evidence for decision making. For example, “Nina” (NGO) gave an example of a client asking her to discontinue a current awareness service during the Covid-19 pandemic due to their experience of information overload. She examined the email open rates to confirm that this service was still being used by the majority of clients. In this case, the quantitative data enabled “Nina” to decide to continue the service. Quantitative data, such as gate counts and website page views, is collected unobtrusively, making it concrete, convenient, and less onerous on clients to provide feedback. “Lindsey” indicated that quantitative metrics were informing the strategic plan at their public library for these reasons.

However, participants pointed out the limitations of quantitative data for KE-related activities in particular. “Dana” (Academic Library) summed this up, saying, “you can’t assess community engagement in the same way you can assess other programs and initiatives within libraries.” Dana and others argued that quantitative metrics did not reflect the multiple and myriad ways people interacted with their organizations, nor the impact of their services on community constituents. Academic librarian “Sarah” spoke of the “different kind of understanding” that comes from interpreting quantitative data, e.g., newsletter open rates, compared to “more in-person, more in-depth, higher-touch activities” that enable LIS professionals to understand the people with whom they are engaging.

Interviewees underscored the relational work of community engagement and knowledge exchange and that it was necessary to consider the temporal elements of such work. “Lisa,” whose work was situated with Indigenous communities, felt that the information professional’s role was one of facilitation and connection:
But the value of – the KE that can then happen in the community among Elders and younger generations because of the preceding steps of KE in the profession — we’re an important part of the exchange for cultural revitalization work, but the most important part is with the community. And recognizing our place in that conversation is a very important part of the relationship. Having that respect for our relationship and our place in that relationship, I think that we have to be humble and share what we know while recognizing that the reason we are doing this is so they can take the reins and share the knowledge that they need to share themselves, and decide whether it gets shared more broadly (“Lisa,” Academic Library).

Lisa’s example emphasizes building and maintaining relationships, and supporting communities to make decisions about what happens to the knowledge generated from their collaborations. Community self-sovereignty affects the extent to which LIS professionals may be able to report on the outcomes of community-based initiatives, and how best to do so, which may be at odds with typical assessment and evaluation practices.

Many participants articulated that relationship building takes time and care, and the process may not result in tangible outputs and outcomes. “Lindsey” described their approach to cultivating and maintaining relationships:

“I’d say in terms of trying to make time for it, again I just come back to setting specific goals on the workplan. I have check-in dates where I work to check in with various members of the community just to see how they’re doing, and we’ll go out for a coffee. Almost in the same way I approach a lot of relationships in my life that I see as important, but I know can kind of slip out of my daily purview. If I care about this aunt or if I recognize that this friendship is important to me and our lives don’t crisscross on a regular basis, how do I keep those going? Well, you have to make that time for it…” (Lindsey, Public Library).

These kinds of informal check-ins may be just as impactful as formal programming and services, but may not be viewed as significant or indeed be “counted” as part of one’s work. As Archivist “Tara” astutely asked, “how do you measure a relationship?”

A few interviewees shared that project goals shifted over time due to the learning that took place within the project and changes in the broader environment. As a result, indicators identified at the beginning of a project may be less applicable later on, and other data may not have been collected initially that would later be useful (“Amanda,” Academic Librarian); understanding whether services and programs were truly impactful may not be evident until three-five years had passed (“Alice,” University Knowledge Mobilization Unit); this timeframe was not in alignment with research grant funding cycles and, in the case of one interviewee, the completion of their formal role coordinating a project with industry partners (“Carol,” Academic Library). For these reasons, library strategic plans may be limited by taking a short-term view: “I mean you put something in your strat[egetic] plan and it’s your four-year strat[egic] plan. Do you take it off at the end of those four years?” (“Lindsey,” Public Library). The long-term nature of KE-related work warrants consideration of the sustainability of community-based initiatives and the fate of relationships when funding dries up, strategic plans change, and information professionals are assigned to new projects or in precarious employment situations (e.g., contract work).

**Showing the value of KE-related work**

Although participants agreed that quantitative methods do not adequately capture the impact of their work, they were required to collect and report on statistics. This revealed a disconnect between what interviewees were evaluating versus what they most cared about or wanted to evaluate.

A few interviewees said there was an emphasis on “numbers” (e.g., partnerships, new funding) in how their units were evaluated. “Alyssa,” a research facilitator, spoke to the challenge of trying to show the value of qualitative outcomes, such as network and relationship building, when reporting to funders in an academic environment where “papers published and conferences attended” were most prized. They described their reporting process as “kind of like checking boxes,” where the relational work was “harder to quantify and to justify as being worth the funding that we get but, in my opinion, [is] even more important than publication counts or citation counts” (“Alyssa,” University; embedded in research team).

In contrast, the practice of gathering, sharing and reflecting upon stories was highly valued by interviewees. The use of stories was motivated by the desire to learn about the impact of services and programs on communities over time. “Lindsey” (Public Library) viewed impact stories as a powerful expression of “trust and goodwill” when shared by constituents. Some interviewees took an active role in trying to document relational work with communities to demonstrate its value within their institution, as “Tara’s” example illustrates:

What we try to do is…report on the collaborations we’ve worked on. For example, we were asked to -- because of a relationship with a particular First Nations community, because of the trust that’s been established and the longstanding relationship that’s evolved -- we were asked to assist with the return of
regalia to the community. And reporting on all the joint workshops we’ve given across communities or the meetings we’ve attended across communities…reporting on those things, joint exhibits, internships, just whatever we can to show that these relationships bear fruit, in whatever way you can show (Tara, Archives).

Overall, gathering evidence to show value for one’s work was a strong thread in the interviews. Many participants expressed the value of stories as a way to “keep building the case” for their work (“Sarah,” Academic Library), and, in some cases, these narratives were incorporated into formal reporting mechanisms. This was especially important when a program or service did not have consistent funding, or when the numbers of people served by a program or service was low. “Alex” (Public Librarian) and “Dana” (Academic Librarian), for example, gave examples where the numbers of people served by an initiative was low, but the actual impact was significant for individual community members. In addition, “Laura” described a number of community-based partnerships as part of an ongoing effort to enhance their institution’s reputation, where the goal was to:

try to extend our physical collections beyond our physical walls and display these materials to members of the local public…reinforcing the message that we don’t just exist for the community of faculty, staff, and students -- we are a public university; therefore, these collections belong to the public and really trying to message that in new and different ways over the past five or so years (“Laura,” Archives).

Several people spoke to feeling supported in KE-related work in their organizations by administrators at different levels. At the same time, one person who said they felt supported also mentioned the constant battle to demonstrate the relevance and value of their work (“Kate,” College Librarian). In addition, “Lisa” indicated that, even when they did gather information for evaluation purposes, lack of uptake within their organization was problematic. She said, “It’s difficult for us to ask people to take time out of their day to contribute to a report that is necessary for us to demonstrate that value but it’s not even a report that always gets read” (“Lisa,” Academic Library). This observation reflects that LIS professionals risk overburdening their constituents when they engage in evaluation activities; the lack of acknowledgement and reciprocity in response to investments from communities could perpetuate narratives of extraction in community-institutional interactions.

**Doing evaluation differently**

Interviewees described working as part of committees on community-based projects, working alongside communications professionals in their organizations, creating specific professional positions for assessment and evaluation, and forming committees within their organizations to determine what data to collect and how to report on activities and outcomes. However, some of these ambitions were not yet at the implementation stage. In one interviewee’s case, the ability to evaluate program outcomes was possible because external funding allowed them to hire contractual research staff specifically for this purpose (“Sarah,” Academic Librarian). Thus, KE-related work and its evaluation may be viewed as important by interviewees and their organizations, but was largely at a nascent stage at the time the study took place.

One of the reasons for this may be that information professionals have limited capacity for evaluation in their current roles. Several participants relayed it was challenging to do the work, let alone evaluate and advocate for it. “Alex” (Public Library) said that their organization was trying to build evaluation into various positions, but this was “very exhausting. It takes a lot of time.” Time was lacking for individual participants, but also their organizations. “Lindsey” (Public Library) indicated that their workplace was, “in a state right now as an organization where we need to do some evaluation around what do we keeping doing and what do we let go of,” demonstrating the need to pause, reflect on, and reorient current practices.

In addition to limited time, interviewees expressed that knowing how to evaluate KE-related work was difficult given its intangible, relational elements. “Caitlin” (Academic Librarian) indicated that their institution was strategizing how to “measure knowledge exchange on our campus” but spoke to the limitations of the “bibliometrics-based” approach it was currently taking. As a result they admitted, “we want to support knowledge exchange, but we’re not exactly sure how to do that.” “Caitlin” was not the only person who was struggling with how to go forward. “Alex” (Public Librarian) shared that the question of how to engage in evaluation was much discussed in a community-engaged interest group in which they participated, but no clear directions had yet emerged. Others underscored the need for more dynamic assessment that featured both formal and informal practices, but they also felt constrained by project-limited funding and timelines (e.g., “Carol,” Academic Librarian).

“Amanda” (Academic Librarian), who described the “disconnect” between current evaluation models and efforts and emerging areas of work, including community engagement, relationship building, and accountability in long-term projects, suggested that it might be necessary to look “outside of our profession” for solutions. “Amanda” specifically highlighted models of knowledge mobilization and exchange, and “Alice” (University, Knowledge Mobilization Unit) emphasized the need to go to constituents or partners to understand impact: “So ‘Has there been
a policy change? Has there been a service improvement? What’s the story there?’ that’s what we try to get people to think about.”

“Dana” (Academic Library) pointed out that LIS roles involving knowledge exchange constituted “such unique positions” and they desired “some sort of network, or community…even a community of practice of people doing similar work.” “Dana” also asked whether “there are other knowledge exchange or knowledge mobilization tools that I should be learning, that I should be incorporating into my practice?” and had not come across any such resources. In addition to the need for support at the institutional and professional levels, “Lindsey” (Public Library) raised the need to make the work of LIS professionals in knowledge exchange more visible to illustrate “what libraries are doing to fill in the gaps when different services are cut.”

**DISCUSSION**

Participants in our study reported a number of quantitative and qualitative methods in use in their organizations. Quantitative approaches were more formalized, while qualitative strategies tended to be more emergent and informal. Our interviewees revealed challenges with existing approaches to evaluation and assessment, felt an impetus to show value or “build the case” for KE work, and expressed a desire to do things differently.

The LIS professionals we spoke with saw benefits to collecting quantitative data (e.g., convenient, non-obtrusive), but did not feel it provided a holistic picture of KE work. Specifically, existing evaluation frameworks did not support longitudinal projects with shifting goals or contexts, and did not legitimize time spent building and maintaining relationships with communities. This may be because service delivery is unique in different settings, and standardized evaluation frameworks may not map to diverse community settings and needs (Matthews, 2019). Magnus et al. (2019), explain that “desire to do useful, actionable assessment work compels us to focus on questions with clearly articulated answers, on activities by which we can easily measure ‘use’ or ‘impact’” (p. 600), but that this approach may be at odds with exploring complex issues. Interviewee “Lisa’s” (Academic Librarian) comments about allowing communities to “take the reins” reinforces that communities should be able to establish their own goals and priorities and determine what outcomes are shared from a collaboration (if any) (Nathan et al., 2017). Thus, in some ways, the process of assessing and evaluating may be antithetical to some aspects of community-based KE. There may be a mismatch in the kinds of outputs, outcomes and impacts that are important to different communities; transactional activities may be viewed more as “box checking” by communities, and LIS professionals themselves may desire deeper, more relational engagement.

Interviewees were aware of the tension between quantitative and qualitative modes of assessment. Some described working in environments that prized quantification (e.g., publication counts, gate counts) and struggling to articulate qualitative outcomes, even though they believed they were more important for conveying impact. Stories were frequently mentioned as tools for personal reflection, and as ways to understand the value of their projects and institutions in the lives of constituents. Some were actively documenting stories they received verbally and via email, creating stories for social media, and collecting photos and artifacts from events.

Yet, Magnus et al. (2018) contend that it is “not just ‘other forms of assessment’ that might be valuable” (“Critiques and Responses,” paragraph 4), but the acknowledgement of “assessment as a social and political act” (“Critical Assessment, paragraph 2). Study participants wanted to do assessment and evaluation differently, but encountered barriers. For busy professionals, assessment and evaluation is a time-consuming activity that leaves less time for doing the work. Clarke et al. (2022), who investigated the labor practices of academic librarians, found that many respondents in their study completed impact reports outside of paid work hours. They argued that this kind of invisible labor is linked to economic valuations that treat the library “as a passive object to be used” and “homogenize” librarians’ labor (Clarke et al., 2022, p. 938). Operating in such a model means that some kinds of labor may be “counted,” while other forms are discounted.

Nitecki et al. (2015) caution that assessment that does not encompass professional values, e.g., lifelong learning, knowledge preservation, access to information, “may run the risk of hindering the evolution of the library’s most powerful values” (p. 203). Different systems may need to be put in place before LIS professionals can engage in more authentic assessment of community-based KE. This may require dramatic organization-level changes in service delivery and redefining professionals’ roles and responsibilities in order to align evaluation with community engagement, advocacy, and collaboration priorities (Kendrick et al., 2023).

**Implications and recommendations**

Some interviewees expressed not knowing where to go to learn about knowledge exchange and its assessment and evaluation, and that being in unique positions in their organizations made it difficult to find support from others engaged in similar work. Next, we consider support at the individual and organizational levels, drawing upon previous research in LIS and implementation science. We return to the idea that knowledge translation,
mobilization, and exchange may offer useful contributions to LIS, specifically with respect to documentation and valuation.

**Individual**

Existing library assessment and evaluation scholarship critiques existing assessment and evaluation frameworks and culture, including the emphasis on economic value, and calls for greater reflexivity with respect to what is measured and how it is measured. Magnus et al. (2019) pose a series of questions to deconstruct the assessment process by centering considerations of power, privilege, and consultation. They write,

> It is precisely through stepping back and questioning the way we have always done things that we begin to consider the ways in which our work has the potential to uphold inequities—in the questions we ask, the populations we survey, and the analyses we conduct (Magnus et al., 2019, pp. 602-603).

The practice of critical reflection or “stepping back” is useful for recognizing the relationship between positionality and practice. It is also aligned with the desire to achieve more socially minded assessment outcomes (Magnus et al., 2018) that align with the KE projects our interviewees described.

Research evaluation typically features well-defined participants, timeframes, and levels of participant involvement, along with the ability to link actions and outcomes (Bonaccorsi, et al., 2020). However, when it comes to societal impact, such attributions are not possible; we can only show how a study, service or program has made a contribution, recognizing that other contributing factors may also be at play (Mayne, 2001).

> The library and other partners in the community identify pressing concerns within the community, and every partner works on improving that topic be it unemployment, kindergarten readiness, and so forth. Community indicators are used to track the cumulative impact of every organization focused on a specific concern over time. Clearly, the public library cannot claim that it is solely responsible for reducing the unemployment rate, but it can claim some credit along with the other partners (Matthews, 2019 p. 122, emphasis added).

Though not attributed as such, Matthews (2019) alludes to the concept of contribution analysis for helping LIS professionals make a stronger case for their role in societal impact. Building a “contribution story” (Morton, 2015, p. 412) involves strategies such as capturing the context, documenting service or program goals and decision-making frameworks, and describing activities, outputs, and observed outcomes (Mayne, 2001). The idea of the contribution story aligns with what our interviewees referred to as impact stories and current LIS research applying storytelling methodologies to digital literacy initiatives and information experience (LaRose & Detlor, 2021; McDowell, 2021). This line of inquiry has the potential to introduce robustness to practitioners’ current story documentation practices.

> We recommend that professional development opportunities, such as online toolkits, videos, and workshops, support LIS professionals in cultivating reflexivity and storytelling practices, and that stories are recognized as legitimate ways for information workers and organizations to document contributions that lead to societal impact.

**Organizational**

Assessment is not only the purview of individuals, but the organizations within which they work. LIS organizations are embedded in systems where decisions are made by university administrators, governments, accrediting bodies, and so on; these external stakeholders influence what memory institutions must “prove” (Doucette, 2016). Theoretical frameworks within implementation science may hold promise for application in LIS institutions. We briefly describe two: Morton’s Pathway to Impact and Ozanne et al.’s Relational Engagement models.

Morton’s (2015) “Pathway to Impact” model is comprised of three stages: research uptake, research use, and research impact (p. 411), and advocates for the use of multiple methods, including self-reports, observations, population statistics, and policy analysis. Research uptake involves creating opportunities for specific users to engage in research. The results of these activities are appraised in terms of research use, i.e., research users’ awareness and capacity to utilize research, and changes in their knowledge, skills, behaviors and practices. Outcomes and contributions are assessed as part of understanding research impact. Building on Morton’s model, Ozanne et al.’s (2017) “Relational Engagement” model proposes three additional elements: productive interactions, enhanced capacity, and improved social networks. Productive interactions are multidirectional exchanges between researchers and constituents; research users and researchers both enhance their capacity through collaborative projects, e.g., increased knowledge, new skills. This component is particularly interesting for reinforcing reflexivity amongst LIS professionals, where lessons learned can be actively applied in future practice. Finally, social networks include new contacts and improved knowledge flows, but also take into account trust and community building. The Relational Engagement model attempts to make the intangible more concrete by recommending quantitative and qualitative metrics and gathering evidence from indicators inside and outside the organization. Considering a wider range of assessment activities would be useful for LIS organizations and would justify activities that may not
currently be considered part of assessment and evaluation frameworks, i.e., checking in with partners over coffee or attending a community event as part of relationship building.

*We recommend exploring ways in which research impact models can be adapted to the LIS context to support the development of assessment and evaluation frameworks that champion demonstrating social value and impact.*

**Limitations**

In reviewing the literature about research impact, including university-community engagement, we observed that the scope of activities and assessment benchmarks is wide, many diverse internal (e.g., students) and external (e.g., local community organizations) stakeholders are discussed (e.g., Nelson, 2019), and there are challenges in terms of how to define research impact and what tools and strategies to employ to demonstrate it (Given et al., 2015). Thus, while we see promise in drawing from other disciplines including implementation science for LIS, we acknowledge that work in this space continues to unfold and solidify, and this will affect the ways in which LIS is able to apply it. In putting forward our recommendations, we also recognize that the systems in which our participants and other LIS professionals operate within are complex and entrenched, and making changes to such systems is not straightforward.

**CONCLUSION**

This paper reported on interviews with 24 information professionals about the ways in which they and their organizations assessed knowledge exchange activities. Participants described a range of quantitative and qualitative methods in use in their organizations. They expressed that traditional, quantitative metrics failed to capture the relational, holistic nature of KE, while qualitative metrics were favored but less formalized and legitimized. Our participants identified gaps in current assessment and evaluation frameworks with respect to KE work, including a mismatch between what they wanted to capture and what current tools and methods enabled them to capture, and incongruence between the timescales of community-based projects and organizational strategic plans and mandates. They also identified resource constraints that challenged their ability to practice meaningful assessment of KE, along with the need for more flexible evaluation frameworks. We discussed these findings in relation to prior research, but also drew upon ideas and models from implementation science to make recommendations for supporting information professionals in the many roles they occupy in the K* Spectrum.

LIS professionals have unique and valid perspectives on KE-related work. Our participants understood the kind of information they needed to demonstrate success when it came to mobilizing knowledge and supporting positive outcomes in their communities. Yet, they did not have an effective evaluation framework to shape and justify the collection of this information, and they knew it did not do the work justice to compress it to fit within the standard metrics or reporting mechanisms. This paper gives voice to these challenges and proposes some future directions to help shift library assessment and evaluation toward the kinds of social impacts our participants aspired to achieve.

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An Investigation of the Use of Theories in Misinformation Studies

Ogbadu-Oladapo, Lydia  
Chung, Hsin-Husan  
Li, Jiyuan  
Chen, Jiangping  

University of North Texas, USA | LydiaOladapo@my.unt.edu  
University of North Texas, USA | hsin-hsuan@my.unt.edu  
University of North Texas, USA | jiyuanli@my.unt.edu  
University of North Texas, USA | jiangping.chen@unt.edu

ABSTRACT
This paper examines social science and humanity theories that have been applied to studies dealing with misinformation. We identified 273 articles published from 2012 to 2023 from Web of Science, Scopus, and ScienceDirect. These articles are empirical studies that have applied one or more social science or humanity theories. Applying content analysis approach, we identified 124 theories that authors have used in their studies. These theories belong to different disciplines or fields, such as political science, psychology, communication, sociology, and economics. We discuss the top 11 theories and how they have been used to understand misinformation and its impacts. This study provides insights into understanding current misinformation studies and rich resources for information evaluation and information literacy education.

KEYWORDS
Misinformation, theories, systematic review

INTRODUCTION
Current information age makes it convenient to obtain information via all kinds of digital platforms, such as search engines and social media. However, people and society are challenged by the flooding of misinformation, which has become a popular topic of discussion at the recent iConference and ASIS&T annual conferences. Various aspects of misinformation have been raised and investigated by the keynote speakers and the conference participants. Literature shows that information science researchers have been exploring, along with researchers in other disciplines, the spread of misinformation on social media, its impact on different groups of people, and the methods to detect and correct misinformation.

Studies investigating the spread and impact of misinformation apply theories in multiple disciplines to guide the investigation. Nguyen et al. (2023) conducted a content analysis of 151 articles in the library and information science domain. While around 39% of the articles did not use theories, more than 40 theories, models, and frameworks have been applied in these studies. However, their analysis was limited to library and information studies (LIS) journals and did not differentiate theories in social science and humanities from frameworks or models in computer science. The coverage of social science and humanity theories and their disciplines is unclear.

This study aims to achieve the following purposes: (1) to identify social science and humanity theories that have been applied in misinformation research; (2) to understand the disciplines of these theories, and (3) to examine how they were used. The research questions we would like to answer include the following:

RQ1: What theories have been applied to guide misinformation studies?
RQ2: What are the disciplines or fields that these theories belong to?
RQ3: How have these theories been applied in misinformation research?

Our study focuses on social science and humanity theories. Many computational models and frameworks have been adopted to study misinformation detection and correction, which are also part of misinformation research. These types of theories are worth a separate examination for the purpose of improving information systems fighting misinformation, which is out of the scope of this study.

RELATED LITERATURE
Theories and their functions
There is no agreed-upon definition of theory. The word theory originated from the Greek word “theorēin,” meaning “to look at”; “a rational type of abstract thinking about a phenomenon, or the results of such thinking,” (Wikipedia), “to consider, speculate, and look at” (Etymonline, n.d). Among the many definitions of theory, Merriam-Webster Dictionary describes it as “a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena”; Oxford Dictionary defines it as “a supposition or system of ideas intended to explain something, especially one based on general principles independent of the thing to be explained.” Also, a theory is viewed as “a set of statements about the relationship(s) between two or more concepts or constructs” (Jacoby & Jacoby, 2010, p.28), as a model applied to everything and nothing specific (Prokopowicz, 2019), as a set of claims advanced amid continuous abstractions aimed at a generalized statement expected to interpret a phenomenon.
The concept of Misinformation also has different definitions or other names. It is defined as “false information” (Fetzer, 2004), inaccurate information (Karlova & Lee, 2011), as a virus (Spinney, 2019; Smith & Bastian, 2022), and as “articles that are intentionally and verifiably false, and could mislead readers” (Allcott & Gentzkow, 2017) (Nguyen et al., 2023, p. 2). Although misinformation and disinformation are often misunderstood, misused, or even used interchangeably (Allen & Zimmerman, 2022), they are different. However, misinformation, disinformation, rumor, or fake news share the wrong message(s) that can mislead with adverse consequences (Nguyen et al., 2023; Wu et al., 2019) and can be much worse when it relates to health, senior adults, and children. Therefore, this study focuses solely on misinformation as an umbrella term, and the essential characteristics of misinformation include that it is not true and may lead to serious, negative consequences when it is believed or spread.

Various social media platforms are considered the most popular channels for spreading misinformation. These platforms, such as Facebook, Twitter, Instagram, TikTok, and Snapchat, make it easier for people to share information and connect with each other. Unfortunately, people may be misled by misinformation if they do not carefully evaluate messages they receive from these platforms. Research found that there are many factors that may aid the spread of misinformation, such as Altruism, ignorance, peer pressure, and attention-seeking (Apuke & Omar, 2020; Horner et al., 2021). Evidence suggests that misinformation is more likely to be shared, especially when it aligned with people’s pre-existing beliefs (Del Vicario et al., 2016). Health-related and political misinformation tends to spread quickly (Roozenbeek et al., 2019).

Wilson (1977) explores the prevalence of private ignorance and public knowledge in our world, which may help us to understand the misinformation spread. He asserts that the public seems ill-informed, while individuals often possess significant gaps in their understanding. This gap will lead to decisions based on unreliable information. Wilson argues that as long as credible knowledge is not effectively shared with the public, the proliferation of misinformation will persist.

Misinformation could be costly and deadly. For example, health-related misinformation has been a major threat to people’s health during COVID-19 (Roozenbeek et al., 2019). Certain groups of people are vulnerable to misinformation, for example, young adults (Leeder, 2019; Veeriah, 2021) and senior adults (Lee, 2018; Seo et al., 2021). In this study, we used a similarly broad definition as by Nguyen and colleagues (2023) for misinformation: misinformation refers to articles, posts, messages, and other representations that are intentionally fabricated and verifiably false to mislead people.

**Review Studies on Applying Theories in Misinformation**

Misinformation studies have emerged as an important area of research due to their increasing prevalence and potential consequences on people and society. We believe theories are essential to guide empirical misinformation studies and should be explored more, especially in the field of Information Science for fighting misinformation. Unfortunately, we found very few reviews that have been conducted to understand the theories and their applications in misinformation research.

Orr and Gordon (2022) conducted a scoping review on communication and messaging interventions that utilize health behavior theory to address COVID-19 vaccine hesitancy. An exhaustive list of keyword pairings was used to search the articles. The identified 36 articles and analyzed them to answer their research questions. The scoping review identifies several health behavior theories that have been applied in the context of COVID-19 vaccine hesitancy studies, such as the Theory of Planned Behavior, the Health Belief Model, and the Social Cognitive Theory. These theories concentrate on various factors that could influence individuals’ decision-making processes, such as perceived susceptibility, perceived benefits, social norms, etc. The authors concluded that utilizing health behavior theories in communication and messaging interventions holds promise in addressing vaccine hesitancy.
These interventions typically involve tailored messages, persuasive communication, and targeted information delivery. The authors resulted in some vital intervention strategies, such as providing factual information about vaccine safety and efficacy, addressing misconceptions and concerns, utilizing social norms, and emphasizing the collective benefits of vaccination. The writers also emphasized the importance of evaluating the cultural, social, and individual factors that contribute to vaccine hesitancy.

Another study by Tsamakis et al. (2022) reviewed 43 studies of the data and factors associated with COVID-19-related conspiracy theories during the first year of the pandemic. Their systematic review aimed to summarize the existing literature on the topic and identify the main factors contributing to the development and spread of conspiracy theories related to COVID-19. The authors organized the factors into three categories: sociodemographic (age, gender, income, etc.), psychological (pessimism, impulsivity, anger, and many more), and others (political conservatism, religiosity, mistrust in science, fear, panic, social polarization, and more). Their analysis showed that between 0.4% and 82.7% of participants agreed with at least one conspiracy belief. Therefore, the authors suggest that large-scale collaborations between governments and healthcare organizations are needed to curb the spread of conspiracy theories and their adverse consequences.

**RESEARCH DESIGN**

This study utilized a systematic review approach to answer the research questions. The research design process is shown in Figure 1. As illustrated by Figure 1, our study can be divided into three stages: Data collection, Data Selection, Verification, and Analysis. Specifically, we chose three renowned large academic databases (Scopus, ScienceDirect, and Web of Science) to collect metadata and select articles according to several inclusive and exclusive criteria. Then, we performed meta-analyses automatically to understand the characteristics of the data, and conducted manual content analysis to answer the research questions.

**Figure 1. The Research Design**

**Data collection**

To achieve our research purposes, we utilized search terms such as “misinformation,” “theories of misinformation,” “theories,” and “theory” to search for relevant articles. First, we entered the keywords into the topic search fields: Article title, Abstract, and Keywords on Web of Science, Scopus, and ScienceDirect databases. The searches retrieved 1,015 articles on the Web of Science, 1,268 articles on Scopus, and 51 articles on ScienceDirect as of February 08, 2023. There are in total 1,526 articles after we manually removed the duplicates.

We established explicit exclusion and inclusion criteria to further narrow down the dataset. We decided to analyze articles published from 2012 to 2023. Furthermore, these articles needed to be peer-reviewed and written in English. We found 840 articles from the Web of Science, 747 articles on Scopus, and 17 articles on ScienceDirect that met the above requirements. We manually removed the duplicates among these articles, and 876 remained. The metadata records of each article, such as author, article title, venue, publication year, ISSN, URL, DOI, abstract, and author keywords, were used to remove the duplicates.
Data selection and verification
Because this study focused on exploring the application of social science and humanity theories in misinformation, we used the articles' subject field to retain only articles in social science and humanity fields, which led to 489 qualified articles. Furthermore, we manually reviewed each article to finalize the target articles—the inclusion criteria for target articles as in Table 1. Selected articles were empirical studies, full text available, related to misinformation, applied one or more theories, and did not focus on developing computer science or mathematics models. Finally, we downloaded 273 articles, or 55.8% of the 489 articles, as our dataset for analysis and answering the research question.

<table>
<thead>
<tr>
<th>Criteria for target articles</th>
<th>Articles included</th>
<th>Articles excluded</th>
<th>Number of Paper excluded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Empirical study</td>
<td>Opinion article</td>
<td>84</td>
</tr>
<tr>
<td>Full text available</td>
<td>Yes</td>
<td>No</td>
<td>45</td>
</tr>
<tr>
<td>Specific theory(s) based</td>
<td>Yes</td>
<td>No</td>
<td>43</td>
</tr>
<tr>
<td>Related to misinformation</td>
<td>Yes</td>
<td>No</td>
<td>32</td>
</tr>
<tr>
<td>Subject</td>
<td>Humanity and Social Science</td>
<td>Computer science or math model</td>
<td>9</td>
</tr>
<tr>
<td>Language</td>
<td>English</td>
<td>Non-English</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 1. Article Selection Criteria

Meta-analysis and coding
We conducted a bibliometric analysis of the 273 selected articles to understand their general characteristics. Then we focused on identifying theories that have been cited in these articles. Our coding scheme is straightforward: we looked for the following from the articles:

- Theory - A specific theory(s) that is claimed by the author(s) that had guided the research
- Context - The main topic/field or background of the study
- The use of the theory and specifics of the study – How the study used a theory or theories in the research, sample size if applicable, and study context.

After discovering the theories in 273 articles, we searched for several general characteristics, including developer, development time, definition, and discipline, of the top 11 theories.

RESULTS
This section first presents the characteristics of the dataset – the 273 selected articles. Then we focus on the theories applied by these studies, including the list of the theories and examples of how they were applied by the studies.

Characteristics of the selected articles

Paper distribution over time
The final 273 articles were published from 2012 to 2023. Figure 2 shows their distribution over time. The result indicates that 102 articles (37.4%) were published in 2022, followed by 2021 (55 or 20.1%), 2020 (28 or 10.3%), and 2019 (25 or 9.2%). The results are consistent with those by Nguyen et al. (2023). Research on misinformation is still attracting a lot of attention from researchers in different disciplines.
Publication venues
The 273 articles were published in 173 different venues that most of them are academic journals. Table 2 shows the top 11 venues that published the most articles in our dataset. The *Frontiers in Psychology* and *Health Communication* rank first with 10 articles, followed by *Applied Cognitive Psychology* (7) and *Proceedings of the ACM on Human-computer Interaction* (6). Among them, 8 of the journals consider themselves multidiscipline and will accept submissions from different fields. For example, the journal *Information Processing and Management* has been a popular venue for computer science and information science researchers. Also, our dataset includes 3 articles from ASIS&T annual conference proceedings.

<table>
<thead>
<tr>
<th>Venue</th>
<th>Field/Discipline</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontiers in Psychology</td>
<td>Psychology</td>
<td>10</td>
</tr>
<tr>
<td>Health Communication</td>
<td>Social Sciences</td>
<td>10</td>
</tr>
<tr>
<td>Applied Cognitive Psychology</td>
<td>Multifield</td>
<td>7</td>
</tr>
<tr>
<td>Proceedings of the ACM on Human-computer Interaction</td>
<td>Multifield</td>
<td>6</td>
</tr>
<tr>
<td>Social Science and Medicine</td>
<td>Multifield</td>
<td>6</td>
</tr>
<tr>
<td>American Behavioral Scientist</td>
<td>Multifield</td>
<td>5</td>
</tr>
<tr>
<td>Computers in Human Behavior</td>
<td>Multifield</td>
<td>5</td>
</tr>
<tr>
<td>Frontiers in Political Science</td>
<td>Multifield</td>
<td>4</td>
</tr>
<tr>
<td>Information Communication and Society</td>
<td>Social Sciences</td>
<td>4</td>
</tr>
<tr>
<td>Information Processing and Management</td>
<td>Multifield</td>
<td>4</td>
</tr>
<tr>
<td>Journal of Risk Research</td>
<td>Multifield</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2. Top 11 Publication Venues for Selected Articles

Authorship
Our analysis found that most of the papers have 1-4 authors. Specifically, 84 (30.9%) articles were written by 2 authors, 62 (22.8%) by 3 authors, 42 (15.4%) by 4 authors, and 37 (13.6%) by single author.

Theories and their categories
Our analysis identified 124 theories that have been used in the 273 papers. The complete list of the theories we discovered from these articles and their fields can be found from the Appendix 1 of a Google sheet [the link to the Google sheet is provided at the end of the Summary and Conclusion Section]. We are not familiar with some of these theories, so their fields were determined with the aid of search engines and Wikipedia. The fields of the identified theories are summarized in Table 3. The result indicates that most theories are in the field of psychology and its sub areas. Specifically, 27 theories are in Psychology, followed by Communication (18), Social Psychology (13), and Sociology (10).
The number of theories listed in Appendix 1 demonstrates that misinformation researchers have applied a good number of different theories. However, most of the theories were used by just one or two studies in our dataset – the 273 articles. To save time and effort, we decided to focus on the theories that have been used by more than two studies and take a closer look at them. Table 4 lists the top 11 most frequently used theories, their disciplines, frequency (number of papers that used them in our dataset), the creators, and the reference to their initial publications. The Conspiracy theory ranks first with 117 applications, which means this theory was applied by 117 out of the 273 articles, or 42.4%. Other highly applied theories include the Inoculation theory (14), the Fuzzy-trace theory (7), and the Theory of planned behavior (6).

<table>
<thead>
<tr>
<th>Theory</th>
<th>Discipline</th>
<th>Frequency</th>
<th>Developer</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conspiracy theory</td>
<td>Political Science</td>
<td>117</td>
<td>Charles Astor Bristed</td>
<td>Bristed (1863)</td>
</tr>
<tr>
<td>Fuzzy-trace theory</td>
<td>Psychology</td>
<td>7</td>
<td>Valerie F. Reyna &amp; Charles Brainerd</td>
<td>Reyna and Brainerd (1995)</td>
</tr>
<tr>
<td>Theory of planned behavior</td>
<td>Social Science</td>
<td>6</td>
<td>Icek Ajzen</td>
<td>Ajzen (1985)</td>
</tr>
<tr>
<td>Framing theory</td>
<td>Sociology</td>
<td>5</td>
<td>Erving Goffman</td>
<td>Goffman (1974)</td>
</tr>
<tr>
<td>Dual process theory</td>
<td>Psychology</td>
<td>4</td>
<td>Peter Wason &amp; Jonathan St B. T. Evans</td>
<td>Wason and Evans (1974)</td>
</tr>
<tr>
<td>Protection motivation theory</td>
<td>Psychology, Medical Science</td>
<td>4</td>
<td>Richard W. Rogers</td>
<td>Rogers (1975)</td>
</tr>
<tr>
<td>Fallacy theory</td>
<td>Philosophy, Politics</td>
<td>3</td>
<td>Aristotle</td>
<td>Aristotle (1934)</td>
</tr>
<tr>
<td>Signal detection theory</td>
<td>Psychology</td>
<td>3</td>
<td>Gustav Fechner</td>
<td>Fechner (1966)</td>
</tr>
<tr>
<td>Social network theory</td>
<td>Psychology</td>
<td>3</td>
<td>Émile Durkheim and Ferdinand Tönnies (1890s); modified by Jacob Moreno</td>
<td>Moreno (1934)</td>
</tr>
</tbody>
</table>

Table 4. Top 11 Common Theories Leading in Misinformation Research

It is interesting to observe from Table 4 that the most frequently applied theories are mainly developed more than 40 years ago. The most applied theory – conspiracy theory, was initially published 160 years ago. Theories developed a
while before the age of social media were applied to explain the infodemic and misinformation. In the next section, we will describe these top 11 theories and their application in some of the articles of our dataset.

**Top 11 common theories leading in misinformation theory research.**

**Conspiracy theory.** A conspiracy is “a secret plan by a group to do something unlawful or harmful” (Oxford Dictionary, n.d.). Conspiracy theory was designed initially to resist fabricated information and reinforced by circular reasoning. But it is now commonly applied to explain a situation that invokes a scheme by certain groups when other reasons are more probable, often seen as politically motivated. This theory has been used in many ways, for example, in our review, Lewandowsky (2021) used it to investigate the rejection of science. Hřčková et al. (2019) used it to deduce the intention of fake news and propaganda. Lewandowsky et al. (2013) applied it to identify the factors underlying the rejection or acceptance of climate science. Nyhan et al. (2016) used it to investigate and test the effects of redactions of government documents on beliefs. And Bolsen, Palm and Kingsland (2020) utilized it to explore social media users’ perceptions and behavior in the context of a pandemic (COVID-19) misinformation.

**Inoculation theory** was initiated to provoke attitudinal resistance against propaganda. It offers an intuitive solution to problems, such as fake news diffusion regarding a viral infection, by suggesting an alternative possibility of a ‘vaccine’ against it. In our dataset, authors utilized this theory in many ways – Roozenbeek & Linden (2019A) used it to develop educational games that can counter the reliance on misinformation and pilot-tested it on 95 randomized fields. Basol et al. (2021) used it to evaluate the efficacy of two pre-bunking interventions to improve individuals’ ability spotting manipulation techniques commonly used in COVID-19. Also, Maertens et al. (2020) applied it to a preregistered extension and replication experiment while exposing subjects to a persuasive misinformation message for a week, then tested whether inoculation effects can protect against a misinformation attack, then examined the efficacy over a certain period.

**Fuzzy-trace theory** proposes that information is encoded on a continuum from precise (verbatim traces) to imprecise representations (fuzzy traces), which generally require more effort to adopt. It helps explain false memory and its development, probability judgments, biases, and fallacies in decision-making. Broniatowski and Reyna (2020) propose and test a model of online media platform users’ decisions to act on and share received information. The model uses factors derived from fuzzy-trace theory to make predictions regarding which content is more likely to be shared. The authors test their model on an existing dataset of tweets about vaccines. Brackmann et al. (2016) recruited 220 participants in the experiment to examine the effects of different types of testing on the vulnerability to misinformation in different age groups based on Fuzzy-trace and Associative-activation theories. Wolfe et al. (2023) used fuzzy-trace theory to guide the assessment of the characteristics of web pages presenting medical misinformation about vaccination that are most likely to affect medical decision-making.

**Theory of planned behavior** maintains that 3 core components, namely, attitude, subjective norms, and perceived behavioral control shape an individual's behavioral intentions. Filkuková et al. (2021) recruited 405 Norwegian participants to examine the impact of individual beliefs on precautionary health behavior, and the results agreed with the theory of planned behavior assumptions. Xiao et al. (2021) based on the theory of planned behavior to explore the relationship between individual trust and experience in fact-checking platforms and their fact-checking behavioral intentions. Alwreikat (2022) applied the Theory of Planned Behavior to investigate 210 Library and Information Science students' behavioral intent to verify the information before sharing it during the COVID-19 pandemic.

**Framing theory** proposes that human thinking is informed by unconscious mental frames triggered by some words or phrases (Gorton, 2016). This theory, on the one hand, can be applied to detect microtargeting. On the other hand, it can be used for misinformation correction, to test theory-based correction messages using loss versus gain framings to combat misinformation online (Facebook), and to investigate online climate change denial and advocacy (Xu & Atkin, 2022). Also, to extend the impacts of correction messages from misperceptions to behavioral intentions and to examine the conditional effects of reflection on information processing. In our dataset, this theory and agenda-setting theory guided Xu and Atkin (2022) in topic modeling of web pages (from 2007-2019) to investigate online climate change denial and advocacy. Likewise, Park, Lee & Jeong (2022) adopted this theory in exploring how the Korean news has framed or attributed the causes of fine dust to internal and external factors. Also, Borah et al. (2022) conducted an experiment guided by this theory to extend the impacts of correction messages from misperceptions to behavioral intentions and examine the conditional effects of reflection on information processing.

**Dual process theory** posits that two systems operate in the human mind - the fast and the slower decision-making process; individuals use both to varying degrees depending on the issue at hand. This story can be used to check propaganda and unfounded rumors (Irenoa, 2021; Nerino, 2021). Irenoa (2021) employed the theory to develop an instrument for purposive sampling and content analysis to understand social media's role in the generation and diffusion of information during the 2015 general elections in Nigeria. Irenoa noted that social media was used to
post offensive information to misinform the citizen against some candidates to sway the election. Furthermore, Nerino (2021) embraced it to explore computational propaganda, a type of political misinformation executed on social networking platforms by automated agents to increase support for a specific political standpoint. To accomplish their goal, the author compared socio-political tweets with the news of the week to check whether the issue addressed by the tweet matched those from the most prominent news media, then to determine the existence of emotional verbiage, emoticons, catchy punctuation, and capital letters. Findings suggest that about 74% attempted to establish a link between the topics, while others may have been misled by these persuasive strategies. It implies that as advocates of democracy and climate action exploit social media to gain support, bad actors can also spread misleading information designed to manipulate users to support a particular cause or leader.

**Protection motivation theory** was initially developed by Rogers in 1975 to help understand human responses to fear appeals and expanded in 1983 to a more general persuasive communication theory. PMT proposes that people protect themselves based on threat and coping Appraisal. It explains how people react to threats and take protective measures to reduce their risk of harm. Laato et al. (2020) adopted the protection motivation theory with 294 Facebook users from Bangladesh to appreciate the relationship between online information trust, information overload, sharing of unverified COVID-19 information, and COVID-19-related cyberchondria. Kim and Tandoc Jr (2022) surveyed 1,023 Singapore residents to investigate the consequences of receiving online COVID-19 prevention misinformation based on the protection motivation theory. Naeem and Ozuem (2022) combined the protection motivation theory and the theory of rumor transmission to recognize how socially shared misinformation, and rumors may increase motivation to protect personal interests and the desire to panic buy across the world. Overall, the protection motivation theory is a valuable framework for understanding how individuals respond to threats and can be applied to a wide range of contexts, including issues of health and political misinformation.

**Social network theory** posits that social groups could exist as personal and direct social ties that link people who share common beliefs and values or formal, impersonal, and instrumental social links (Durkheim & Tönnies, 1893). Moreno (1934) modified this theory by developing sociograms, a graphical illustration of social links to investigate interpersonal relationships. This theory application in our review includes helping to determine relationships between people, groups, organizations, and society. Guided by this theory, White (2014) used it in their approach to illustrate how inaccurate research, media, and public opinion through community ties and social networks led to a reduction in the use of vaccinations in the U.S. and an increase in disease outbreaks (for example, measles). This theory, therefore, can be used to understand how media or a particular group can reshape health knowledge through misinformation and change public health behavior. Mututwa and Matsilele (2020) embraced the theory to develop a qualitative study to explore how some international celebrities announced their COVID-19 infection using their Twitter pages. In addition, Roberts et al. (2017), through the lens of this theory, investigated 109,400 to understand the disparity of Ebola infection news. Therefore, social network theory helps us understand the essence of interrelationships, implications, and impacts on society.

**Fallacy theory** derives from logic theory and relates to arguments that seem correct but are not (Musi & Reed, 2022), thereby misleading. Musi et al. (2023) adopted the Fallacy theory to counter the fake news phenomenon using immunity chatbots. Likewise, Musi & Reed (2022), through the lens of this theory, address misinformation issues by providing a systematic approach for classifying and analyzing different types. Furthermore, Musi et al. (2022) used it along with the logic theory to explore the best way to counter the challenges associated with infodemic and propose reverse engineering, which is the manipulation of information. Musi and colleagues then suggest the means of becoming fact-checkers through critical thinking and digital literacy. This suggestion is timely because, if embraced by many, it will go a long way to mitigate against misinformation.

**Signal detection theory** provides value for humans to differentiate between fake and real news. In our study, Batailler et al. (2022) used it to separate two distinct aspects in identifying fake news: separating fake from accurate information and response biases to consider news as fake or real irrespective of news veracity. Batailler and colleagues adopted it in analyzing existing data sets to unravel two different aspects of the label of fake news to provide more insights into how cognitive reflection, partisan bias, and previous exposure affect the identification of fake news. Guided by this theory, Wagner and Skowronska (2019) designed an experiment where they exposed participants to a list of words to examine whether prior exposure to false information impaired recognition memory. And Wasike (2022) adopted it to examine how social media influencers impact people’s engagement with COVID-19 misinformation. Signal detection theory is a useful tool for identifying misinformation and biased responses. It can be applied in real-world situations to improve understanding of how people identify and react to misinformation.

**The theory of motivated reasoning** suggests that people think in alignment with their uniqueness and established point of view (Gaozhao, 2021). It helps determine how the social context shapes people's feelings, thoughts, and behaviors. Li et al. (2022) adopted this theory to evaluate information and test for biases in news reporting. In addition, Walter et al. (2020) used the theory as a lens to investigate the effectiveness of fact-checking in fixing
political misinformation while analyzing data from 20,963 respondents. Finally, this theory guided Ross et al. (2021) in two studies using diverse pools of participants (n=1,973) to examine the motivation behind sharing misleading partisan information.

**DISCUSSION**

This review study examines the theories guiding misinformation research in social science and humanity areas. Our analysis provided answers to our research questions. For the first research question: What theories have been applied to guide misinformation studies? Our review found 124 specific theories that have been applied to misinformation research in social science and humanity areas. The most frequently used theories include Conspiracy theory, Inoculation theory, Fuzzy-trace theory, the theory of planned behavior, and Framing theory. Researchers have widely used conspiracy theories to study misinformation.

For the second research question: What are the disciplines or fields these theories belong to? We identified more than 24 fields that these theories belong to. Most theories belong to political science, psychology, communication, sociology, and economics. We found it challenging to identify the discipline or field for some theories in Appendix 1 on our Google sheet. They may belong to multiple areas. For example, Discourse theory provides a framework for analyzing language, communication, and power. It suggests that language is not simply a tool for expressing ideas but is instead a complex system that shapes how we understand and interact with the world. It could be categorized as a theory in linguistics or communication. Some theories were labelled as interdisciplinary in Appendix 1 as we think they could be classified into more than one fields.

For the third research question: How have these theories been applied in misinformation research? We took a closer examination of the 11 most frequently applied theories to find out how they were used in our dataset. The application of these theories can be summarized into the following functions: (1) To design a study. For example, theories could be used to design questionnaires or experiments (Irenoа, 2021; Ross et al., 2021; Wagner & Skowronski, 2019); (2) to explore or investigate a phenomenon (Bolsen, Palm and Kingsland, 2020; Lewandowsky, 2021; Lewandowsky et al., 2013). (3) To test the impact or effectiveness of a treatment (Li et al., 2022; Nyhan et al., 2016; Walter et al., 2020). (4) To explain study results (Hrcaková et al., 2019; Irenoа, 2021; Musi & Reed, 2022); and (5) to be part of a new theory (Musi et al., 2022).

Our study may benefit researchers and educators in Library and Information Studies in multiple ways. This paper is the first to examine theories that have been applied to misinformation research. The theories we identified from the review may inform other researchers when they look for theories for their studies; our study deepened our understanding of the popularity of misinformation research – many disciplines and researchers are conducting studies in misinformation; for LIS education, this study informs instructors’ theories, definitions, and application that should be included in related curriculum on information behavior, information evaluation, and information literacy; lastly, the systematic review approach used in this study could be applied by other researchers to explore other topics. Especially our experience in the research may be helpful to others. We found that it was not always easy to identify the theories applied by a study. This type of literature review requires that the coders read the entire paper; to determine the dataset, we went through multiple steps, and we had to read more than 600 papers initially. Only a small part of them used theories. Besides, some papers are not empirical studies, so we dropped them from our dataset. Also, apart from the articles, we used other tools to assist in understanding the theories and their fields, such as Google, ChatGPT, and Wikipedia.

Our study has some limitations. First, some related literature may have been excluded since we narrowed it down to only articles meeting our criteria and used only three databases Scopus, ScienceDirect, and Web of Science. Some related articles may not be included due to the query terms we used, or may have been in other databases or published in other venues. We also dropped some articles that were not written in English and those that did not adopt or specify any theories after reading the entire paper. Moreover, some of the latest applications of the theories of misinformation may have been overlooked as some related articles may have yet to be published.

**SUMMARY AND CONCLUSION**

This paper reviewed the existing literature to identify theories that have guided misinformation studies in social science and humanities and to understand how they have been applied in those studies. Through a systematic approach, we selected 273 articles published from 2012 to 2023 and analyzed them to determine the theories and how they were applied. Our review identified 124 social science and humanity theories applied in the 273 studies. These theories belong to more than 24 fields. We took a closer examination of the 11 theories that are most used in misinformation studies. We found that theories have guided misinformation studies in various ways, including questionnaire design, interpreting misinformation phenomena, and spread behavior, detecting aberrations, and explaining research results.
In sum, librarians, researchers, and theory users could emphasize preventing private ignorance and publicizing knowledge to combat the spread of misinformation. It underscores the role of library and information policies in promoting informed decision-making and fostering a more knowledgeable society.

Our future study will explore the non-social science theories, models, and frameworks for fighting misinformation. Then, we will work to create a misinformation ontology that helps design applications to detect and correct misinformation and create educational materials on evaluating information and information literacy.

A complete list of references and other appendices are available on our Google sheet and can be accessed through the link below: https://docs.google.com/spreadsheets/d/1GT4XPuaCINx29rtZZ-W3AoDWmemux7c-631AhXGg-jU/edit?usp=sharing.

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Meeting People Where They Are: Hyper-local Engagements Around COVID-19 Misinformation in New Jersey

Paris, Britt  
Rutgers University, USA | britt.paris@rutgers.edu  
Costley White, Khadijah  
Rutgers University, USA | klw147@comminfo.rutgers.edu

ABSTRACT
This paper details the findings from a study investigating the efficacy of community-based and -organized information sessions for dispelling public health misinformation around COVID-19. The authors used community-engaged participatory action research methods to co-organize town halls with community members, groups, and officials to disseminate COVID information for two New Jersey towns and townships with differing demographic compositions in late 2020 through 2021. These sessions aimed to share reliable, trustworthy public health and safety information around the COVID-19 pandemic. This small-scale, qualitative study suggests that this type of hyper-localized information session where residents can interact with local leaders and talk openly about local problems around public health can be a point of connection for people with their community, that helps them access and address localized public health problems in myriad ways. In so doing, this study suggests ways to re-imagine public health information and communication practices to promote informational justice.

KEYWORDS
Community-engaged research; participatory action research; Covid-19; misinformation; community information sessions; public health information, hyper-localized information sources; online forums

INTRODUCTION
Research suggests that in the context of attenuated public institutions and rampant misinformation, localized engagements with experts may work to diffuse the harmful effects of misinformation (Burgess et al., 2021; Kuppali, 2020). In this study, the term misinformation is used as a catchall to describe false and misleading information spread with and without the intention to deceive (Jack, 2017), because this study focuses on outcomes rather than intentions. To date, there is research in library and information science around hyperlocal community information sessions as a site to increase local engagement with public health issues and combat health misinformation (Paris, Carmien, et al., 2022), but it far from normalized in the field. This study builds on Paris’ previous work as a step towards normalizing these interventions in the field. While there are investigations of community sites of public health campaigns (Allen et al., 2020; Bossaller et al., 2022; Luo, 2018), and many studies around developing technical information systems to support public health (Clarke & Steele, 2015; Unertl et al., 2016; McCall et al., 2022) library and information science researchers can also more fully engage participatory action research or community-engaged methods to enact or simulate a public-forum experience to generate dialogue and recommendations about misinformation, public health issues, and community safety as an end in itself. This study aims to provide an example of such an endeavor that addresses Covid-19 misinformation in New Jersey, one of the hardest-hit states at the onset of the pandemic, that has seen its share of localized misinformation around Covid-19 shaping daily life (Allred et al., 2021; Associated Press, 2021).

The authors work was motivated by informational and medical justice initiatives designed and implemented by minoritized communities for to respond to medical discrimination and misinformation around public health issues by cultivating their own medical and informational practices (Burgess et al., 2021; Nelson, 2011). Following these informational and medical justice interventions’ methods, the study at hand used rigorous participatory action research methods combined with intersectional analysis (Haines, 2022; Harrington et al., 2019; Author et al., 2021) to help plan and execute live online forums in two towns in New Jersey where they live and have community ties, each with differing demographic makeup: Franklin Township, NJ and the community cluster of Maplewood and South Orange, NJ. While both communities lean towards Democratic party affiliation and are white-majority communities, with 25% of the Black population comprising around 25% of the total population, Franklin is in Central Jersey and is more diverse, with a lower proportion of white inhabitants and a higher proportion of Asian and Pacific Islander and Latinx residents (U.S. Census Bureau, 2020a, 2020b, 2020c). The South Orange and Maplewood cluster lies in closer proximity to New York City and Newark with a median income of around $151,000 (U.S. Census Bureau, 2020a, 2020c). Franklin township has a lower median income ($94,000) (U.S. Census Bureau, 2020b).

These online information sessions were initiated by researched and co-hosted by local community groups, elected officials, and libraries from November 2020 to May 2021 to understand how this subsample of the New Jersey population trusts and responds to localized public health issues around the pandemic and how effective these hyper-
localized information sessions might be in addressing public health misinformation. This study helps those interested in combating misinformation better understand localized perspectives on public health practices related to the pandemic and promote community dialogue to re-imagine information systems to promote informational justice.

LITERATURE REVIEW
To effectively ground our study of hyper-localized engagements and public health misinformation, we looked to the contemporary example of COVID-19, rife with misinformation leading to disastrous public health consequences. Here we first outline the scientific health communication and misinformation problems related to Covid-19 to open a conversation about scientific health misinformation in general and the difficulty of dispelling this misinformation. Next, we look to successful examples of addressing and dispelling science and health misinformation, identifying how public health misinformation can be understood as a localized phenomenon and can be addressed through community-based information sessions.

COVID-19 information ecology
Politically-charged misinformation has been a growing problem for public health officials, even before the pandemic (Fallis, 2009; Hussain et al., 2018). The context and motivations of such misinformation can vary. People often look online first for health information because the barriers to seeing a health professional are so high, or because they are directed to by mobile health applications (Costello & Veinot, 2020; Pluye et al., 2019). In some circumstances, incomplete knowledge, mistrust in the medical industry, and unverified rumor drives misinformation around public health issues (Donovan et al., 2021). In any case, health misinformation can be incredibly damaging to public health outcomes because people have difficulties grappling with what is true and false, and how to act accordingly (Chi et al., 2020). Once this false and misleading information reaches people, it can be difficult to dispel the false beliefs and claims (Ognyanova, 2020; Southwell & Thorson, 2015; Tromble & McGregor, 2019).

In 2020 the Covid-19 pandemic was characterized as an “infodemic” by the World Health Organization, and aspects of the phenomenon have been studied by many researchers who suggested solutions in light of a large-scale misinformation event (M. Chong et al., 2022; Donovan et al., 2021; Starbird et al., 2019). Online spaces have been vectors of misinformation as platforms reward false information as it receives higher engagement and travels faster and spreads wider than true information (Singh et al., 2021). Moreover, misleading and false content left unchecked on sites like Facebook, YouTube, and WhatsApp often directs users to insular sites and chat groups that peddle even more nefarious disinformation (Paris & Pasquetto, 2024). Researchers found this to be especially true with Covid-19 misinformation (Bridgman et al., 2020). This information glut became dangerous at the pandemic’s onset as people had few resources to process and filter the information, namely inadequate information about the novel coronavirus, combined with a widespread mistrust in public health institutions, scientific expertise, and government entities (Donovan et al., 2021; Verma et al., 2022).

Covid-19 misinformation is particularly harmful as the virus is a public health issue and requires collective adherence to public health rules to limit spread. Those acting on misinformation engage in behavior that puts others at risk, such as refusal to wear masks, be vaccinated, and or abstain from gathering in large groups in close proximity (Y. Y. Chong et al., 2020). Further, those exposed to COVID-19 misinformation act on it in ways that are detrimental to themselves—after the circulation of the false claim that hydroxychloroquine cured COVID-19, the rush to consume these products caused a rash of poisonings and a shortage that, in the case of hydroxychloroquine, threatened the health of people with lupus and others who depend on those drugs (Aquino & Cabrera, 2020).

The early pandemic failure on the federal level to put out a cohesive response or plan created an information vacuum which U.S. states scrambled—or failed—to fill. The varying guidelines between states left people further confused about best practices to mitigating the spread of COVID-19, which in turn, opened the door for mis- and disinformation. In many cases, the federal government itself, particularly former President Trump, and administration officials, served as a prominent source of misinformation (Wang et al., 2022). This phenomenon further erodes support for public health and trust in institutions. It is not just ever-changing information about the virus, and the lack of credible voices; often, people who believe false claims spread by disinformation are aware of the information and activity accepted and promoted by the government, medical and scientific establishment, they do not trust these institutions (Kuppali, 2020).

The multifaceted problem of trust
Consistent messaging about mask-wearing did not convince people who believe Covid-19 is a hoax or people who think it is their right to not wear a mask (Verma et al., 2022). People's attitudes about information, in particular their trust in this information, is as important as what information they are exposed to (Sinatra et al., 2014). People are more likely to seek out and believe information that is in accord with beliefs they already hold, while downplaying or ignoring information that challenges those beliefs (Southwell & Thorson, 2015). At the same time, people are more likely to believe new information from a trusted source, or one that most of their social group believes. Meanwhile, the world has transitioned into a high-choice information and communication environment where
people can gather information from thousands of different channels, and never see something they do not agree with (Southwell & Thorson, 2015). Non-mainstream news media, such as podcasts and influencer channels on social media are designed to cater to consumers by making emotional appeals for inclusion into a persecuted in-group, which is particularly effective in garnering trust (Lewis, 2018).

The exaggeration of persecution and belonging, and doubt for political purposes can take many forms (such as using the gap between scientific and colloquial terminology to claim that because something is a “theory” that means there is room for debate or it is unproven) (Sinatra et al., 2014). As issues around COVID-19 are politicized, people become less open to acting in accordance with the public good. Lowered trust in science means that people may be less likely to follow CDC guidelines such as masking and social distancing. Given the existing difficulties in the vaccine rollout, people deciding not to take the vaccine have made conditions ripe for harmful variants that infect, hospitalize, and kill unvaccinated people at high rates (Verma et al., 2022)

Proposed interventions like pre-bunking (Dan et al., 2021), providing corrections (Bode & Vraga, 2021), supplying widespread, high-quality information, and encouraging better informational literacy are partial solutions for the problem of misinformation (Milner & Phillips, 2020; Paris, Marcello, et al., 2022). However, where these informational tactics come from is also a crucial piece of the puzzle. Research has shown that high usage of the internet for socializing correlated with weaker ties with local communities, lower trust of others, and of institutions, and lower contentment overall (Milner & Phillips, 2020). For many of the people who spread the most information, they often know it is not correct; thus, many of the tactics above are not effective (Dan et al., 2021; Ognyanova, 2020; Tromble & McGregor, 2019). Conversely, engagement with local news is closely associated with strong connections to and more activity in the community and voting in local elections (Barthel et al., 2016). People who feel positively about their communities and have close ties with their neighbors also strongly tend to feel positively about local news, and therefore have high trust in local news sources. These findings from Barthel and co-authors (2016) motivated our study to focus on community engagement as an effective means of combatting public health misinformation.

Community engagement around public health information

Thus, researchers have suggested that the best solution for misinformation around public health is community-based public health interventions (Burgess et al., 2021; Kuppali, 2020). Burgess and their co-authors (2021) noted in their published study of public information sessions around Covid-19 in 2020, that public health responses must be adapted to each local context, using a deep understanding of what each specific community needs. This requires that public health officials collaborate with and empower trusted local leaders, giving them the resources and knowledge to communicate about and implement public health measures, do outreach and messaging, and dispel false information. Local public figures are best suited to this task because people already trust them, and they know what their community needs. But this activity also runs the risk of further burdening already over-extended local institutions, experts, and individuals (Pierre et al., 2021), and in many cases, only reaching those who are already interested in the narratives and information presented at these events, while those who need to hear the messages the most do not attend and remain mistrustful (Paris et al., 2022). This phenomena is not new, one example of meeting these issues head-on happened in the 1960s with the Black Panthers Party (BPP) Free Health Clinics that trained local, Black medical experts to provide care and information around health issues that affected Black communities, e.g. sickle cell anemia, prenatal care, diabetes treatment, as hegemonic, White-run medical institutions discriminated against Black communities, as the medical industry predominately used Black test subjects, extended harms, and segregated Black patients out of quality medical care (Nelson, 2011). The BPP medical interventions were an intervention in creating infrastructures, meaning people and their social practices around various systems of communicative, technological and scientific tools (Star & Ruhleder, 1996), for informational and medical justice.

Echoing this history and drive for informational justice, Burgess and her co-authors (2021) conclude in their study running town halls around Covid-19 in Black communities that it is important not to conflate all vaccine hesitancy with conspiracy theories; marginalized people have plenty of good reasons to be distrustful of their governments. So the medical establishment must meet concerns about the vaccine with understanding and real explanation. Public health officials should, through existing community channels, such as faith groups, sports and youth clubs, local online networks, schools, and the like, and ask local leaders in those areas to take charge of vaccine messaging and rollout and community engagement (Burgess et al., 2021). Forums for local community leaders and members builds communal trust, makes sure each community's unique and specific concerns and challenges are addressed, and increases receptivity to public health messaging, and overall, promotes better public health outcomes.

RESEARCH QUESTION AND METHODS

Given that misinformation around Covid-19 is rampant as it is politicized and rewarded by platforms, we wanted to provide a participatory context that might be useful for people grappling with the information glut in their own lives, faced with risky public health behavior of those around them, and struggling with the safest course of action for
themselves and their loved ones. We wanted to provide this context, understand the particular issues of trust in information respondents grappled with as they attended these events, and gauge the efficacy of such participatory approaches for addressing Covid-19 misinformation to provide trustworthy public health information. Our study is guided by the research questions and sub-question below:

RQ1: What informational problems did respondents express drove them to the events?
RQ2: What were respondents’ level of trust in COVID-19 information from various sources?
RQ3: How, and in what ways, were these informational events effective and not effective for respondents?

Methods & site description
One way that the participatory information sharing contexts described in the literature can be realized is in town halls, or localized information sessions where local people can ask questions directly to experts (Bejarano & Yanovitzky, 2018; Burgess et al., 2021). In the state of New Jersey, where our intervention was staged, Bejarano and Yanovitzky (2018) studied how state-wide town halls influenced community perceptions of opioid abuse and collective efficacy to fight opioid abuse and addiction. The state of New Jersey ran town halls in each of New Jersey’s 21 counties and the researchers ran surveys, polling nearly 2500 attendees on their perceptions and attitudes on opioid use. We used Bejarano and Yanovitzky’s work as we built our own, as their large survey gauged the outcomes and utility of town halls over the public health issue of the opioid epidemic across New Jersey.

This project departs from Bejarano and Yanovitzky’s in that it employs methods variously referred to as participatory action research (Burgess et al., 2021; M. Currie et al., 2016) and community-based research (Harrington et al., 2019; Unertl et al., 2016) to engage a concerned public, of which the authors are an active part, on a relevant topic and provide an opportunity to express themselves in a participatory space. The authors organized virtual information sessions in conjunction with community partners: the local government in Maplewood, and with a local grassroots organization Community Coalition on Race (CCR) in South Orange, and in Franklin Township, these events were held in conjunction with local government and the public library.

These towns were chosen because of the authors’ situatedness in these towns and because of their diversity and demographic differences mentioned in the introduction. Franklin township was more recently rural than Maplewood and South Orange in Essex County, and these communities have been longer known as hubs in Northern New Jersey as the population and industrialization moved outward from New York City and Newark (Birkner et al., 2012). Franklin Township and the Maplewood/South Orange cluster’s disparate historical and current demographic compositions make them rich sites for comparison.

Positionality and access
In any interpretative study, researcher positionality is a methodological concern (Paris & Pasquetto, 2024) as it shapes data collection and analysis. Authors Paris and Costley White have a background in participatory action research (Currie & Paris, 2018) community-engaged methods (Currie et al., 2016), and activist research (White, 2016) which motivated their focus on these research questions within the hyper-localized contexts of New Jersey where they live and participate in movement building and organizing. Researchers used their contacts to organize the events. In the case of Maplewood, the town hall was already planned, and Costley White who is a resident and knows local official who had planned the event, asked for the ability to survey the audience; similarly with the South Orange CCR event, she regularly engages with this grassroots group asked for the ability to send surveys to participants. In Franklin Township, Paris set up an event with the local library and invited the mayor and suggested others to invite to be on the panel. Franklin Township public library both publicized and hosted both events through its Zoom portal. Research respondents were consented into the study using the authors’ university IRB protocols.

Interventions and data collection
These informational sessions included a panel consisting of a mix of expert epidemiologists, local officials, public health experts, and librarians. As these individuals are local public figures, they are named in the paper. Due to the pandemic, these sessions were hosted online and made available to the public through the collection of email addresses that community partners maintained. These sessions were recorded. Patrons submitted questions beforehand for the panelists to answer, moderated by Paris and Costley White in respective townships. Following the event, attendees completed a voluntary, anonymous survey that allowed them to answer questions about their information habits, how trustworthy they thought the event was, and what types of things the panel clarified for them. Further, these surveys allowed us to connect with people who might be interested in talking more in-depth about the issues of health misinformation that affect them. These interviews were conducted via phone because of the pandemic, recorded via audio, and later transcribed.

The following events were staged from November 2020 to May 2021. Here we outline the events structure and the demographic responses from survey respondents, as well as how many interviews from each event we performed.
November 2020: Town Hall Maplewood, NJ and South Orange, NJ
Fifty-six survey respondents either attended a town hall event on Sunday November 22, 2020 from 7:30 - 9pm over Zoom, or viewed the event via YouTube recording. Respondents were predominantly white women, though 11 men responded and 13 of the 56 respondents identified as Black and African American (11), Asian, and Southeast Asian (2). No respondents from this event agreed to be interviewed. Respondents ranged in age from 21 to 84, concentrated more heavily in age ranges 40-50 and 70-80. There was a fairly even split in survey respondents living in Maplewood (30) and in South Orange (24).

February 2021: Franklin Township Library-Hosted Q&A Session
Thirty-four people attended the first Franklin Township Library-Hosted Q&A session held via Zoom. This event hosted Dr. Mayor Kramer, Dr. Namitha Reddy the Somerset County Director of Public Health, and Director Commissioner of Somerset County, Shanel Robinson. Director Commissioner Robinson spoke directly to the efforts that Somerset County and Franklin Township were undertaking to ensure that Black, Latino, and elderly communities had access to vaccines, as well as to address questions around racial health disparities in Somerset County during the pandemic. Most of the 12 attendees who responded to the survey were over 60, three-quarters of attendees responding identified as women, and one-quarter reported their race as South Asian, Latinx, and Black or African American, while the remaining three-quarters identified as white. Three agreed to be interviewed. All respondents were from Franklin Township or Somerset County.

February 2021: Community Coalition on Race Maplewood and South Orange, NJ
Dozens of people gathered virtually for the Community Coalition on Race (CCR) Session held on February 28, 2021. Dr. Camara Phyllis Jones was the only one of the four panelists to discuss in-depth the structural arrangements primarily racism and capitalism, leading the outsize impact of the pandemic on Black communities. Only five respondents, all of which were Black women responded to the survey; three agreed to be interviewed.

May 2021: Franklin Township Library-Hosted Q&A Session
The final information session was held May 5, 2021 via Zoom in conjunctions with Franklin Township Public Library. Mayor Kramer was again an invited guest, and while Dr. Reddy could not attend at last minute, Kramer invited Dr. Ron Nahass a local epidemiologist. Of all the events, this was the most sparsely attended and survey responses were the lowest. Survey respondents all identified as Black or African American women from the Franklin Township community; one person agreed to be interviewed.

Survey and interview questions
The survey and interview questions were adapted from Bejarano and Yanovitsky’s (2018) intervention collecting surveys on town halls in NJ around the opioid epidemic. Our survey questions are included in the appendix (Survey Question Appendix: https://rutgers.box.com/s/whxotdu68arevmjfgfx22vybn5ng77bh) focused on COVID-19 and related informational public health issues, as well as a few questions about where respondents get information, and what sources they trust.

As adapted from Bejarano and Yanovitsky’s (2018) study around communicating public health issues, interview questions were semi-structured to elicit a relaxed and engaging conversation about the events, and to gather more qualitative nuance on the survey responses (Alvesson, 2003). Each of the questions below was followed with a “why” or “why not”, as relevant, if it was not expounded upon in the response.

- Tell me a bit about yourself, where you live and how you identify.
- Why did you attend this event?
- What about it was compelling to you?
- Where do you get most of your health information?
- Where do you get most of your news?
- What did you learn about COVID-19 at this event?
- Do you feel that people in your community struggle with misinformation?
- Do you feel that people in your community struggle with misinformation around COVID-19?
- Do you feel that local officials, medical experts, and leaders are responding appropriately to COVID-19?

**Figure 1. Interview questions**

Analysis
The analysis of the survey data for each intervention was performed in Google Sheets populated from the Google Forms where participants took the surveys. The authors collaboratively and iteratively analyzed the survey findings,
the interviews, and video transcripts using their knowledge of political communication, participatory action research, intersectional analyses of misinformation, and information retrieval and interpretation. We developed codes based on aspects to the research questions, which included: trust, efficacy, misinformation, race and gender that are provided in the findings. Then, as we continued to analyze the data, themes in the discussion section subheadings emerged in relation to the research questions.

**Strengths and limitations**
This type of event and the assessment of these types of events will continue to be useful as the pandemic and its fallout unfurls—evidence while it has been declared over (Jørgensen et al., 2022), it will still be a long road ahead. The authors conducted this study as the pandemic’s context was rapidly changing. On one hand, this provides us with robust data on how informational needs changed as vaccines became available and as new variants emerged. Finally, though the study is small and highly locally contingent, the findings and analysis provide a qualitative snapshot of useful observations that can be used in the small-scale, localized settings described to develop practices that promote informational justice around misinformation topics, as well as support the possible utility of organizing hyper-localized engagements around misinformation and the study of those events in the form of participatory action research. As the N is small, we report themes broadly below.

**FINDINGS**
We found four main themes of interest emerged in the data: the first is the type of misinformation the respondents claimed to see or reported needing help with, which tied closely with the nuanced answers respondents gave regarding their motivation for attending the event. These coincide with the theme of trust, or what media and outlets the respondents distrusted and trusted and why, as well as why they did not see these types of events as trustworthy. Finally, issues and components of efficacy of the events are described in the last subsection.

**Topics and motivation to attend: across sites, over time**
As the events were held over seven months, in different localized New Jersey locations, with diverse demographics, the types of community questions around misinformation asked at the sessions varied greatly. In November 2020 Maplewood residents were concerned with the science behind COVID-19, the progress on a vaccination, and how the community was responding to the virus, specifically regarding public school protocols. In February of 2021, vaccines began to roll out in New Jersey; thus, the Franklin Township public library’s event focused on vaccine science, epidemiology, and protocols, where to get it, how to make an appointment, which vaccines were best, and what to do if someone couldn’t make it for their second dose. Later that month, the event held by the Community Coalition on Race (CCR) in South Orange and Maplewood, NJ, focused on the pandemic precursors and official response, as well as how inequitable practices in health institutions and governments contributed to vaccine hesitancy in the Black community, and discussed how to overcome vaccine hesitancy. Finally, the last event held in May 2021 with the Franklin Township public library occurred just after a vaccination wave in which adults who wanted to be vaccinated, were vaccinated, or were in the process of being fully vaccinated. Many questions surrounded reopening protocols and what to do about children, immunocompromised people, and vaccine refusal in their social circles and local communities. At the same time, the delta variant has just exploded in India, and people were concerned about different strains of COVID-19, whether there would be the need for new vaccines or booster shots, and how must they needed to worry about new strains if they were already fully vaccinated.

Respondents for three of the four events overwhelmingly claimed they attended the event because they wanted to learn more about Covid-19 in their community. Respondents for the CCR event identified that they were most interested in connecting with other community members around COVID-19 and seeing what they could do to help. They were also interested in learning what was being done about COVID-19 in their community, learning about the science behind vaccines, and how to get one.

**Trust**
Interview respondents also noted that they encountered so much information around COVID-19, it was hard to know what information would help them make choices for themselves and their loved ones on a day-to-day basis. The survey results showed that the town hall was unanimously rated “completely trustworthy” or “mostly trustworthy” across events. While most respondents found local news and radio and friends and family to be more trustworthy than other media such as state and national news sources, a few suggested greater trustworthiness in national news sources like the New York Times and National Public Radio programming as well as governmental agencies like the Centers for Disease Control and Prevention. However, all the respondents and interviewees found these media or sources as less trustworthy than the local information session in question. This, along with the other findings, suggests that this type of town hall event, where residents can interact with local officials and talk about local problems around COVID-19 can be very useful for residents, as it at once connects them with trusted community members and officials, helps them access and address localized problems in myriad ways, and honors them as stakeholders in community issues. However, while the majority of those attending the first Maplewood, NJ event
found it to be highly trustworthy, survey respondents who did not view it as trustworthy expressed disagreement with Dr. Griffin’s (who does not live in the community) characterization of the activities of school-aged kids in their community.

**Intersectionality and trust**

Overall, the CCR event in South Orange, NJ was one of the most trustworthy, according to participants who spoke with us. Though few of the attendees responded to the survey, those who agreed to talk with us afterward had excellent insights as to why they thought this engagement was so useful and trustworthy. All respondents were Black women who make decisions for their household and extended family and were appreciative of Dr. Jones’s expertise as a physician and epidemiologist in racism as a public health issue and that as a Black woman, she knew the unique problems they faced. They also said that they appreciated that instead of focusing on literacy or individualized solutions, Dr. Jones spoke about systems like social hierarchies, racism and capitalism, as contributing to the problems with the pandemic and the destruction in its wake, as well as the botched responses to the pandemic and the deserved mistrust that emerged. One interviewee who attended the event explained:

“I love the fact that [Dr. Jones] brought it full circle. And you know we are speaking about the virus the vaccine our community as one whole system and not just a society we tend to put things in boxes. How have to look at everything just full circle and how will a quarantine be effective when people don't have adequate housing, what happens when you put people who have to work on the front lines everyday who live in close quarters with the elderly? You have to think of all those things to be able to just connect all of those dots. And she did in a way that I just loved. So, I thought that was probably the most powerful thing. And this echoes the other presentations that I saw which is they were speaking to the data. This vaccine is going to keep you off of a ventilator. And you know, we know that most people who go on a ventilator do not do well and typically die. So you know, took like a basic equation, you know, vaccine equals no ventilator, equals no death” (Respondent, interview, March 18, 2021)

Across the CCR and the first Franklin township event, there were instances of Black women who identified as members of Black racial groups and had been mistrustful of traditional medical expertise whose opinions on and openness to being vaccinated changed as a result of the town hall and ones like it. Interestingly attendees at the last event in May 2021 in Franklin Township that responded found this mostly trustworthy at best, in contrast to the previous events that were rated completely trustworthy, and mostly trustworthy. But they still found it more trustworthy than other media. The possible reasons underpinning this finding will be further unpacked in the discussion.

**Efficacy**

Across events, respondents claimed they learned new information about how prevalent COVID-19 is in the community, what causes spread, what local officials were doing to address the virus at a community level, and how to help in the fight against spread. As the vaccine became available, respondents articulated feeling more at ease about vaccination. At the first event in Maplewood, NJ, while folks claimed they left feeling more empowered, overall, they said they were less confident that the community can effectively respond to COVID-19. This was similar to the findings from the CCR event. Respondents attending the Franklin Township public library events conversely reported feeling more confident that their community can respond to COVID-19. Overall, the CCR event respondents reported the highest level of new knowledge and confidence on what to do about COVID-19 because of the event.

**DISCUSSION & ANALYSIS**

**Understanding trust and relationships to misinformation**

Most interview respondents expressed frustration at the proliferation of information about COVID-19, some of it true, some of it false, was a hardship for them. This phenomenon aligns with Southwell and Thorson’s (2015) and Verma et al’s (2022) observation that high-choice information and communication environment where information can be gathered from thousands of different channels. While we did not encounter anyone who doggedly adhered to misinformation, it was a topic on attendee’s minds, as shown through their decisions to attend, and through the instances of misinformation that all interview respondents claimed to have encountered either firsthand or had experienced colleagues, friends and loved ones sharing. Interview respondents, as well as the survey responses from the attendees of the events showed that the topics of COVID-19 and how communities responded were important to attendees. The responses suggested a willingness to believe the virus was real, and something can and should be done to mitigate its spread, as well as trust in the expertise of local officials, medical practitioners, and science, more generally. This finding supports Sinatra’s (2015) suggestion that people’s attitudes about information: how they trust it is as important as the information they are exposed to. In this case, people attending had the same mindset as those producing and speaking at the events, which made information uptake easier and more helpful. But, as we did not encounter any attendees disagreeing with the information presented, or even finding the event “not trustworthy”, it
politicization of health information, which is premised on the with opposing viewpoints around expertise and information. This observed phenomenon also underscores the further negotiation between particular group rather than based on the veracity of any piece of information (Sinatra, 2015).

However, there were instances of negotiation between one’s group affinity and accepting the expertise of public health and medical experts, as the Black women who expressed initial reticence to accepting official statements and traditional medical expertise where experimentation was concerned, especially in relation to the vaccine, became more open to being vaccinated because of the town halls she had attended. This supports Burgess et al (2020) conclusion that it is important to understand vaccine hesitancy in minoritized communities as a unique phenomenon to be met with deep explanation around structural issues, as they have valid reasons to be distrustful of governments and the medical establishment.

Informational justice: localized, bottom-up expertise and possibilities for increased efficacy

On this note of group affinity, and racial group belonging, in particular, we must mention that the meetings led by Black women were rated as more trustworthy and illuminating by other Black women, as was the case with the CCR event. The first Maplewood event was run by one of the authors, a Black woman, and the panelists included people of color. The first Franklin Township event included women of color panelists, and was also rated as highly efficacious. The last event at Franklin Township public library where the panel was solely comprised of white men was significantly lesser attended, and seen as less trustworthy than the others. At the same time, respondents for that event were Black women. This observation also supports Burgess’ (2021) suggestion that asking local, trusted Black leaders to take charge of public health messaging and rollout would be more efficacious in building trust, ensuring the community’s specific concerns and challenges are addressed, and increasing uptake of information and related decisions. This observed phenomenon presents an actionable practice to promote community dialogue that engenders informational justice of the type offered by the Black Panthers’ Free Medical Clinics (Nelson, 2011) that focuses on the informational needs of marginalized communities around health issues being more efficiently met by local members of those communities organizing to build out systems of practice and communication around medicine and public health, that include community engagement around scientific expertise, and technologies.

These events and the responses around them indicate that basing these live informational events within communities, hosted by community organizations can be incredibly trustworthy, effective, and build opportunities for growing community bonds. Though the first Maplewood event and those Franklin Township events were rated highly, they might have been rated higher if they had included more local experts, such as scholars or local physicians, that weren’t strictly government representatives, as the government is not always seen as a reputable source of information. That the CCR event featuring local public health expert and woman of color and that the other three events were organized and moderated by local scholar activists suggests that localized expertise, such as those held by local scholar-activists can be a useful and compelling community resource that can be leveraged against public health misinformation, and perhaps around misinformation more broadly.

The declining participation over time suggests that perhaps the virtual aspects of these events is an obstacle to efficacy. It suggests a sense of Zoom fatigue that may have been a result of the onflow of programming provided on Zoom through the course of the pandemic, and as weather in New Jersey became warmer and as people became vaccinated, people were spending less time in front of Zoom. The virtual aspect of information dissemination and data collection during the pandemic has been an obstacle to institutions and professions everywhere. However, this study suggests that these types of virtual events can be incredibly efficacious and helpful in unique public health crises similar to those in the U.S. pre-vaccine, for people who have internet access, free time, and the desire to learn more about a given public health issue from experts, widely construed.

CONCLUSION

This study provides a qualitative snapshot of small-scale hyper-localized town hall information sessions in diverse and distinct locations New Jersey. The authors are visible members of and have strong contacts in the diverse communities where these events were held. The authors co-organized four town hall events with local institutions in North and Central New Jersey in 2020-21 and collected data on these endeavors. Overall, respondents found the town hall more unanimously trustworthy than any other sources of information--local, state, and national, newspapers and news sites, radio, television, social media, and word of mouth. This, along with the other findings suggests that this type of town hall event, where residents can interact with local officials and talk about local problems around public health, specifically COVID-19, in this case, can be very useful for residents, as it connects them with trusted community members and officials, helps them access and address localized problems in myriad ways, and honors them as stakeholders in community issues.
This study supports others (Barthel et al., 2016; Burgess et al., 2021) that suggest that as misinformation is increasingly highly targeted, so too must be tactics to address misinformation, particularly in events that affect the broader public like the COVID-19 pandemic. Hyper-localized informational events like these are highly targeted and contextualized. Studies of hyper-localized public health communication and information sessions across the country or sections of the globe around similar public health or public facing issues prone to misinformation would also be a welcome next step for future research.

As the COVID-19 pandemic wears on with variants, boosters, and continued misinformation around public health issues, and as climate change, economic inequality, and systemic racism continue pose problems of global concern, we suggest informational, community-building interventions such as these that are staged by community members, for community members, may be a potent antidote against the influx of information problems likely plaguing us in the near future.

REFERENCES


From Principles to Practice: Comparative Analysis of European and United States Ethical AI Frameworks for Assessment and Methodological Application

Pierson, Cameron M.  L3S Research Center, Leibniz Universität Hannover, Germany | pierson@l3s.de
Hildt, Elisabeth  L3S Research Center, Leibniz Universität Hannover, Germany | Elisabeth.hildt@l3s.de

ABSTRACT
The Z-Inspection® Process is a form of applied research for the ethical assessment of AI systems. It is quickly establishing itself as a robust method to ethically assess AI in Europe. The process is predicated on the European Union's Ethics Guidelines for Trustworthy AI, outlining ethical principles intended to guide European AI development. In contrast, the United States has only recently released its holistic version of such guidelines, the Blueprint for an AI Bill of Rights. The aim of this paper is to assess the suitability of the Blueprint for an AI Bill of Rights as an ethical framework underpinning the use of the Z-Inspection® Process in the United States. This paper provides preliminary findings of comparative analysis of European and United States ethical frameworks for responsible AI development. Findings outline primary ethical concepts that are shared between respective frameworks. Findings suggest the US Blueprint is suitable as an ethical framework for the Z-Inspection® Process. There are notable omissions within the US framework which would require further development for Z-Inspection® use. Discussion will consider opportunities for adapting Z-Inspection® to the United States context, including contributions from the information professions and research.

KEYWORDS
Artificial intelligence; AI ethics; International information issues; Value-sensitive AI design; Legislation and regulation

INTRODUCTION
Rapid development and deployment of artificial intelligence (AI) is increasingly impacting information ecosystems. Ethical assessment of AI is necessary to ensure the just and equitable distribution of benefits and potential harms, as an information technology impacting almost every aspect of the information society. To insure safety and ethical alignment of AI systems, ethical assessment expressed in regulation and scalable, interdisciplinary mechanisms is therefore required, and acknowledged among major governmental jurisdictions (High-Level Expert Group on AI, 2019; White House Office of Science and Technology Policy, 2022). The proposed European Union AI Act, for example, is informed by the Ethics Guidelines for Trustworthy AI (High-Level Expert Group on AI, 2019). While the European Union (EU) is aiming to establish itself as the leader in ethical AI development, the United States (US) has only recently outlined its own version of ethically informed principles to guide AI development, the Blueprint for an AI Bill of Rights (White House Office of Science and Technology Policy, 2022).

Principle-based guidelines have been criticized as too high level and vague for practical application (Munn, 2022). Application and proposed regulation with high level ethical underpinnings requires processes and ethical scrutiny which are sound and scalable. Similar mechanisms have been proposed, such as embedding ethicists in the design process (van Wynsberghe & Robbins, 2014), ethical foresight analysis (Floridi & Strait, 2020), or algorithmic auditing (Raji et al, 2020). The Z-Inspection® Process, however, is establishing itself as a reliable and robust method to assess ethical issues and tensions of AI systems (Zicari, Ahmed, et al., 2021). This process is developed on the premise of the EU’s Ethics Guidelines for Trustworthy AI and uses the guideline’s ethical principles as a central instrument to guide analysis informing AI development. This process requires applied ethical research within the collaborative participation of researchers and experts across multiple disciplinary and professional fields.

However, there remains no such mechanism in the United States context mirroring the Z-Inspection® Process, predicated on a jurisdictional level expression of ethical expectation. To adopt such a process in the US context, the comparative positioning of the counterpart ethical guidelines must first be understood to assess compatibility and identify opportunities and recommendations for praxis-oriented research and collaboration. The aim of this paper is to understand the extent of similarity in the ethical positioning between jurisdictions, and the plausibility of adopting such a process in the United States. This paper outlines the similarities of the respective frameworks. It will provide an assessment of the US Blueprint for an AI Bill of Rights as an alternative ethical framework within the Z-Inspection® Process. Finally, it discusses considerations for its adaptation to the United States jurisdiction, with implications for information science research and practical and international collaboration.
LITERATURE REVIEW
The European Union’s Ethics Guidelines for Trustworthy AI

The European Ethics Guidelines for Trustworthy AI outlines the ethical principles constituting trustworthy AI in the European jurisdiction (High-Level Expert Group on Artificial Intelligence, 2019). The concept of trustworthiness is fundamentally relevant to the European approach, i.e., the idea that for an AI system to be trustworthy, it must fulfill several preconditions, including ethical alignment in design and development. The guidelines document defines trustworthy AI systems as systems that are lawful, ethical, and robust throughout their entire life cycle. The guidelines characterize four ethical principles (also called ’pillars’) as central for AI to be trustworthy: Respect for Human Autonomy, Prevention of Harm, Fairness, and Explicability. The Guidelines characterize seven central requirements that are closely related to and building on the ethical principles: 1) human agency and oversight, 2) technical robustness and safety, 3) privacy and data governance, 4) transparency, 5) diversity, non-discrimination and fairness, 6) societal and environmental wellbeing, 7) accountability. The requirements are a mezzo-level component of the framework, connecting the abstract ethical principles with their application to practice. The Ethics Guidelines provides some conceptual reflection on the seven requirements and their various aspects, supporting translation and understanding of the principles in AI development. Furthermore, a self-assessment list is provided with the intent to support operationalizing trustworthy AI (High-Level Expert Group on Artificial Intelligence, 2020). It is explicitly recognized that there may be tensions between these principles and requirements, that need to be attenuated or resolved in the respective AI context.

While the Ethics Guidelines for Trustworthy AI provide a valuable conceptual framework, they are positioned generally with no direct connections to types of AI tools, domains, or areas of applications. Further, trustworthiness has been noted to be a concept conferred to humans and that technology ought to be conceived as reliable, not trustworthy (Freiman, 2022). Thus, AI ethics should reconceive the place of social justice relative to trust and distrust in the power structures associated with AI (Freiman, 2022). Nevertheless, the trustworthy AI approach is influential. The Ethics Guidelines, for example, is foundational for the proposed European Artificial Intelligence Act (European Commission, 2021; Mökander, Axente, et al., 2022). Moreover, the Ethics Guidelines serve as the ethical framework by which the Z-Inspection® Process is grounded.

The Z-Inspection® Process

The Z-Inspection® initiative has developed a method for assessing trustworthy AI within use context (Z-Inspection, 2020). Whereas the Ethics Guidelines outlines static principles, the Z-Inspection® Process is intended to address this limitation, in addition to providing validation of claims made of a system. As a holistic approach, teams of experts are assembled to consider ethical, technical, legal, and domain-specific considerations while developing sociotechnical scenarios and considering the context of the system’s use. Moreover, the process can be applied at any stage of the system’s life cycle, from design to monitoring.

The process is composed of several steps. To bring together a broad spectrum of stakeholders, an interdisciplinary group of researchers from various countries work together to analyze the use context of specific AI tools (Zicari, et al., 2022). Once assembled, the teams define context and boundaries of the assessment relative to the system, create and maintain a log of the steps taken and relevant information through the duration of the process and begin to define sociotechnical scenarios of the system’s use. These involve the various people involved in developing, deploying, and using the AI tool, and their expectations and aims. Additionally, an evidence base is developed, for example, through scholarly and empirical literature among other sources. The scenarios support understanding and analysis of the system’s aims, the relevant actors, their expectations and interactions with the system, processes of the system’s use, and the broader ecosystem in which the system is embedded and operates. From these scenarios and their initial analytical focus, the teams then identify and build consensus around the ethical issues and their tensions. Next, the ethical issues are mapped to the ethical principles and requirements outlined by the Ethics Guidelines for Trustworthy AI, moving from the use of natural language (“open vocabulary”) to the terms used by the Guidelines as a controlled vocabulary (“closed vocabulary”). The mapped issues are then ranked by relevance within context. If necessary, working groups are formed to analyze certain questions or contexts in more detail, for example a technical working group, a domain-specific working group, or a legal working group. From analysis, teams produce a report outlining recommendations on how to address identified ethical tensions, where resolutions are and are not possible, and feedback to relevant stakeholders of the AI system for further development, appropriate use, and ability to redress issues. This is a highly collaborative, co-design process with the aim to produce actionable insights from ethical analysis to inform design or further development (Zicari, Ahmed, et al., 2021; Zicari, Brodersen, et al., 2021; Zicari, Brusseau, et al., 2021; Allahabadi, et al., 2022). The Z-Inspection® Process can therefore be understood as a form of applied research whose aim is to translate findings into practice. The design of the process relies on broad, interdisciplinary collaboration while sensitive to context of use of AI systems. The guiding mechanism of the process, however, is the EU’s Ethics Guidelines. The design of the process suggests both usefulness of application in other jurisdictions and the potential to use a similar ethical framework as a guiding
mechanism for analysis. Thus, it is key to assess compatibility of potential alternative ethical frameworks to assess alignment with the process and its analytical approach.

**The United States’ Blueprint for an AI Bill of Rights**

The Blueprint for an AI Bill of Rights is a white paper published by the White House Office of Science and Technology Policy in October 2022, three years after its European counterpart (White House Office of Science and Technology Policy, 2022). It outlines a framework of five principles and associated practices to inform the design, development, and use of automated systems, such as AI. Developed in consultation with the American public, domain experts, and international input, these five principles express national values intended to guide the development and deployment of systems that are “aligned with democratic values and protect civil rights, civil liberties, and privacy” (p. 4). These principles are: Safe and effective systems; Algorithmic discrimination protections; Data privacy; Notice and explanation; and Human alterations, consideration, and fallback. Each principle is accompanied by an explanation of meaning, including intended provisions and processes. For example, the principle Algorithmic discrimination protections states: “Independent evaluation and plain language reporting in the form of an algorithmic impact assessment… should be performed and made public whenever possible to confirm these protections” (p. 5). It is notable that each principle begins with a summary statement of the core idea of the principle framed as a right, addressing the American public directly. Returning to Algorithmic discrimination protections: “You should not face discrimination by algorithms and systems should be used and designed in an equitable way” (p. 5). The Blueprint also includes a technical companion, outlining expectations of systems relative to principle and how principles can be realized in practice. It is tended for public and private organizations of varying sizes and provides “concrete steps” toward their application, including using preexisting legal frameworks as templates to curb harm or relevant industry best practices (p. 21). The Blueprint is unique among its global counter parts for its emphasis on community-level equity (Hine & Floridi, 2023).

There are, however, two important limitations. First, some of the provisions may be unattainable. As Hine and Floridi (2023) note: “It is unclear what “fully transparent” means, and many algorithms that rely on machine learning are inherently inscrutable.” Second, a key limitation is the non-binding nature of the document, noted by researchers and policy organizations alike (Hine & Floridi, 2023; Lee & Malamud, 2022). Without substantive legislation to support and enact the principles, they remain voluntary guidelines. Similarly, it has been noted that AI ethics is “useless” when abstract principles contribute little to practice (Munn, 2022). Moreover, modern concerns of bias vis-à-vis intersectionalities and structural power dynamics in the public and private sectors must be considered when enacting AI justice. The Z-Inspection® Process potentially offers a method in the US context to apply ethical principles to AI practice. The Blueprint for an AI Bill of Rights is an expression of US ethical guidelines for the responsible development of AI. Therefore, the Blueprint must first be assessed to understand its potential relevance and compatibility within a process predicated on an ethical framework for practice-oriented analysis.

**Previous Comparative Analyses**

Previous work demonstrates varying degrees of scope and specificity. Global approaches looked to map the AI governance landscape (Schmitt 2022) or global policy trends (Ulincanne et al, 2022). Comparative analysis will often focus on groups of actors, such as investigated the use of AI for social responsibility as outlined by Russian, Chinese, and US strategies (Saveliev et al, 2020). Roy and Sreedhar (2022) focus on China, EU, and US AI development and regulation, arguing the EU ought to lead a transatlantic effort. They noted “specific differences in the ethics and values are yet to be explored” between the EU and US (p. 85). Dixon (2022) similarly analyzed Chinese, EU, and US AI governance, including ethical “AI principles.” While substantively engaging with these principles, emphasis is on policy perspectives drawing on the US’ Guidance for Regulation of Artificial Intelligence Applications (Vought, 2020) document. Others have approached comparative analysis of China and the US governing AI documents using quantitative analysis, without a comparative focus on ethical principles (Heine & Floridi, 2022). Mökander, Juneja, et al. (2022) argued the US Algorithmic Accountability Act 2022 could be strengthened by looking to and the proposed EU AI Act, omitting ethical analysis. As the US AI Bill of Rights is relatively new, it is not as represented in the literature, including the above. There is also a lack of analytical focus on ethical comparative analysis of principles underpinning proposed AI regulation.

**RESEARCH QUESTIONS**

1. What are the similarities between the ethical principles expressed in the European Union’s Ethics Guidelines for Trustworthy AI and the United States’ Blueprint for an AI Bill of Rights?
2. Can the Blueprint for an AI Bill of Rights be used as the ethical framework to guide the Z-Inspection® Process in the United States’ context?
3. If so, what are preliminary considerations for required modifications to the Z-Inspection® Process?
METHODOLOGY
This study used qualitative content analysis (Zhang & Wildemuth, 2009). The aim was to condense each set of data into categories to understand how the data sets were similar and how they differed. Assessing similarities and differences was crucial to understand compatibility within the Z-Inspection framework and American and European ethical alignment vis-à-vis potential AI regulation. The data set comprised only of the US’ five principles (White House Office of Science and Technology Policy, 2022) and the EU’s four principles (also called ‘pillars’) (High-Level Expert Group on AI, 2019) within respective documents. Each author began by independently reading over each set of principles, remaining open to the data. Upon initial reading, each author developed an initial set of categories and noted that all but one principle had an analog in its counterpart document. For example, the EU principle number 2 corresponded with US principle number 1. The authors then met to discuss their arrangement of analog principles and confirm categories arising from the data. After building consensus, the authors then independently coded according to the categories: Shared aspects, EU only aspects, US only aspects.

Each author adopted similar processes for coding. The first author used Excel to arrange data, creating individual tabs for each category. For example, using the following fields within individual columns within the “Shared” category: EU Principle; EU Quotation; US Principle; US Quotation; Rationale; Notes. For the category of “EU only aspects” (similarly with US only aspects): EU Principle; EU Quotation; Corresponding; US Principle; Notes. The second author used Word to arrange data, creating one document for the above three categories, arranging them by heading. Under each category heading, the respective principles and their quotations were noted together. After coding, the authors reviewed each code and quotation, discussed their reasoning, and built consensus where possible. Among all of the codes, there were only two instances where the authors made note that their interpretations differed to a substantive degree. Due to the size of the dataset, the authors were able to review coding for all categories. Moreover, the authors were able to review each individual sentence or sentences constituting the quotation which related to both its category and counterpart quotation to assure coherence and consistency between the two. Unit of analysis was themes, typically associated with some ethical principle or what was shared between the two jurisdictions or what was unique to respective jurisdictions. Themes of what was being expressed within increments of the principles were isolated and, where appropriate, either joined with its analog in the “Shared” category or arranged within the respective “only” categories. Concurrently, those aspects which could not be mapped to an analog were noted in their respective “only” categories. This paper only reports on the results of analyzing the Shared aspects category.

FINDINGS
Principle Analogs
Analysis revealed that four principles outlined in respective documents were analogs and expressed a primary ethical concept. The core theme(s) being discussed within the principles shared substantive aspects, while being expressed differently. For example, the EU principle Prevention of harm and the US principle Safe & effective systems primarily express how systems should be designed and deployed to maintain the safety of people, and thus motivated by protecting people from potential harms caused by automated systems such as AI. In most instances, the first sentence of each principle’s explanation acts to declare its fundamental meaning, while further elaboration is provided to clarify or extend scope within respective jurisdictions and traditions. In this example, the first sentences are as follows: Prevention of harm (EU): “AI systems should neither cause nor exacerbate harm or otherwise adversely affect human beings”; and Safe & effective systems (US): “You should be protected from unsafe or ineffective systems.” Both principles invoke safety and protection as their primary concept. Sharing a primary ethical concept thus evidenced analog arrangement and further comparative analysis. Table 1 shows principle analog arrangement and the linking primary ethical concept.

<table>
<thead>
<tr>
<th>EU Principle</th>
<th>US Principle</th>
<th>Primary Ethical Concept</th>
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<tbody>
<tr>
<td>2) Prevention of harm</td>
<td>1) Safe &amp; effective systems</td>
<td>Protection/Safety</td>
</tr>
<tr>
<td>4) Explicability</td>
<td>4) Notice &amp; Explanation</td>
<td>Explainability</td>
</tr>
<tr>
<td>3) Fairness</td>
<td>2) Algorithmic Discrimination Protections</td>
<td>Justice (fairness as an expression of)</td>
</tr>
<tr>
<td>1) Respect for human autonomy</td>
<td>5) Human alterations, consideration, &amp; fallback</td>
<td>Human autonomy</td>
</tr>
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</table>

Table 1. Principle analog arrangement and the linking primary ethical concept

Note, however, that the US principle Data Privacy has no direct analog within these frameworks. This principle states “You should be protected from abusive data practices bias built-in protections and you should have agency
over how data about you is used. You should be protected from violations of privacy through design choices that ensure such protections are included by default, including ensuring that data collection conforms to reasonable expectations and that only data strictly necessary for the specific context is collected” (White House Office of Science and Technology Policy, 2022). The EU’s General Data Protection Regulation (GDPR), enacted in 2018, created regulation for the processing and movement of personal data. The law “protects fundamental rights and freedoms of natural persons and in particular their right to the protection of personal data” (European Union, 2023). In the European Guidelines for Trustworthy AI, issues related to data privacy are not addressed on the level of ethical pillars, but on the level of requirements. The US principle of Data Privacy was therefore excluded from comparative analysis of principles, as its analog is already enacted regulation and thus falls out of scope. Along with the GDPR, however, the primary ethical concept represented is privacy and therefore can be regarded conceptually as the additional primary ethical concept constituting the principles undergirding trustworthy AI regulation. Such privacy protections are required and must be accounted for in systems development in the EU or for use in the EU.

**Shared Aspects**

Each of the principles were analyzed for their shared themes relative to their analog. This analysis aimed to understand better the nature and extent of shared ethical underpinnings and associated themes between the US and EU. Below we offer a principle-by-principle discussion arranged by shared primary ethical concepts.

**Protection/Safety**

Themes of protection, safety, and averting potential harm of systems or their use to cause such harm are evidence in respective a and b statements (Table 2). The US quotation states that systems should be designed to proactively protect, while the EU quotation broadly states “not open to malicious use.” The US principle elaborates to qualify protection design via harms “from unintended, yet foreseeable, uses.” Statements c similarly acknowledge the role of “vulnerable” or “diverse communities” in the development of such systems. These statements indicate an expanded role for marginalized communities in creating the technological future.

<table>
<thead>
<tr>
<th>EU Principle &amp; Quotation</th>
<th>US Principle &amp; Quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2) Prevention of harm</strong></td>
<td><strong>1) Safe &amp; effective systems</strong></td>
</tr>
<tr>
<td>1. “They [AI systems] must be technically robust and it should be ensured that they are not open to malicious use.”</td>
<td>1. “Automated systems should not be designed with an intent or reasonably foreseeable possibility of endangering your safety or the safety of your community. They should be designed to proactively protect you from harms stemming from unintended, yet foreseeable, uses or impacts of automated systems.”</td>
</tr>
<tr>
<td>2. “AI systems should neither cause nor exacerbate harm or otherwise adversely affect human beings.”</td>
<td>2. “You should be protected from unsafe or ineffective systems.”</td>
</tr>
<tr>
<td>3. “Vulnerable persons should receive greater attention and be included in the development, deployment and use of AI systems.”</td>
<td>3. “Automated systems should be developed with consultation from diverse communities, stakeholders, and domain experts to identify concerns, risks, and potential impacts of the system.”</td>
</tr>
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**Table 2. Quotes of shared aspects of EU Prevention of harm and US Safe & effective systems**

The authors also agreed that another corresponding set of quotations were shared between the principles. However, the authors provided different analytic accounts to support this coding. The authors discussed this part of the dataset at length and while they could agree on the category coding, consensus required acknowledging differing perspectives. These sections are: EU: “AI systems and the environments in which they operate must be safe and secure”; and US: “They should be designed to proactively protect you from harms stemming from unintended, yet foreseeable, uses or impacts of automated systems.” These sections are closely related to the previous sections, and provide further qualification and contextualization of safety, protection, and avoiding harm. The EU stresses safe, secure systems and environments in which they operate, linked to protection-by-design the US suggests. The point of difference, however, focused on the term and use of “environment.” This can be understood as focusing on the AI tool and on the broader context in which the AI tool operates. In this interpretation, the use of the term “environment” suggests organizational, institutional, professional, and similar settings of the human-made world. In contrast, the US principle focuses on the AI tool itself without explicitly mentioning the environment in which it operates. The EU principle, however, qualifies environment: “Preventing harm also entails consideration of the natural environment and all living beings.” Thus, the use of the term “environment” is ambiguous depending on interpretation.
**Explainability**

Respective principles indicate the relevance of explicability/explainability for AI yet collocate this specific theme with different emphasis for importance. The EU indicates user trust in system, while the US indicates notice that such systems are in use and concisely states “understand how and why it contributes to outcomes”, in which the EU elaborates. The US continues with "impacting you", directly indicating individual citizen/right. The US is comparatively more specific. Both, however, discuss informing those impacted, if not the public at large (EU: technically valid, meaningful, useful, and calibrated to level or risk). Both share the idea that explainability may take on different linguistic form relative to context. While the EU appears to use one word (explicability) to convey this specific key functionality changes, while the US “people impacted by the system should be notified of significant use case or key functionality changes.” While the US indicates “generally accessible plain language documentation; notice such systems are in use, notices kept up-to-date). The US, however, includes “notice” whereas the EU does not. While the EU notes systems should be explainable, the US goes on to define this concept for its uses. The EU mentions “those directly and indirectly affected”, while the US “people impacted by the system should be notified of significant use case or key functionality changes.” While the US indicates “generally accessible plain language documentation; it does not go so far as to say for those “directly and indirectly affected”, and these groups of people in the US context appear to also be accorded with changes in functionality and “significant use case changes”, signaling the US couples (public) notice with explainability as concepts in this document.

Similarly, the US suggests a distributed responsibility with “Designers, developers, and deployers.” The US ends with reiterating their definition of explainability as it relates to the citizen, and includes when AI systems are “not the sole input determining the outcome” as a part of explainability, reflecting a kind of 'human-in-the-loop' in notice features. Both refer to explainability within context, and both indicate level of risk (EU: severity of consequences; US: level or risk). The EU indicates explicability is by “degree”, whereas the US links explainability to being technically valid, meaningful, useful, and calibrated to level or risk. Both share the idea that explainability may take on different linguistic form relative to context. While the EU appears to use one word (explicability) to convey several ideas, the US delineates among three components: technically valid, meaningful/useful, calibrated.

<table>
<thead>
<tr>
<th>EU Principle &amp; Quotation</th>
<th>US Principle &amp; Quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. “Explicability is crucial for building and maintaining users' trust in AI systems”</td>
<td>1. “You should know that an automated system is being used and understand how and why it contributes to outcomes that impact you.”</td>
</tr>
<tr>
<td>2. “This means that processes need to be transparent, that capabilities and purpose of AI systems openly communicated, and decisions - to the extent possible - explainable to those directly and indirectly affected.”</td>
<td>2. “Designers, developers, and deployers of automated systems should provide generally accessible plain language documentation including clear descriptions of the overall system functioning and the role automation plays, notice that such systems are in use, the individual or organization responsible for the system, and explanations of outcomes that are clear, timely, and accessible. Such notices should be kept up-to-date and people impacted by the systems should be notified of significant use case or key functionality changes. You should know how and why an outcome impacting you was determined by an automated system, including when the automated system is not the sole input determining the outcome.”</td>
</tr>
<tr>
<td>3. “The degree to which explicability is needed is highly dependent on the context and the severity of the consequences if that output is erroneous or otherwise inaccurate.”</td>
<td>3. “Automated systems should provide explanations that are technically valid, meaningful and useful to you and any operators or others who need to understand the system, and calibrated to the level of risk based on the context.”</td>
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| Table 3. Quotes of shared aspects of EU Explicability and US Notice & Explanation |

**Justice**

The EU address ‘fairness’ directly, while the US through an inverted framing of “not face discrimination” and “systems should be designed in an equitable way.” The EU indicates concepts of fairness, that they are so inherent they are implied to have commitments to these related principles, and be involved in the development of these systems: these include justice, beneficence, and avoiding “unfair” bias to people and groups. The US, however, defines discrimination within its legal context, listing groups of protected people/groups/attributes under the law. This contrasts with a broader conceptualization of principles. The US also uses “unjustified different treatment”, similar to the EU’s “unfair bias, discrimination, and stigmatization.” Both suggest there are allowable instances of
such bias in systems. While different avenues into a shared concept (EU: fairness, US: discrimination avoidance),
the shared focus is on protection of people/groups.

Both principles indicate that those responsible for AI in some way have certain duties toward its design and
deployment regarding fairness and its impact on people. The EU focuses on proportionate means and ends, and
balancing various interests. The US focuses on protection of individuals and communities and equitable design.
Equitable design could be interpreted to be related to balancing “means and ends”, e.g., means of development with
proportional impacts of ends, however the use of “equitable” explicitly signals a specific view on development,
which is not mentioned by the EU. The EU uses “equal”, while the US uses “equitable”: this is an important
distinction, as it lays out differing ethical priorities of AI development and use, and where equity requires a more
nuanced understanding of communities, their societal positioning relative to protections, harms, and discrimination,
and thus how this can be accounted for in development and use of AI.

<table>
<thead>
<tr>
<th>EU Principle &amp; Quotation</th>
<th>US Principle &amp; Quotation</th>
</tr>
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<tbody>
<tr>
<td>3) Fairness</td>
<td>2) Algorithmic Discrimination Protections</td>
</tr>
<tr>
<td>1. “The development, deployment and use of AI systems must be fair.”</td>
<td>1. “You should not face discrimination by algorithms and systems should be used and designed in an equitable way.”</td>
</tr>
<tr>
<td>2. “The substantive dimension implies a commitment to: ensuring equal and just distribution of both benefits and costs, and ensuring that individuals and groups are free from unfair bias, discrimination and stigmatisation.”</td>
<td>2. “Algorithmic discrimination occurs when automated systems contribute to unjustified different treatment or impacts disfavoring people based on their race, color, ethnicity, sex (including pregnancy, childbirth, and related medical conditions, gender identity, intersex status, and sexual orientation), religion, age, national origin, disability, veteran status, genetic information, or any other classification protected by law.”</td>
</tr>
<tr>
<td>3. “Additionally, fairness implies that AI practitioners should respect the principle of proportionality between means and ends, and consider carefully how to balance competing interests and objectives.”</td>
<td>3. “Designers, developers, and deployers of automated systems should take proactive and continuous measures to protect individuals and communities from algorithmic discrimination and to use and design systems in an equitable way.”</td>
</tr>
</tbody>
</table>

Table 4. Quotes of shared aspects of EU Fairness and US Algorithmic discrimination protections

Comparison of the above principles included a second instance where the authors agreed on category coding, yet
with different analytical accounts for justification. As with the previous instance, while the authors agreed on the
category coding, consensus required acknowledging differing perspectives. These sections are: EU: “Moreover, the
use of AI systems should never lead to people being deceived or unjustifiably impaired in their freedom of choice.”;
and US: “Depending on the specific circumstances, such algorithmic discrimination may violate legal protections.”
The point of difference focused on the use of “freedom of choice” and “legal protections” as parallel concepts in this
context. One interpretation was focused on American economic structures and voting (e.g., who/what can I choose,
when and how?), with an emphasis of freedom of choice as, to some extent, a legal protection. Another
interpretation considered that freedom of choice and individual autonomy can be infringed despite no legal
infringements, possibly arising from algorithms, miscommunication, or deception. Even if not legally relevant, these
may have significant negative implications.

Human autonomy
Both principles are fundamentally concerned with human autonomy and maintaining human choice in an
increasingly automated context. Both signal that systems should be designed around the human and not the reverse.
Similarly, both suggest human-in-the-loop design principles in outlining the degree human participation should be
involved in design, use, and remediation. Respective b quotations mention the impacts of AI on labor. The EU states
such systems should support humans in undertaking work with an aim to create “meaningful work.” The US,
however, indicates “sensitive domains” and the use of systems in these domains should be purpose built with the
ability for oversight and incorporation of human action. The US provides a more detailed qualification of both
maintaining human choice vis-à-vis systems and their impact on labor domains. The EU, however, frames these
same topics broadly.
<table>
<thead>
<tr>
<th>EU Principle &amp; Quotation</th>
<th>US Principle &amp; Quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Respect for human autonomy</td>
<td>5) Human alterations, consideration, &amp; fallback</td>
</tr>
<tr>
<td>1. “Humans interacting with AI systems must be able to keep full and effective self-</td>
<td>1. “You should be able to opt out, where appropriate, and have access to a person who can quickly</td>
</tr>
<tr>
<td>determination over themselves, and be able to partake in the democratic process…The</td>
<td>consider and remedy problems you encounter. You should be able to opt out from automated systems in</td>
</tr>
<tr>
<td>allocation of functions between humans and AI systems should follow human-centric design</td>
<td>favor of a human alternative, where appropriate.”</td>
</tr>
<tr>
<td>principles and leave meaningful opportunity for human choice.”</td>
<td>2. “Automated systems with an intended use within sensitive domains, including, but not limited to,</td>
</tr>
<tr>
<td>2. “This means securing human oversight over work processes in AI systems. AI systems may</td>
<td>criminal justice, employment, education, and health, should additionally be tailored to the purpose,</td>
</tr>
<tr>
<td>also fundamentally change the work sphere. It should support humans in the working</td>
<td>provide meaningful access for oversight, include training for any people interacting with the system,</td>
</tr>
<tr>
<td>environment, and aim for the creation of meaningful work.”</td>
<td>and incorporate human consideration for adverse or high-risk decisions.”</td>
</tr>
</tbody>
</table>

Table 5. Quotes of shared aspects of EU Respect for human autonomy and US Human alterations, consideration, & fallback

DISCUSSION

The similarities between the EU and US ethical principles are robust. When including privacy as the primary ethical concept between the US principle Data Privacy and the GDPR, the following are the ethical notions two major jurisdictions are drawing on to guide policy and regulation of AI: Protection/Safety; Explainability; Justice; Human autonomy; and Privacy. Four of the five US principles have a corresponding European analog, underpinned by a primary ethical concept. This finding suggests the use of the US Blueprint for an AI Bill of Rights would make a viable ethical framework as the guiding mechanism for the use of the Z-Inspection® Process in the US context. As mentioned previously, it is important to note that the analog to the US ethical principle Data Privacy appears to be addressed by the GDPR in Europe. This finding indicates that in the developmental and regulatory landscape, the EU already affords these protections. The GDPR therefore provides legal expectations that AI systems developed in the EU or for use within the EU will comply with these protections and strengthens European ethical AI development. Moreover, adaptation of the Z-Inspection® Process in the US context would also suggest data privacy as a perennial ethical issue without a US counterpart to the GDPR or substantive AI regulation predicated on the Blueprint for an AI Bill of Rights. While the seven requirements are an important elaboration of and addition to the four EU principles, the US document does not provide a similar level of granularity in this way. Rather, the US approach emphasizes direct practical application through its Technical Companion. The Technical Companion provides expectations of systems within the context of each principle and often identifies existing laws, regulations, and industry approaches as examples by which to enact the principles. This approach, however, provides no indication of assessment or oversight and remains voluntary. Adoption of the Z-Inspection® Process as an AI assessment process in the US context therefore provides rich opportunity for practical application with a compatible ethical framework and evidence of the methods efficacy (e.g., Zicari, Ahmed, et al., 2021; Zicari, Brodersen, et al., 2021; Zicari, Brusseau, et al., 2021; Allahabadi, et al., 2022). Several options are possible.

First, adapt the process, not the frameworks. For the Z-Inspection® Process to be used in additional global and jurisdictional settings, an adaptation of the process itself would be necessary to accommodate respective frameworks. Focus would be on structural changes to the method within respective jurisdictions, largely independent of respective developments. This approach would account for jurisdictional context, affording potential for individual development as necessary. It would be limiting, however, to disregard potential affordances of multi- or international collaboration. Second, use the process with the US principles expressed in the Blueprint. Focus would be minimally on structural changes to the process, with no mezzo-level requirements. The analytical focus would be on the five US principles. However, previous assessment based on the EU Ethics Guidelines for Trustworthy AI has shown that the level of granularity and specificity offered by the seven requirements is very useful, and that the requirements are more closely related to the context of AI tools than the principles alone (e.g., Zicari, Ahmed, et al., 2021; Zicari, Brodersen, et al., 2021; Zicari, Brusseau, et al., 2021; Allahabadi, et al., 2022).

Third, use the process with the US principles expressed in the Blueprint and develop mezzo-level requirements. To achieve a similar level of granularity, a US adaptation could seek to incorporate similar requirements or turn focus to
the Blueprint’s Technical Companion. Such requirements could utilize the rationales and suggested applications pathways provided for each principle in the Companion. Similarly, the principles outlined in Executive Order 13960 on Promoting the Use of Trustworthy Artificial Intelligence in the Federal Government could also be utilized (as cited in White House Office of Science and Technology Policy, 2022, p. 21). These principles are: (a) lawful and respectful of our Nation’s values; (b) purposeful and performance-driven; (c) accurate, reliable, and effective; (d) safe, secure, and resilient; (e) understandable; (f) responsible and traceable; (g) regularly monitored; (h) transparent; and (i) accountable. However, these principles would need to be defined in such a way as to be useful on the mezzo-level to support the application of the high-level principles in the Blueprint. Utilizing the Technical Companion would provide a mezzo-level to ethical analysis grounded in a jurisdiction-specific focus on application. With the Technical Companion’s reliance on pre-existing legal and regulatory standards, its use in a US adaptation would potentially support analysis of where further regulation may be needed.

Fourth, joint development of adaptations or modifications. In view of the striking similarities between the five US principles and the four EU principles (including the GDPR), a promising approach could consist of relevant US and EU stakeholders developing a joint approach together. This group could build on the existing documents and their principles to add granularity relevant to AI tools. This approach holds potential for increased transatlantic scientific collaboration informing an adapted, modified, or revised version of the Z-Inspection® Process. Joint developmental efforts would support an alignment of AI assessment through the Z-Inspection® Process. This approach could also yield a more generalized assessment method.

Such an adaptation could prove useful both to the US and EU frameworks. The US Blueprint explicitly mentions diverse communities in developmental efforts (Safe & effective systems), equity and historically excluded and legally protected groups (Algorithmic discrimination protections), and sensitive domains of use (Human alterations, consideration, & fallback). Inclusion of these themes at a higher level suggests potential to incorporate concepts of economic and technological justice, intersectionality, and the societal and contextual structures which provide affordances and limitations to equity and justice (Munn, 2022). In the EU approach, these aspects are discussed in the Requirement of Diversity, non-discrimination and fairness. In a US approach, themes of equity and inclusion would therefore be central to ethical appraisals of such technologies, thereby beginning the process of enacting AI justice in practice. However, while the US Blueprint addresses diverse communities in several of its principles, there is no explicit diversity category or requirement such that exists in the EU guidelines. A US-based assessment process may therefore benefit from a more diversified ethical framework consistent with the expression of equity and inclusion within the US principles.

Adapting the Z-Inspection® Process for the American context would potentially provide a conducive environment, both in research and praxis, to align and coordinate effort to develop and maintain responsible AI development. The information professions thus have key contributions, as disciplinary focus is often at the intersection of technology, information, and people. Information research is increasingly necessary to inform responsible advanced technologies development and their ethical appraisals. The impact of AI, for example, on information behaviors, practices, professional education, and in practice (e.g., Cox, 2023; Huang, Samek, & Shiri, 2021) is increasingly prompting relevant new questions as developments continue at a rapid pace. Adaptation of the Z-Inspection® Process in the US context, utilizing the Blueprint for an AI Bill of Rights as its ethical and analytical mechanism provides rich opportunity for information research to follow new lines of inquiry, particularly focused on applied research. Adaptation of this process also creates opportunities for information researchers and practitioners to contribute unique disciplinary perspectives on ethical appraisals of developing technologies alongside experts in other domains of research and practice. Indeed, professional duty and ethics in modern and future information environments may require active participation in ethical appraisals of advanced socio-technical information systems and preparing practitioners for this same.

**CONCLUSION**

The European Union is a leader in its ethical vision for AI, while the United States’ recent addition to the global landscape of ethical principles for AI development contributes a unique vision for equity in AI assessment. The striking similarities between the respective principles suggests the Blueprint for an AI Bill of Rights would make a viable alternative ethical framework underpinning the Z-Inspection® Process. Modifications, however, would be necessary, particularly focused on the mezzo-level within the process, such as the EU’s seven requirements fulfill. Moreover, a joint developmental approach between US and EU stakeholders for further modification of the Z-Inspection® Process for US use presents a unique opportunity for modification and could be a model for an EU-US joint assessment approach. Information research would additionally have unique contributions to make in any of these efforts, as disciplinary focus lies at the intersection of technology, information, and people. Future research should analyze the comparative differences between the frameworks for a more robust understanding of specific adaptations that would need to be developed. Future research could also consider a viable mezzo-level for the US, such as the EU counterpart of the seven requirements.
ACKNOWLEDGMENTS
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Data Flourishing: Developing Human-Centered Data Science through Communities of Ethical Practice

Poole, Alex H. 
Drexel University, USA | ahp56@drexel.edu

ABSTRACT
Data Science is a burgeoning area in the iField. But Data Science practices have far outstripped the field’s ethical safeguards. We argue that Data Science graduate education programs must address this critical problem. In this theoretical and conceptual paper, we posit an ordinary macroethics that we call data flourishing. We contend that this macroethics is most appropriately developed through a holistic, human-centered data science (HCDS)-based pedagogy that concentrates on cultivating communities of ethical practice (COEPs) through social learning. We favor embedding this macroethics throughout iField programs’ graduate data science curricula and by extension, the entire data science education enterprise. This paper aligns with the 2023 ASIS&T annual meeting theme of translating research into practice, particularly the subthemes of “improving decision-making” and “understanding the power of information to develop human happiness, equality, and wellbeing.”

KEYWORDS
Ethics; data science; data science education; pedagogy; communities of practice

INTRODUCTION
Data science (DS) work constitutes an ethical minefield. Ethics remains far from embedded in the graduate DS curriculum, however. Scholars have proposed human-centered data science (HCDS) to deal with ethical challenges, which is a positive but insufficient development. DS instead demands an ordinary macroethical foundation that promotes what we call data flourishing (eudaimonia). We argue that this foundation is most appropriately developed through a holistic, human-centered data science (HCDS)-rooted pedagogy that centers on cultivating communities of ethical practice (COEPs) through social learning. We advocate embedding this principle throughout iField programs’ graduate data science curricula and by extension, throughout the entire data science education enterprise.

This conceptual paper first discusses and contextualizes Big Data and data science. Next, we explore algorithms and their implications for data science work, which funnels into the need for HCDS. Third, we describe fruitful HCDS approaches. We broach data ethics fourth. Fifth, graduate data science education is addressed; we then suggest the usefulness of a communities of practice (COPs) model for teaching an HCDS-based ordinary macroethics to promote data flourishing. We conclude with implications for practice and research.

THE APOTHEOSIS OF BIG DATA—AND DATA SCIENCE
Boasting volume, variety, velocity, value, and (ostensibly) veracity, Big Data work capitalizes on probabilities generated through well-nigh labyrinthine mathematical operations (Mayer-Schönberger & Cukier, 2013). However incomplete, Big Data may be wrangled to enable tabulation, aggregation, and analysis—i.e. datafied (Mayer-Schönberger & Cukier, 2013). Datafication putatively enables more sophisticated discernment of patterns or correlations; it involves knowing what, not necessarily why (Mai, 2016; Mayer-Schönberger & Cukier, 2013; Zwitter, 2014).

Big Data work exploits trace data, which emanates from social media, financial transactions, and public transportation use; such data purportedly represents individuals’ actions, not their claims (boyd & Crawford, 2012; K. Davis & Patterson, 2012; Gitelman & Jackson, 2013; Kogan et al., 2020; Leavitt, 2016; Mayer-Schönberger & Cukier, 2013; Zwitter, 2014). Individuals reveal such personal information consciously or unconsciously, willingly or unwillingly, through their prosaic activities (e.g. social media data, health tracking data, emails, text messages, search engines) (Brower, 2013; Mai, 2016; McAfee & Brynjolfsson, 2012; Zwitter, 2014). “Every login, every page view, and every click leaves a trace” (Gillespie, 2014, p. 170); individuals therefore seem merely the aggregate of their social relationships, online interactions, and connections with content (Mayer-Schönberger & Cukier, 2013, p. 157). What is more, service providers entice individuals to volunteer personal information under the auspices of often specious self-empowerment (Brower, 2013; Gillespie, 2014). These providers advance an insidious argument: the more personal information they glean from their users, the better services they can offer (Mai, 2016). This enables the commodification of nearly any banal action.

Big Data elicited a superabundance of hype, appearing the “next frontier for innovation, competition, and productivity” to McKinsey and Company (Manyika et al., 2011). In alluring policy terms, it hinted at more effective medical treatments, more efficient energy use, and individually tailored educational curricula (Big Data Senior Steering Group, Subcommittee on Networking and Information Technology Research and Development, 2016; Executive Office of the President, 2014). At their most hubristic, its advocates warned to technochauvinism, the
notion that computing technology’s alleged objectivity and neutrality represents an effective panacea (Broussard, 2018).

Coincident with Big Data’s rise, data science emerged as both a field of study and a practice that surfaced the collection, preparation, processing, analysis, visualization, storage, management, and preservation of Big Data to construct new insights (Shah, 2020; Stanton, 2012; Wu et al., 2022). The unduly hyped role of data scientist, “a hybrid of data hacker, analyst, communicator, and trusted adviser,” soon followed (Davenport & Patil, 2012, p. 73).

**ALGORITHMS AND THEIR DISCONTENTS**

Even as Big Data’s apostles lauded its potential, others adopted a more cautious if not skeptical tone. Big Data swamped current social, political, and legal institutions; Lazer et al. (2014) warned of “Big data hubris”—the conceit that Big Data supplants conventional data practices (e.g., validity and reliability). Some scholars worried about potential harm from (mis)interpretation and bias as well as from unintended consequences (Bollier, 2010; K. Davis & Patterson, 2012; Metcalf et al., 2016). Key concerns centered on algorithmic opacity and interpretability, objectivity and neutrality, bias and discrimination, agency and accountability, and ownership, rights, and privacy.

**Opacity and interpretability**

Encoded mathematical rules that specify task execution procedures, algorithms tease out patterns and relationships (Ames, 2018; J. L. Davis et al., 2021; Gillespie, 2014). Ever more complex and autonomous, algorithms drive artificial intelligence and agents, especially those deployed in machine learning (Floridi & Taddeo, 2016).

Algorithms’ legitimacy claims rest upon the shibboleth that they are fair and accurate, impartial and objective, efficient and trustworthy (Gillespie, 2014). Belying these attributes, however, algorithmic outputs in fact remain opaque: they seldom disclose their author’s motives or biases, much less how these affect the algorithm’s design, machinations, or outputs (Executive Office of the President, 2014). As a result of unknown or proprietary inputs or black-boxed tools, opacity characterizes Big Data-driven decisions (Burrell, 2016; Iliadis & Russo, 2016). Opacity invariably excludes individuals from opportunities; it also precludes individuals’ ability to seek redress for invidious algorithmic outputs (Executive Office of the President, 2014; Floridi et al., 2018; Floridi & Taddeo, 2016). What is more, opacity militates against interpretability. The complexity of the models on which high predictive accuracy (and thus high generalizability) depends truncate interpretability, as does representational complexity (Bamman, 2016).

**Objectivity and neutrality**

Big Data’s presumptions of objectivity and neutrality are similarly problematic. Common framings of Big Data connoted transparency, even self-evident truth; by apparently mooting human subjectivity, its advocates inoculated their outputs against challenge (Gillespie, 2014; Tanweer et al., 2016). Some phenomena defy representation, however, and Big Data’s pretensions papered over a fundamental if unsettling truth: all DS workers are designers and interpreters (Big Data Senior Steering Group, Subcommittee on Networking and Information Technology Research and Development, 2016; boyd & Crawford, 2012). In fact, Big Data may suggest spurious patterns, even causations, in the process proving neither neutral nor objective nor beneficent (Bollier, 2010; boyd & Crawford, 2012; Executive Office of the President, 2014, 2016; Noble, 2018; Zwitter, 2014).

**Bias and discrimination**

Since they undergird local and global computational infrastructures, algorithms indelibly imprint individuals’, groups’, and communities’ opportunities in areas such as public sphere participation, hiring and employment practices, business management, credit and loan access, policing, criminal sentencing, and welfare and public resource apportionment (Ames, 2018; Burrell, 2016; J. L. Davis et al., 2021; Eubanks, 2017). Algorithms wield power. They both reflect and augment systemic and structural social, political, and cultural inequities (J. L. Davis et al., 2021), encouraging “a feedback loop of injustice” (Eubanks, 2017, p. 7). Algorithms promote the so-called digital redlining of underrepresented or marginalized groups, which leads to (further) inequitable distribution of resources and services (Blodgett et al., 2022; Executive Office of the President, 2014; Noble, 2018).

**Agency and accountability**

Both opacity and lack of interpretability and misleading claims of objectivity and neutrality complicate assignation of agency and accountability. Big Data-driven decisions involve myriad actions by myriad individuals. This globally distributed morality spawns a “many hands” problem; it forestalls assigning or assuming responsibility for data authorship, ownership, output(s), analysis, or (re)use (Zwitter, 2014). As Metcalf et al. (2019) assert, traditional compliance mechanisms (e.g., codes of ethics, ethics trainings) fasten on personal accountability. This jaundiced propensity, however, absolves institutions and social structures. Obscuring harm and blame—and therefore accountability—the many hands problem upends public trust in data science tools and methods (Bowker, 2013; Executive Office of the President, 2014; Floridi & Taddeo, 2016; Gillespie, 2014; Leonelli, 2016; Mai, 2016).
Ownership, rights, and privacy

Fundamental questions regarding data ownership and rights exacerbate the challenges of agency and accountability (Aragon et al., 2016; K. Davis & Patterson, 2012; Gitelman & Jackson, 2013). Policymakers deferred to physical property-based legal traditions, but these fail to accommodate data trace- or data sharing-based concerns (Fiesler & Brubaker, 2016). Furthermore, as Noble (2018) argues, data protection relies upon a rights-based discourse that foregrounds free speech and expression. But since web content is private property, she explains, an individual can effectively purchase another’s web identity. Suffice to say that policy vacuums abound.

Data ownership and rights are inextricable from privacy concerns. Vitiating the fragile distinction between private and public, online and offline, Big Data torpedoed the notion of informed consent, which hinges on individuals making decisions consciously, rationally, and autonomously. An overwhelming number of consent-based requests channels into cognitive overload, even paralysis (Young, 2016). Indeed, individuals tend to consent reflexively, with often perfunctory understanding, which puts them at an ethical disadvantage (Mai, 2016; Zwitter, 2014).

Big Data also upended privacy mechanisms such as opting out, profile controls, encryption, and de-identification (Big Data Senior Steering Group, Subcommittee on Networking and Information Technology Research and Development, 2016; Executive Office of the President, 2014; Mayer-Schönberger & Cukier, 2013). Privacy is not merely an individual issue, moreover; data scientists must consider potential injury, especially to historically marginalized communities, as well (Young, 2016).

To scholars’ dismay, protecting privacy and leveraging data richness surfaced perhaps insoluble trade-offs (Manyika et al., 2011; McAfee & Brynjolfsson, 2012; Young, 2016). On the one hand, many reputedly anonymized datasets remained re-identifiable through data mining, linking, or merging; breach of privacy could result in discrimination (Floridi & Taddeo, 2016; Leonelli, 2016; Young, 2016). On the other, by obscuring provenance de-identification potentially trammeled data’s utility (Executive Office of the President, 2014).

THE IMPERATIVE FOR A HUMAN-CENTERED DATA SCIENCE (HCDS)

Staring down a proverbial Frankenstein’s monster, scholars in the 2010s gravitated toward a human-centered data science (HCDS). Unadulterated data science approaches neglect social nuances, affective relationships, and ethical or value-driven concerns (Aragon et al., 2016). By contrast, HCDS fuses human-computer interaction (HCI), computer-supported cooperative work (CSCW), human computation, data science, and apprehension of social context(s) to yield potentially unique insights (Aragon et al., 2016; Herman et al., 2020; Kogan et al., 2020). Richness, sociality, relationality, complexity, and contextuality—each of these attributes characterizes HCDS (Kogan et al., 2020; Muller et al., 2020).

Eschewing reductive technical and functional problems and goals, human-centeredness holistically, reflectively, and prosaically foregrounds human values and ethics. Elevating individual and communal social responsibility, human-centeredness focuses on the normative as well as the feasible, thereby nurturing trust between people and technology (The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems, 2019). HCDS offers a powerful antidote to technochauvinism (Tanweer et al., 2022).

Human-centered data science approaches

Numerous scholars advance fruitful HCDS approaches whether conceptual, methodological, or both, each of which we unpack briefly below and later incorporate in our pedagogical model. Each HCDS approach addresses one or more of the key challenges of opacity and interpretability, objectivity and neutrality, bias and discrimination, agency and accountability, and/or ownership, rights, and privacy. Some approaches such as algorithmic reparations have been suggested by individual scholars; others such as design and research methods have been considerably more developed by multiple scholars across the HCDS arena.

Race Critical Code Studies

Attacking technochauvinism, Benjamin (2019) calls attention to a “New Jim Code”: “the employment of new technologies that reflect and reproduce existing inequities but that are promoted and perceived as more objective or progressive than the discriminatory systems of a previous era” (pp. 5–6). Since historically discriminatory or exclusionary policies and practices produced extant data, and since designers do not work in a vacuum, she clarifies, claims for objectivity or neutrality fall flat. Benjamin (2019) promulgates “race critical code studies” (RCCS) as an overarching approach to counter Jim Code. Profoundly emancipatory, RCCS democratizes data’s design and its application in line with solidarity and justice. An integral part of RCCS, “coded equity audits” should be employed to scrutinize existing and novel technologies alike (Benjamin, 2019, p. 185).

Algorithmic reparation

J.L. Davis and her colleagues (2021) insist on data scientists’ moral responsibility to battle historical and structural inequities. This involves reparations, “historically grounded mechanism[s] by which offending parties symbolically and materially mend wrongdoings enacted against individuals and groups” (J. L. Davis et al., 2021, p. 3).
Specifically, these researchers lobby for data curation- and distributed AI-based algorithmic reparation. Grounded in praxis, interdisciplinary, and sociotechnical, such reparations revolve around the collaborative design, production, and evaluation of equitable, anti-oppressive algorithmic systems. Reparations involve accepting community members as experts and embracing reciprocal engagement and cross-training, accounting for multiple intersectional identity configurations (e.g., race, ethnicity, class, gender), determining what data to collect (or not), and system co-creation with members of the impacted communities. Such systems then remedy intersectional structural inequality through systems auditing, censure of discriminatory outputs, and resource redistribution.

**Data feminism**

Insofar as oppressive, historically rooted power structures and systems imperil human-centered data science work, D'Ignazio and Klein (2020) call for “co-liberation” through intersectional data feminism. Based on feminist activism and critical thought and both a goal and a process, data feminism encompasses pluralism, context, and affect; interrogates power relationships, binaries, and hierarchies; and renders labor visible. As D'Ignazio & Klein (2020) remind us, “Before there are data, there are people—people who offer up their experience to be counted and analyzed, people who perform that counting and analysis, people who visualize the data and promote the findings of any particular project, and people who use the product in the end. There are also, always, people who go uncounted—for better or for worse” (p. 10). Data feminism augurs just, equitable, and livable futures.

**Data Science for Social Good**

Rejecting the shibboleth that sheer efficiency constitutes data science’s ultimate goal, Data Science for Social Good (DSSG) promotes individual and collective well-being through democratized policies and programs that involve diverse community partners (Zegura et al., 2018). Notably, DSSG embraces a logic of care in its iterative data collection, preparation, wrangling, visualization, analysis, and presentation. As a normative feminist moral theory, an ethics of care develops, maintains, and enriches caring relations (Noddings, 2013). It foregrounds interconnection and interdependence, relationality and responsibility for others, elevating empathy, receptivity, responsiveness, trust, mutual concern, and sensitivity to local context(s) (Gilligan, 2003; Held, 2005; Noddings, 1992).

**Critical Data Studies**

Given Big Data’s potential for mischief, Iliadis & Russo (2016) insist on the need for an ecumenical Critical Data Studies (CDS), or “research that interrogate[s] all forms of potentially depoliticized data science and...track[s] the ways in which data are generated, curated, and how they permeate and exert power on all manner of forms of life” (p. 2). Put another way, CDS premises resistance and alternatives to technochauvinism. Located at the juncture of science and technology studies, policy and legal fields, the social sciences, and the humanities, CDS claims that because data is inherently interpretive, it necessarily involves values negotiation and communication (Dalton et al., 2016; Neff et al., 2017). Data, in other words, represents starting, not end, points; therefore data sense-making demands collective reflection and compromise (Neff et al., 2017). CDS concentrates on participatory learning and research for the common good through an appreciation of situated, contextualized daily practices.

**Data empathy**

“Human judgment is not a contaminant that can be removed from data,” Tanweer et al. (2016) contend, “but an inherent ingredient in the construction of data sets, which...establish patterns of inclusion and exclusion.” Given an increasing propensity for collaboration and exploiting data from diverse sources (e.g., academic, non-profit, governmental), they recommend not only embracing, but also harnessing human subjectivity through data empathy. According to Stueber (2019), empathy constitutes “the primary epistemic means for knowing other minds.” It therefore includes “a wide range of psychological capacities that are thought of as being central for constituting humans as social creatures allowing us to know what other people are thinking and feeling, to emotionally engage with them, to share their thoughts and feelings, and to care for their well-being” (Stueber, 2019). Data empathy entails discerning data-related values, intentions, expectations, and practices and determining how they shape data’s meaning and its possible uses.

**Design**

Invariably value-laden and effectively political, design reflects and (re)inscribes possible racial, ethnic, gender, and class biases (Eubanks, 2017; Noble, 2018). Design challenges include understanding and wrangling data, collaborating, and communicating results (Muller et al., 2019). Whether concentrating on potential users, datasets, scenarios, models, prototypes, platforms, or interfaces, design decisions and practices impact free speech, censorship, network neutrality, security, and privacy concerns (Feinberg, 2017a; Shilton, 2016). Therefore, designers must interrogate not only their motivations, but the contexts of their decision making (Feinberg, 2017b). In other words, data science workers bear a moral obligation to grapple with how their decisions impact data creation, discovery, capture, analysis, and curation; system design and use; and policy (Floridi & Taddeo, 2016; Muller et al., 2019; Shilton, 2016).
Scholars call for collaborations or partnerships among data scientists, designers, and community members (Muller et al., 2019; Wettersten & Malmgren, 2018). For example, Girardin and Lathia (2017) mandate partnerships to address the biases engendered by feedback loops. In brief, algorithms first exploit ingested data, then communicate outputs to the individual, ostensibly to enrich her experience. The interaction of algorithm and individual creates new behavioral data, which is then parlayed into retraining the algorithm. This process demands a holistic, translational partnership among designers and data scientists; only such collaboration reveals how the interaction of data, algorithms, and interfaces molds individuals’ experiences (Girardin & Lathia, 2017).

In like mind, Aizenberg and van den Hoven (2020) warn against the “formalism trap,” the tendency in design to sacrifice social issues and contexts for apparent technical solutions (p. 2). Insisting that more automation is not always optimal, they favor participatory design, value sensitive design, and values in design. These approaches center negotiating stakeholders’ value tensions and interdisciplinary communication (Aizenberg & van den Hoven, 2020). Participatory design involving voices from marginalized communities to share in decision-making is particularly fruitful (Zytko et al., 2022).

Unpacking the ways in which design “distributes benefits and burdens, reproduces and/or challenges the matrix of domination (white supremacy, heteropatriarchy, capitalism, ableism, settler colonialism, and other forms of structural inequality),” Costanza-Chock (2020) endorses design justice (p. 23). Design justice, in summary, gives control to those with direct salient lived experience of the conditions being changed.

In effect, the partnerships suggested by scholars such as Costanza-Chock, Aizenberg and van den Hoven, and Girardin and Lathia embrace “equal opportunity by design”: systems that promote fairness even as they obviate discrimination (Executive Office of the President, 2016). Ultimately, human-centered design must infuse algorithm design (Aragon et al., 2016).

Research methods

HCDS shows great promise in enriching data science research methods. According to Metcalf & Crawford (2016), traditional, discipline-specific research regulations exempt projects predicated on extant public data, classifying discrimination (Executive Office of the President, 2016). Ultimately, human-centered design must infuse algorithm design (Aragon et al., 2016; Muller et al., 2016). In HCDS, quantitative and qualitative approaches computationally-generated quantitative data and qualitative, socially-situated approaches (Aragon et al., 2016; Kogan et al., 2020; Muller et al., 2016). In HCDS, quantitative and qualitative approaches are “complementary, mutually reinforcing, and co-constitutive” (Tanweer et al., 2021, p. 3). Scholars such as Brooks et al. (2013), Gluesing et al. (2014), Maddock et al. (2016), and Qazi and Wong (2019) demonstrate the utility of synthesis.

First, Brooks et al. (2013) scaled up human analysis via machine learning; this marriage enabled affect detection in a large international collaborative chat log of astrophysicists. Second, by combining automated data collection and analysis and a localized ethnographic approach, Gluesing et al. (2014) obtained both broad and deep understanding.
of the global diffusion of organizational innovation. Third, Maddock et al. (2016) conducted two productive studies. One analyzed social media rumors concerning the 2013 Boston Marathon bombing to develop automated detection algorithms. The other explored Wikipedia talk and article pages. Qualitative findings informed these researchers’ sampling methods and coding schemes, which in turn helped validate their quantitative findings. Fourth, Qazi and Wong (2019) focused on more effective and efficient extraction and visualization of temporal, spatial and behavioral associations pulled from crime reports’ unstructured data. Integrating individuals’ domain knowledge into machine learning systems’ algorithms alleviated the burden of manual, time-consuming database searches.

In HCDS, mixed methods come together perhaps most fruitfully in ethnography and machine learning. A foundational qualitative method, ethnography involves human researchers-cum-instruments immersing themselves in a natural setting. They conduct sustained observation of a small number of individuals to understand those individuals’ activities and the meanings the latter ascribe to those activities (Dourish, 2014; Rotman et al., 2012). Machine learning, by contrast, applies algorithmic processes to myriad anonymized data points (Leavitt, 2016).

Yet ethnography and machine learning occupy much common ground. Exploratory and iterative, grounded and inductive, both demand interpretation and theory development (Leavitt, 2016; Muller et al., 2016; Yapchaian, 2018). What is more, each research paradigm may profitably inform the other’s sampling, coding, analysis, interpretation, and validation procedures (Kogan et al., 2020; Maddock et al., 2016; Murthy, 2013). On the one hand, ethnography enhances Big Data analysis by establishing ground truth (i.e. external validity), and by enabling thick description (Bjerre-Nielsen & Glavind, 2022). On the other hand, machine learning facilitates ethnographic work, e.g., by identifying aggregate population trends encouraging granular investigation, or by sampling multiple sites to depict a larger phenomenon (Leavitt, 2016; Rotman et al., 2012).

In one case, Geiger and Ribes (2011) shed light on Wikipedia vandalism by fusing participant observation and trace ethnography. Diverse, often automatically generated traces (e.g., transaction logs or conversation transcripts) document events; individuals often employ these traces for coordination and accountability purposes. Researchers may parlay such thin traces into thick description. But ethnography does not necessarily permit researchers to demonstrate these activities’ sociocultural importance, much less their change over time. Ethnography should therefore be combined with other qualitative and quantitative methods, Geiger and Ribes (2011) reasoned, whether archival, interview, survey, or statistical. Like other unobtrusive research techniques, however, trace ethnography gives rise to ethical concerns surrounding privacy and informed consent since users can scarcely imagine how their traces may be datafied for research.

In a second example of an ethnography-machine learning collaboration, Rotman et al. (2012) embraced “extreme” ethnography to analyze online environments featuring preternatural size, scope, and fluidity. Just as applied ethnography seeks understanding of and guides decisions, so does extreme ethnography integrate ethnographic and quantitative methods. Extreme ethnography illuminates novel behavior and nuanced relationships in vast, dynamic networks; this empowers individual voices in tandem with massive structural and interactional data.

Overall, scholarship centering on Race Critical Code Studies, algorithmic reparation, data feminism, Data Science for Social Good, Critical Data Studies, data empathy, design, and research methods shows that HCDS scholars occupy much common terrain. An optimal data science, they reason:

- Eschews technochauvinism.
- Features an intersectional, Rawlsian moral commitment to equity and social justice.
- Orient toward praxis.
- Focuses on quotidian practices and on local context(s) and situatedness.
- Is communicative, participatory, democratic, pluralistic, community-based, relational, collaborative, and collective in nature.
- Surfaces visibility and transparency.
- Appreciates affect.
- Is historically informed, acknowledging past oppressions and their structural and institutional legacies in current data and pledging to forestall new data inequities.

HCDS scholars have done meritorious work in proposing frameworks such as DSSG and exploring the importance of design and research methods in particular. Although these HCDS examples have yet to be coordinated—and in many cases implemented or evaluated—they nonetheless represent useful foundational work that can be parlayed into the macroethics we set forth below.

**DATA ETHICS FOR HUMAN-CENTERED DATA SCIENCE**

HCDS approaches offer vital if inchoate contributions to ethical data science theory and practice. But an optimal HCDS demands not a piecemeal, but rather a full-fledged data ethics—viz., a *macroethics.*
Alarmingly few individuals and teams design the technologies that govern and even transform everyday life globally, technologies that often produce inequity (Floridi & Cowls, 2019). A lack of codes, standards, and laws exacerbates this knowledge deficit, which impacts politics, the legal system, and social services (Zwitter, 2014). Hence a profound need exists for a robust data macroethics. Ideally, Florid and Taddeo (2016) posit, such a macroethics envelops “moral problems related to data (including generation, recording, curation, processing, dissemination, sharing and use), algorithms (including artificial intelligence, artificial agents, machine learning and robots) and corresponding practices (including responsible innovation, programming, hacking and professional codes), in order to formulate and support morally good solutions (e.g. right conducts or right values)” (p. 1).

Given scholars’ insistence on the situatedness and quotidian nature of HCDS, a suitable data macroethics is perforce an ordinary ethics, which stipulates that ethical behavior and humanness are prosaically inextricable (Lambek, 2010). Ordinary ethics engages the “tension between the everydayness of the present and the possibility of a different, better everydayness” (Metcalf et al., 2019, p. 457).

Floridi and Cowls (2019) advance five core principles for an Artificial Intelligence (AI) macroethics, principles that are similarly appropriate for HCDS. These principles include beneficence (e.g., safeguarding human well-being and dignity and sustaining the environment), autonomy (e.g., preserving the human power to decide), justice (e.g., preserving solidarity and avoiding unfairness), explicability (e.g., intelligibility and accountability), and non-maleficence (e.g., privacy and security). This macroethics, properly translated into an ordinary macroethics, is the foundation for data flourishing. It should constitute the core of iField graduate data science education.

**GRADUATE DATA SCIENCE EDUCATION**

As Poole (2021) observes, numerous scholars characterize the iField as an ideal venue for data science pedagogy (Anderson & Parker, 2019; Bishop et al., 2019; Durr, 2020; Greenberg et al., 2017; Han & Zhu, 2017; Marchionini, 2016; Shah et al., 2021; Song & Zhu, 2017; Wang, 2018; Wu et al., 2022; Zhang et al., 2022). Despite the iField’s rich potential, scholars seldom addressed ethics in the 2010s. Many publications neglected the matter altogether (Cao, 2018; Chen et al., 2019; Danyluk et al., 2019; Demchenko et al., 2016, 2017; Dumbill et al., 2013; Durr, 2020; Han & Zhu, 2017; Kim, 2016; Oh et al., 2019; Raj et al., 2019; Tang & Sae-Lim, 2016; Varvel et al., 2012; Wiktorski et al., 2016). Others mentioned it only cursorily (Cao, 2019; Irizarry, 2020; Song & Zhu, 2017). Despite burgeoning iField interest, then, data science curricula in the 2010s remained circumscribed (Ortiz-Repiso et al., 2018; Salz et al., 2018; Si et al., 2013).

There were a few exceptions, however. Metcalf et al. (2016) and Wing et al. (2018) enjoined instructors to integrate ethics throughout their curricula. Wing et al. (2018), for instance, suggested offering a stand-alone ethics course, ensuring ethics pervaded all coursework using real data (e.g., project-based), or weaving ethics into all courses. Under these auspices, Wing et al. (2018) favored covering general principles such as codes of ethics; incorporating case studies such as ethical problems caused by biased data; and balancing ethical concerns with business value. Wing (2019) later urged instructors to consider privacy and ethics during each phase of the data lifecycle.

Some scholars, most notably Wu et al. (2022) and Zhang et al. (2022) have developed data science education models. Though Wu et al. (2020) exhorted data science programs to promote social good, these researchers’ rather facile content analysis of 2,239 Chinese job advertisements showed ethics almost absent. Faced with these findings, they called for “special training” in ethics as “a bottom line” (p. 10). In a similar vein, Wu et al. (2022) conducted a content analysis of 96 graduate DS programs that listed 2,084 courses. Practice and project management courses ranked first (34.98%), followed by data mining, analysis, and modeling (14.88%), library and information science (10.51%), “humans and society” (8.83%), data processing, storage, and management (8.73%), mathematics and statistics (6.14%), and computer science and artificial intelligence (6.09%). Wu et al. (2022) parlayed these results into a four module, supposedly human-centered curriculum. Module 1 concentrated on data-driven methods and techniques (e.g., data collection, processing, and storage; data mining, analysis, and modeling; data visualization; statistical analysis; algorithms and programming languages; and machine learning and artificial intelligence); module 2 homed in on domain knowledge (e.g., from information science, health informatics, and marketing); module 3 addressed legal, moral, and ethical issues (e.g., trust, privacy); and module 4 foregrounded personal traits such as critical thinking and communication skills (e.g., creativity, attention to detail).

Zhang et al. (2022) recycled Wu et al. (2022)’s content analysis of 2,239 Chinese job advertisements as well as the latter’s content analysis of 96 graduate programs’ data science listings. The former then added the American Library Association’s (ALA’s) JobLIST (24,058 advertisements between 2006 and 2018), and Indeed.com job listings in the US (1,312), Germany (519) and the UK (333) (all from 2020). Zhang et al. (2022) also executed a Delphi study with 16 members of the iSchool Data Science Curriculum Committee (iDSCC). This eclectic group ranked key topics as follows: 1) basic programming and data analytics/visualization/interpretation/communication; 2) basic mathematics and statistics/machine learning, namely clustering, classification, and linear regression; 3) critical reflection on DS’s societal and ethical implications—primarily minimizing bias and misuse while maximizing fairness and
transparency; 4) data processing and management work such as cleaning, digitization, preservation, and archiving; 5) evaluation and use of DS tools; 6) project management; 7) data and information literacy (including the odd pairing of digital humanities and bias detection).

On the whole, these iField efforts to craft a truly ethical HCDS pedagogy are promising but underdeveloped. While acknowledged by some scholars and apparent in some guise in these frameworks, ethics are not given appropriate pride of place. In Wu et al.’s (2022) content analysis, for example, ethics ranked fourth, falling under the broad category of “humans and society.” Second, Zhang et al. (2022)’s iDSCC informants ranked ethics only third of seven key topics (though in discussing this ranking, the authors note in a perfunctory non-sequitur that ethics should be integrated across the curriculum). Third, Wu et al.’s (2022) framework includes only a single module that explicitly mentions ethics, which problematizes if not vitiates the authors’ claim to human-centeredness. In fact, Wu et al.’s framework seems vocationally centered, not human-centered. Fourth, frameworks such as Wu et al.’s (2022) and Zhang et al.’s (2022) give scant indication of how ethics fits with other topics in a given module, much less how other modules might incorporate ethics to militate against siloing. Proposed DS education models might be augmented by reframing modules as both/and instead of either/or, and thus mitigating siloing. Fifth, content analysis of job advertisements and to a lesser extent, of graduate programs, underpins these models. Relying on this data is problematic, though. There is no guarantee that what is listed in a job advertisement as a responsibility at one point in time is actually what a worker actually does. Similarly, there is no assurance that courses listed are ultimately offered (and how frequently, for that matter), or that courses offered succeed in inculcating students with the competencies they claim in their titles or descriptions. These scholars also neglect to explain or justify their sampling strategies and decisions. The addition of interview data in Zhang et al. (2022), for instance, is useful but hardly sufficient, especially given the composition of the sample. Last, by drawing so heavily on content analyses, these models focus more on what is and slights what should be—a seeming abdication of pedagogical and certainly of humanistic responsibility. This shortfall is especially striking since some scholars explicitly proclaim the iField’s commitment to normative data science work (e.g. Shah et al., 2021). Sixth and finally, despite their claims of human-centeredness, scholars by and large neglect to incorporate, much less to foreground, germane scholarly literature, including that rooted in HCDS.

Given the manifest gaps and shortcomings of these efforts, we promulgate a new model for data science education (Figure 1). Floridi and Cows’ five principles (beneficence, autonomy, justice, explicability, and non-maleficence) constitute its foundation. We propose five submodules to flesh out these principles. Three align with but go beyond Wu et al. (2022) and Zhang et al. (2022). We add two other submodules based on our extensive analysis of the HCDS literature.

Our first submodule, data skills and practices, generally conforms to Wu et al.’s module 1 (data-driven methods and techniques), which focuses on data collection, processing, and storage; data mining, analysis, and modeling; data visualization; statistical analysis; algorithms and programming languages; and machine learning and artificial intelligence. We augment this module in two ways, however: we add “tool evaluation and use” (pulling from Zhang et al. [2022]), and we replace the archaic “storage” with “curation,” since the latter term more holistically captures the importance of a lifecycle approach that ensures fit for future purpose (Poole, 2016). Second, our domain knowledge submodule extends Wu et al.’s second module by including Library Science (Poole, 2021). Our third submodule addresses soft skills. It includes project management, communication, cultural competence, customer service, adaptability/flexibility, presentation skills, reflective practice, writing skills, teamwork/collaboration, DEI commitment, interpersonal, initiative, problem-solving, outreach, creativity, critical thinking, continuous learning (Lankes et al., 2015; Partridge et al., 2010; Saunders, 2019; Saunders & Bajjaly, 2022). This submodule overlaps with but again markedly enhances Wu et al.’s (2022) third module. Our review of the HCDS literature suggests the need for a fourth submodule, design, and a fifth, research methods. The latter should be anchored in Science and Technology Studies (STS) (e.g. Latour, 1987; Latour & Woolgar, 1986; Van House, 2005).

As shown in Figure 1, under the aegis of a macroethics of data flourishing, each of the proposed modules (beneficence, autonomy, justice, explicability, and non-maleficence) encompasses each submodule (data skills, domain knowledge, soft skills, design, and research methods). In short, we propose a graduate data science education that turns on a holistic, integrative, profoundly humanistic approach. A HCDS-anchored macroethical approach would be most fruitful in instantiating this model; communities of practice (COPs) are an optimal way to do so.

**COMMUNITIES OF ETHICAL PRACTICE (COEPS)**

Communities of practice represent an ideal vehicle for developing an ordinary DS macroethics. Specifically, we propose the development of HCDS-based communities of ethical practice (COEPS) in and across iField graduate data science programs. These COEPS rest on Floridi and Cows’ macroethical principles of beneficence, autonomy, justice, explicability, and non-maleficence. Under the auspices of these principles are data-driven methods and
techniques, domain knowledge, soft skills, design, and research methods. COEPs address the chronic challenges of opacity and interpretability, objectivity and neutrality, agency and accountability, and ownership, rights, and privacy underscored in scholarly literature. At the same time, COEPs enable the integration and as important, the testing, of HCDS approaches such as Race Critical Code Studies, Critical Data Studies, data empathy, data feminism, Data Science for Social Good, data vision, and algorithmic reparations. We next discuss the attributes of communities of practice.

According to Etienne Wenger (2017), learning inheres in human nature (see also Brown et al., 1989; Brown & Duguid, 1991; Lave, 1991; Wenger, 2000, 2006, 2010). Not a special discrete activity, learning is participatory and social; it flourishes when situated in individuals’ prosaic, lived experiences. Wenger’s social theory of learning includes four components.

First and most holistically, social learning involves experiencing life meaningfully. Second, social learning centers on practice. Incorporating the whole person, both knowing and acting, tacit and explicit, practice surfaces the shared historical and social contexts, resources, relationships, and perspectives that underpin common engagement in action. In other words, practice creates structure(s) for and permits meaning to emerge from individual and communal doing. This negotiation of meaning demands continuous and sustained attention, interaction, and (re)adjustment. Participation in these activities revolves around membership in and experience with communities and enterprises. Both personal and social, participation combines talking, feeling, doing, and belonging; it is a prerequisite for identity formation. A key part of meaning-making in practice, reification “giv[es] form to our experience by producing objects that congeal this experience into ‘thingness’” (Wenger, 2017, p. 58). These objects include terms, concepts, stories, symbols, abstractions, and tools. Third, Wenger’s learning theory includes community, the social arrangements that facilitate competent participation. Community creation, consolidation, and perpetuation depends in turn on common understanding of, engagement in, alignment with, and accountability for a shared enterprise over time, which incorporates a shared repertoire—“routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions, or concepts” (Wenger, 2017, p. 83). Fourth, identity embraces interleaved participation and reification; individual experience and social interpretation inform each other. In sum, learning changes not only our practices and our communities, but also who we are.

To enable social learning in practice, Wenger advocates “legitimate peripheral participation” (LPP). LPP expands the traditional model of apprenticeship from master and student to “one of changing participation and identity transformation in a community of practice” (Wenger, 2017, p. 11). LPP encompasses peripherality and legitimacy. First, peripherality exposes individuals to authentic if approximate full practice. Peripherality incorporates engagement, negotiation, and repertoire, but with lower stakes and augmented support. Second, newcomers must be treated as legitimate potential community members. In sum, COEPs create meaningful practice by developing and leveraging community and identity.

COEPs present a prime opportunity to socialize graduate students into data science work. Although space limitations preclude us from adumbrating curriculum specifics, we make the following modest recommendations. We suggest that programs use authentic public data sets, tackle actual public and private DS ethical dilemmas through case studies, test out conceptual frameworks such as Data Science for Social Good (DSSG) and data feminism, and undertake activities such as algorithmic audits. As part of this socialization, we recommend consistent, prolonged student exposure to practitioners and their real-world work, ideally through an experiential learning component integrated into the curriculum, as well as through research mentoring from DS faculty (especially early career faculty). Ultimately, a COEP-based strategy will enable the development of a truly human-centered data science that supports an ordinary macroethics leading to data flourishing.
CONCLUSION

Data science work is fraught with ethical choices—and challenges. But ethics has been relatively overlooked in the graduate DS curriculum. We advance an ordinary macroethical foundation that promotes what we call data flourishing. This foundation is best developed through a holistic, social, human-centered data science (HCDS)-rooted pedagogy that centers on developing communities of ethical practice (COEPs). We recommend embedding data flourishing in iField programs’ graduate data science curricula and by extension, throughout the data science ecology.

We trust that this paper suggests the rich potential of such a macroethics and redresses the shortcomings of other frameworks. Questions for future research nonetheless abound. First, how might our COEP model be translated into prosaic curriculum materials? What sorts of demos, case studies, readings, exercises, and assignments would prove most useful? Second, how might the proposed model be adapted to undergraduate and/or continuing education? Third, how might different national contexts impact the proposed model? Fourth, who is best equipped to teach data flourishing?

Data flourishing implies data humility. Whether human-centered or not, as Bica (2019) reminds us, data science provides no “silver bullet.”

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“Get Our Feet Wet and Hands Dirty”: Black Community-Based Librarianship and the Fight Against Information Poverty, 1940-1975

Poole, Alex H. | Drexel University, USA | ahp56@drexel.edu

ABSTRACT
Focusing on information services to marginalized urban communities in the United States between 1940 and 1975, this paper argues that African American librarians played foundational roles in early community-based librarianship (CBL) initiatives. In doing so, Black librarians skillfully and resourcefully fought information poverty, pushed for social and political equality, and promoted their communities’ well-being through proactive information provision. By fighting the systemic racism throttling inner-city Black communities, their labors constituted a seminal contribution to the post-World War II United States Freedom Struggle. Theirs was a specifically Black CBL. Underpinned by the theoretical work of Elfreda Chatman, this heretofore hidden history offers fruitful lessons for current library and information science practice. It therefore aligns with the annual meeting theme, “Translating Information Research into Practice, Policy, and Action,” particularly its emphasis on “creating effective models of information provision, creating empathetic information services” and on “understanding the power of information to develop human happiness, equality, and wellbeing.”

KEYWORDS
Diversity, equity, and inclusion (DEI); community-based librarianship; social justice; information poverty; information behavior

INTRODUCTION
Recent scholarly literature stresses the rich and diverse possibilities of community engagement work (Bishop et al., 2009; Connaway, 2013; Dali, 2022; Edwards et al., 2013; Kazmer, 2005; Kranich, 2005; Lenstra & D’Arpa, 2019; Loader, 2003; McCook, 2000a, 2000b; Mehra & Robinson, 2009; Mehra & Singh, 2016; Mehra & Srinivasan, 2007; Melaville et al., 2006; Pershing, 2023; Poole, 2021, 2022; Poole et al., 2022; R. Scott, 2011a, 2011b; Singh et al., 2022; Taylor, 1999; Williams & Durrance, 2017; Yoon & Copeland, 2020). Cultivating democratic citizenship by promoting inclusion, belonging, equality, equity, health, and social justice through civic involvement, community engagement work embraces collaborative, participatory activities, community relationship- and capacity-building, community empowerment, and reciprocal learning. It both respects and harmonizes with community values, its history, and the lived experience of its members. This scholarship points to a broader sensitizing concept (Blumer, 1954): what we call community-based librarianship (CBL).

Focusing on diverse, equitable, and empathetic information services to marginalized urban communities in the United States between 1940 and 1975, this paper argues that African American librarians played foundational roles in early CBL initiatives. In doing so, Black librarians skillfully, resourcefully, and tirelessly fought information poverty and promoted their communities’ well-being through proactive information provision. Encouraging community members to see quality, trusted information as a human right, these information professionals experimented with new activities and services and reconfigured familiar ones. Moreover, by fighting the systemic and institutional racism throttling inner-city African American communities, their labor constituted a vital contribution to the post-World War II United States Black Freedom Struggle. Theirs was a specifically Black CBL.

After first explaining our theoretical debts, namely to Elfreda Chatman, we diagram our methods. Then we explore the larger context of librarianship and race in the twentieth-century United States, highlighting the work of Black librarians in the face of both personal and professional racism. Next, we cover the imperative for new approaches to librarianship and new types of information provision that arose from post-1940 political, social, and cultural change. Two exemplary Black CBL initiatives are then broached: one concentrates on the Free Library of Philadelphia, and the other on the San Francisco Public Library. We conclude by discussing the practical and research implications and lessons learned from Black CBL.

INFORMATION POVERTY AND SMALL WORLDS
Information scientist Elfreda Chatman (1991) characterizes an impoverished information world as “one that has a limited range of new possibilities, and…other perceptions about reality are not adequate, trustworthy, and reliable.” Whether by dint of unwillingness or inability, information poor people perceive themselves as lacking access to potentially helpful information sources that address critical worries or concerns; therefore they elect not to seek it (Chatman, 1996).
Often socioeconomically marginalized, information poor people dwell in small worlds based on routine and predictable activities. A small world, Chatman (1999) clarifies, constitutes “a society in which mutual opinions and concerns are reflected by its members, a world in which language and customs bind its participants to a worldview” (p. 213). Supporting a small world, a worldview represents a collective awareness of or a common set of beliefs about social reality, namely what is important, relevant, or trustworthy (Chatman, 1999). Social norms, or collective, customary habits and behavioral codes that supply a sense of direction, normalcy, and order support a worldview (Chatman, 1999). By extension, a small world’s members see normative behavior as contextually appropriate (Chatman, 2000). As a normative construct, finally, information behavior denotes an approach to “everyday reality and its effect on actions to gain or avoid the possession of information” (Chatman, 2000, p. 14).

Chatman’s 1991 study illuminated the worldview of lower working class women of color. On the one hand, they accepted that problematic situations occurred frequently and without warning; on the other, they avoided long-term planning because it seemed to lead only to failure. Seeing themselves as invisible and effectively helpless outsiders, Chatman’s sample sought and used information solely to address immediate, localized, prosaic, practical, and concrete needs, concerns, or problems. These women leveraged information drawn from their personal experience or information conveyed by trusted others; this information’s believability and its alignment with what others saw as commonsensical reality determined its acceptability. Therefore, membership in a particular social group, Chatman (1996) insisted, paradoxically could exacerbate information poverty: one may experience an information need but decline to address it because of self-reliance or skepticism of outsiders. Admission of one’s need may be risky, potentially even dangerous, so information poor people embrace self-protective behaviors such as secrecy and deception to appear normal and to align themselves with locally sanctioned coping behaviors.

Chatman’s subsequent study of incarcerated women found them living a “life in the round” bolstered by a particular worldview featuring common codes and a common language. In this life, most things are both tacitly understood and publicly monitored. Life in the round “permits social meaning to happen,” as “news comes to a small stage” (Chatman, 1999, p. 212). Given their perceived impotence vis-à-vis the large world, these women’s often avoided information because it proved merely a source of stress. They will cross boundaries only if the information is critical and relevant, and their life in the round is no longer functioning (Chatman, 1999).

Chatman’s body of scholarship is especially well-suited to exploring community-based librarianship. As she (1999) explains, “In a community, one’s sense of self becomes clearer because others reflect the shared values of that world. Community in its most intrinsic sense is the most existential definition of who one is. Ultimately this means that the stuff of one’s world is made from such things as social heritage, language, and the myriad of social norms that govern collective behavior” (p. 211).

Numerous scholars offer thought-provoking critiques and extensions of Chatman’s research (e.g. Britz, 2004; Floegel & Costello, 2021; Franklin, 2020; Gibson & Cooke, 2023; Gibson & Martin, 2019; Gray, 2022; Haider & Bawden, 2007; Kitzie, 2021; Lievrouw & Farb, 2005; Marcella & Chowdhury, 2020; Mehra, 2021; Ndumu & Mabi, 2021; Roy & Shiroma, 2021; Yu, 2006; Yu et al., 2016). In this spirit, the work of Black community-based librarians suggests an opportunity to expand Chatman’s definition of information poverty to include not just exigent practical information, but also historical, heritage, cultural, and social information. African American librarians who fought information poverty both provided prosaic life information and encouraged Blacks to see themselves as empowered actors in history, in stories, and in current culture. What is more, these librarians’ story offers a novel opportunity to use Chatman’s work historically, further attesting to its broad utility (Poole, 2020).

Small world life as depicted by Chatman involved not only homes and workplaces, but also third places. According to Oldenburg (1999), third places are inclusive, local, and casual. Third places unite neighborhoods; provide assimilation spaces, sorting areas (bringing together people for first time who later create other forms of association), and staging areas during crises; serve as political and intellectual forums as well as entertainment venues; stimulate generational mixing; and encourage camaraderie, care, belonging, and welfare. Black community-based librarians took advantage of these spaces.

In light of the prevalence of information poverty in Northern urban communities between 1940 and 1975, Black librarians faced a formidable challenge. We focus on how they ameliorated information poverty in libraries, homes, and community spaces.

**METHODS**

According to information scientist Boyd Rayward (1985), “Historical study consists in the discerning of patterns, the imposition of plausible order, the recognition of coherence existing in the superficial chaos of events, circumstances, developments, ideas, and the personal and institutional interactions that create or surround a particular situation” (p. 121). A qualitative method because of its immanently interpretative nature, historical study reconstructs the past to understand events, situations, processes, behaviors, and practices, and to plan for the future; it therefore plays a key...
role in theory development and practice improvement (Pickard, 2013; Rayward, 2004). A lack of history, by contrast, leads to an attenuated sense of identity (Buckland & Hahn, 1998).

Historical study involves six iterative stages (Pickard, 2013). First, we identified a fruitful topic. In doing so, we considered chronological and geographical limits as well as availability of primary and secondary sources. We asked questions such as where, when, who, how, and why. Second, we unearthed a broad range of primary and secondary sources. Third, we collected and interrogated our sources, posing questions such as: Is the source authentic? What is its provenance? Who created it? Was the creator trustworthy and knowledgeable? What did source mean at the time it was created? Fourth, our analysis was iterative. We sought not only to think critically in terms of themes and relationships, but also to be reflexive concerning our own beliefs and values. Fifth, we interpreted our analysis, seeking to develop “empathy with the context” (Pickard, 2013, p. 174). Finally, we wrote up our findings and sought to convey transparency and to establish trustworthiness.

THE UNITED STATES SOCIAL AND POLITICAL CONTEXT

As historian Manning Marable (2006) explains, the Freedom Struggle focused on two often overlapping, seldom mutually exclusive ideals. First, liberal integrationist African Americans sought equality, which entailed “the achievement of full civil and democratic rights under the existing U.S. state and the abolition of all structural barriers based on racial designation” (p. 213). Second was the Black nationalist tradition, which centered on self-determination. Given the United States’s effective denial of citizenship to African Americans, self-determination represented Blacks’ “inalienable right to determine their own future” irrespective of their chosen political institutions (Marable, 2006, p. 214). These two ideals played out in community-based librarianship between 1940 and 1975; Black librarians borrowed from both traditions and the former’s beliefs, values, and information behavior reflected this dual commitment. In fact, these ideals helped them make war on American apartheid, represent and uplift their fellow Black Americans, and implement new models of community-based librarianship in urban neighborhoods.

American apartheid
Sociologists Douglas Massey and Nancy Denton (1994) characterize the early 1940s coalescence of northern urban ghettos as “American apartheid.” The two Great Migrations of African Americans from the south (encompassing 6.5 million souls) beginning in the mid-1910s exacerbated existing northern housing shortages. Federal and local government policies and agencies abetted residential, vocational, and educational racial discrimination, notably in the Federal Housing Act of 1934 and in the practice of redlining more broadly. Residential segregation via restrictive covenants remained until 1948’s Shelley v. Kraemer; two more decades passed before passage of the Fair Housing Act, which in any event lacked enforcement mechanisms. Burgeoning urban populations led to further ghettoization after the Second World War; nearly two-thirds (64%) of the U.S. population lived in cities by 1950. With postwar suburbanization, urban renewal, and white flight, Black urban communities found themselves in a state of unprecedented racialized spatial isolation (Lipsitz, 2011; Massey & Denton, 1994). Thus starved of resources, these communities constituted small worlds in which information poverty and socioeconomic poverty brutally reinforced one another. Exacerbating matters still further, de facto segregation remained rampant even after Brown v. Board of Education (1954), the Civil Rights Act of 1964, and the Voting Rights Act of 1965. A child of the segregated South and later Director of the Phillis Wheatley Community Library in Rochester, New York, James Wright (1972) agonized, “We moved one after the other to many large urban areas in hope of finding a better life. We only met with despair and broken promises from a ‘liberal White’ in the North” (p. 221).

American apartheid marred libraries as well. Most Blacks migrated from locales-cum-small worlds that barred them from libraries or at best provided separate and profoundly unequal services. African Americans also suffered from grossly inadequate and inequitable southern public education (Anderson, 1989). But effectively integrated public library service remained rare in northern cities due to redlining and government machinations; hence many branches served nearly all-Black populations (Wiegand, 2015). Moreover, as a consequence of white flight, the loss of manufacturing jobs, and the decimation of the urban tax base, federal funding proved indispensable to inner-city libraries. In fact, the most vital CBL achievements drew upon monies disbursed during Lyndon Johnson’s administration through the Library Services and Construction Act (LSCA) (1964), which augmented the Library Services Act of 1956, the Economic Opportunity Act (EOA) (1964), and the Higher Education Act of 1965. Building on Franklin D. Roosevelt’s Four Freedoms, Johnson posited a fifth: “freedom from ignorance.” Yet that funding remained subject to the political climate, and once reaction hit the United States in the 1970s (e.g. Kruse & Zelizer, 2019; Patterson, 2005), Black librarians were hard-pressed to continue their CBL work, however diligently they tried.

The Black professional middle class and uplift
Black librarians who pioneered CBL in the cities contributed not only to the profession, but also to the long Freedom Struggle in the 20th century (Hall, 2005; Hine, 2003; Tuck, 2011). Highly educated professionals, they
generally came from families and by extension, from small worlds that embraced classic bourgeois values as normative and that invested deeply in books and libraries as essential vehicles for education and social mobility. “Books and libraries have always been a part of my life,” Vivian Hewitt (1970) remembered. “As a child, my parents read aloud to us at bedtime. When they couldn’t, the older children did. When the older kids went to the public library, which was in walking distance from our house, the younger ones always tagged along. I had a library card as soon as I could write my name” (p. 254). Spencer Shaw (1970) related the seminal influence of his local branch librarian, who ensured a welcoming environment and whose efforts complemented those of Shaw’s family members, who often gave books as presents for special occasions.

Community-based librarians such as Hewitt and Shaw committed to normative behavior centering on uplift. According to historian Kevin Gaines, uplift “represented the struggle for a positive black identity in a deeply racist society, turning the pejorative designation of race into a source of dignity and self-affirmation through an ideology of class differentiation, self-help, and interdependence” (p. 3). At once representing and uplifting the race constituted a formidable “double burden” (Holt, 2011, p. 241). This two-front fight for racial advancement and uplift surfaced social responsibility and community development and leadership (Gatewood, 2000; S. J. Shaw, 2010; Summers, 2004). Due to their political disfranchisement, Black middle class women in particular owned a lengthy history of community uplift work (Gilkes, 1980; Higginbotham, 1993; Lerner, 1979; A. F. Scott, 1990). The National Association of Colored Women (NACW) (established in 1896) epitomized this pledge with their slogan “lifting as we climb.”

This community-centered worldview animated the information behavior of Black community-based librarians whether men or women. In this spirit, St. John’s University’s Mohammed Aman (1972) wondered, “Have we mobilized and deployed our resources in a delivery pattern that is meaningful to our black clients? Are we helping to provide the necessary commitments and leadership to the black community?” (p. 155). Wendell Wray, the first African American man to graduate from the University of Pittsburgh’s School of Library and Information Science, insisted (1977), “the best talent there is must rally to serve the race” (p. 77). Medgar Evers College’s Robert Ford, Jr. (1972) urged Black librarians to embrace social responsibility through community engagement and uplift. “We must be sincerely concerned about the quality of life in the ghetto and the quality of the institutions that serve it,” he maintained. “For better or worse, these are our people and our posterity” (p. 253).

RACE AND LIBRARIANSHIP IN THE UNITED STATES

Librarianship historically either offered separate but unequal or peremptorily refused service to African Americans, concomitantly marginalizing Black librarians (Cresswell, 1996; Du Mont, 1986; Fultz, 2006; Hanbury, 2019; Jackson et al., 2012; Josey, 1994; Josey & Shockley, 1977; Knott, 2016; Knowlton, 2018; Mehra & Gray, 2020; Ndumu & Chancellor, 2021; Poole, 2018; Tucker, 1998; Wiegand & Wiegand, 2018).

As part of normative racial representation and uplift, Black librarians broke new ground professionally, countered stereotypes, and inspired Black and white users alike. Born in 1920, Vivian Hewitt was a trailblazing Black librarian. When she matriculated at the University of Pittsburgh during World War II, she was the only Black person in the library school and one of four Blacks on the entire campus. “I was really trained to be a part of the community,” she (2003) later noted. After completing her MLS in 1944, Hewitt secured a full-time appointment at Wylie Avenue Branch Library as a Junior Assistant and Special Worker with Young Adults—the first African American to be so appointed. “I was to be the Jackie Robinson of the library profession in the city!” she (1972) quipped (p. 258).

The Wiley branch catered to a predominantly African American community of 60,000 people struggling with information poverty and eager for information services. This small world featured the city’s heaviest concentration of social welfare and recreation agencies, ranging from settlement houses to YMCAs to Boys’ Clubs. The branch was as much a social services agency as a library, and staff members such as Hewitt immersed themselves, serving on all types of community committees in the neighborhood. “Count me among the original, aware, ‘I care,’ inner-city librarians!” she (1970) wrote (p. 262).

As a Black librarian, Hewitt felt keenly the pressure of representing the race both professionally and personally. “24 hours a day, I was expected to represent the Library,” she (1970) noted. Indeed, a fundamental part of Hewitt’s CBL work involved self-presentation. She was “‘showcased’ to the hilt—mixed groups, young people and women’s clubs, men’s organizations, health agencies, you name it” (p. 261). Expected to disprove racist stereotypes about Blacks, Hewitt sought to be “the absolute quintessence of the Model Librarian” (p. 261). But such demands paid off; a justifiably proud Hewitt (2003) concluded, “I paved the way for acceptance of others.”

Other librarians felt similar normative pressure as they worked with members of information poor small worlds. Born in 1911 and the first African American Coordinator of Children’s Services at the New York Public Library, Augusta Baker (1970) reflected, “We children’s librarians worked hard to bring children and books together. We
told stories, read aloud, showed fine art, gave concerts. We were dedicated to the cultural growth of our children” (p. 119). For example, since children’s books usually depicted African Americans as “shiftless, happy, grinning, dialect-speaking menials,” Baker established the James Weldon Johnson Memorial Collection of books to ensure awareness of Black heritage and to correct racist distortions of the historical and cultural record (p. 118). “The black child needs the image of a black librarian—and white children need this image also,” she elaborated. “It hasn’t been too long since a class of junior high school white children in New York City thought that ‘all Negroes are drunks’” (p. 123). Embracing the cultural and pleasurable as well as the practical, Baker’s labors epitomized a broad notion of fighting information poverty.

Like other Black community-based librarians, Baker left a substantial legacy (c.f. Baker, 1991). She described her storytelling efforts as “nurturing the spirit-self” and “enriching and deepening a child’s feelings” (Baker & Greene, 1987, p. xii). “I ride the subways and strange young people speak to me, identify themselves as ‘story hour’ children, and then talk eagerly about the influence of the Library on their lives;” she (1970) marveled (p. 120).

Similar to Hewitt and Baker, Spencer Shaw, born in 1916, shattered racial barriers. Appointed the first Black librarian to work at the Hartford, Connecticut, Public Library in 1941, Shaw (1970) wrote sanguinely to library director Truman Temple, “the library can do much in fostering intelligent racial attitudes among the different groups that go to make up the ‘melting pot’ of America” (p. 152). But Shaw’s faith in the American creed was sorely tested. Inducted stateside into a segregated World War II army, he (1970) recalled feeling that he was “reliving the battle of the North and the South.” “On interstate travel,” he explained, “curtains were pulled in dining cars between my table and the rest of the train if I cared to eat. In Georgia, while my fellow white officers lounged in a beautiful Club, their Negro counterparts were restricted to a converted barracks building which we labeled ‘Uncle Tom’s Cabin’” (p. 156). Shaw was even referred to his base’s chaplain after he “questioned too much the inequalities between our stated democratic principles and the practices evident within the military and outside in civilian life” (p. 156).

Even as they rallied up “firsts,” these Black librarians continued to face professional (e.g., hiring and promotion) and personal (e.g., housing) as well as social and political discrimination. The first minority services coordinator for Los Angeles County Public Library, Binnie Tate (1970) felt isolated when attending school and working in New York. “It became terribly frustrating being ‘The One’—the one black student in the class, the one black employee at a library branch, or the one black included in white social affairs” (p. 126). It was small wonder that she wrote, “There will never really be a free library as long as many who work there are not themselves truly free” (p. 129). Nevertheless, Tate and her fellow African American librarians persisted in grappling with information poverty.

The special roles and responsibilities of Black librarians

A shortage of African American librarians helped account for Black communities’ non-use of libraries (Welbourne, Jr., 1970). Director of the Benton Harbor, Michigan, Public Library, Thomas Alford (1972) insisted that Black librarians related to other African Americans far better than did white librarians. In Black neighborhoods, white librarians often failed to tailor their information services to crucial community needs; this high handedness exacerbated existing community suspicions. Like Welbourne, Alford foresaw increased library use should more African American librarians work in Black neighborhoods and accommodate these small worlds’ information behaviors.

Black librarians had special capabilities for working with urban small worlds. Tate (1970) ascribed this to lived experience and Alford (1972) thought Black librarians generally more familiar with “meeting life’s basic needs and dealing with the hard facts of poverty and destitution” (p. 239). This lived experience enhanced their ability not only to serve as curators of Black history and heritage, but also to develop nontraditional library services and otherwise make the library a key presence in community life (Aman, 1972). A veteran like Shaw of the segregated World War II U.S. army, founder of the Black Caucus of the American Library Association (BCALA), and a seasoned civil rights activist (Abdullahi, 1992; Poole, 2023), E.J. Josey (1972) argued, “Black librarians are inextricably tied to the problems that affect the larger black community. They have suffered the same hurts, humiliations, discrimination in employment opportunity, lack of promotion on the job, denial of decent housing, and the whole panorama of what it means to be black in a racist society” (p. 5). Community empathy was therefore their stock in trade.

Binnie Tate joined the Los Angeles Public Library (LAPL) staff in 1966 as a children’s service specialist on a federally funded project. After the Watts uprising in 1965, she (1970) found, “White and black communities were trying to find ways to deal with the crisis in our city, which was of course only a reflection of the broader crisis in the nation” (p. 128). Notably, Tate discerned and encouraged her community’s voracious thirst for self-knowledge; this she addressed with Black films, filmstrips, and art programs. Reflecting on her community kinship, Tate concluded, “some of us have made a specific contributions as black librarians” (p. 128). True to their roots, Black librarians, she believed, had a key opportunity—and responsibility—to develop profession-wide social consciousness, i.e. a new form of normative behavior.
THE NEED FOR NEW MODELS OF LIBRARIANSHIP

Although some librarians pushed for outreach to the so-called disadvantaged in the late 19th century and scattered efforts followed thereafter, the post 1940 period represented a new phase (Colson, 1975; Weibel, 1983). The United States’ national social, cultural, and political context demanded a new approach both dynamic and aggressive (Josey, 1966). James Wright (1972) decried rampant “information deprivation” (p. 224) and Ella Yates (1972), incensed at the denial of rights and opportunities to African Americans even after the seismic legislation of the 1960s, insisted that information was linked directly to survival.

Black librarians faced a Sisyphean task in working with urban small worlds and seeking to change community members’ norms concerning institutional mistrust. Reasons for library non-use included “functional or actual illiteracy, distance of residence from existing library outlets, lack of awareness of the library’s location and of the relevance of its materials and services, and low motivations or possible antagonism to the library as a public institution” (National Book Committee, 1967, p. 7). Welbourne (1972a) characterized the library as yet another urban institution “whose purpose and rationale is both meaningless and unknown” (p. 50). In a similarly bleak key, Tate (1970) stated, “Too often, libraries are still ‘castles of knowledge’ protected by a moat of unconcern for the immediate community” (p. 124). Aman (1972), too, skewered the profession’s normative behavior, which offered the Black community “insufficient and inadequate library service; attitudinal barriers which have hampered deliverance of services; and failure to incorporate sufficient numbers of minority groups within the profession” (p. 152). Aman alleged that urban libraries—in parallel with other local institutions—ignored community needs. He found most egregious a general failure to engage people of color in planning or decision-making, thus depriving them of joint ownership. Staring down these challenges, African American librarians readied themselves to work with novel types of information behavior through CBL.

In jettisoning traditional ways and adopting a novel conception of normative behavior, Black CBL involved a push/pull dialectic. Black librarians pushed their services out to the community even as they pulled community members into library buildings and third places as well. Innovative services concentrated on community needs, jettisoning the longstanding metric of circulation statistics (Owens, 1987). Black CBL work therefore augured an important professional shift from materials-centric to user-centric, a shift with longstanding repercussions for the profession. Such work was people- and media- as well as book-centered (Yates, 1972). Adopting this perspective, Wendell Wray (1977) hailed the new community-centered roles of “librarian-politician, librarian-social worker, librarian-educator, librarian-civic leader, and librarian-communicator” (p. 76). These “informational Pied Pipers” represented a shift from passive to active, from the building to the street (p. 84). Wray recommended that librarians cultivate skills in how to conduct forums, clinics, and workshops, hold readings, concerts, lectures, and film festivals, and design exhibits. Such activities would likely attract non-users and ideally, stimulate them to explore other library resources and services. New information behaviors also involved more assiduous service to institutions such as prisons, hospitals, reform schools, and homes for the elderly or handicapped. At the same time, Wray stressed community members’ need for survival information to address information poverty, for example that centering on drugs, abortion, employment, and housing.

Welbourne directed the pathbreaking Urban Information Specialist Program (UISP) at the University of Maryland’s School of Library and Information Services (SLIS) (1970-1); he also worked as SLIS’s first full-time recruiter of students of color. By the 1960s, he (1972b) contended, urban American communities had arrived at a crisis point, struggling to weather systemic daily oppression. “Information is a tool for power and control,” Welbourne explained. “People are kept powerless by what they do not know; they are kept powerless by not having time to fashion alternatives to repressive action” (p. 100). Commissioner of New York City’s Community Development Agency Major Owens (1970) agreed. He believed that timely factual knowledge constituted “weapons in the community arsenal” (p. 1703). To this end, Welbourne (1972a) characterized libraries as a prime testbed for Black community information services.

Following Welbourne and Owens, E.J. Josey (1970b) demanded Black librarians tackle intellectual and social challenges and accommodate nontraditional information behavior. Doing so required taking the library quite literally to the people. Such a “library without walls” Robert Ford (1972) equated to a “university of the streets” (p. 251). This outreach needed to be denuded of any traditionally normative missionary attitude, he insisted; instead it should elevate mutual learning. Thomas Alford (1972) expanded on Ford’s stance: “It is perhaps most important that the public library extend itself beyond its clean, beautifully appointed glass and brick buildings, out into the dirty, littered, ragged, physically and culturally hungry areas of the community. We must get our feet wet and our hands dirty through involvement with the many problems facing the urban poor” (p. 239).

Coordinator of the New Jersey State Library’s Office of Library Service to the Disadvantaged Doreitha Madden also advised librarians to follow the people. Librarians, she enthused (1972), “have taken the library to the people—in community centers, on the streets, in the home, in nursing homes, in prisons—and many are excited by the results” (p. 229). Eleanor F. Brown (1971) encouraged librarians further “to walk [community members’] streets, to make
door-to-door contacts, to attend their meetings, to visit their favorite haunts, to place deposits of books wherever they congregate, to take library materials to them by every conceivable type of mobile equipment” (p. 516).

A pioneer in outreach to the blind, disabled, shut-ins, and underrepresented populations, Ella Gaines Yates, too, advocated immersion. “The only way the librarian can thoroughly understand the workings of a group, its objectives, its needs, and how the library can play a viable role, is to get appointed to offices, committees, and particularly planning committees,” she (1972) maintained (p. 245). In like mind, the Free Library of Philadelphia (FLP)’s John Axam (1970), serving on ALA’s Coordinating Committee on Library Service to the Disadvantaged, urged librarians to engage community information loci—third places in their small worlds—such as barber shops, beauty parlors, laundromats, bars, and churches. In such innovative ways was information poverty fought.

Black community-based librarians turned away from mainstream professional librarianship’s invertebrate focus on the middle-class. Most important, they sought to promote community library services as profoundly useful in ameliorating information poverty. Madden (1972) commented poignantly, “Some librarians learned and responded to the fact that a child can not be interested in a Caldecott Award book if he is hungry—and they fed him” (p. 229). Yates (1972) noticed an increased demand for novel library services; she urged librarians to provide practical information on nutrition, health, and shelter. Accommodating community preferences, Black librarians should cater to users who saw information as “an economic asset, a means of saving money, getting a better job with more pay, and achieving a better standard of living” (Brown, 1971, p. 515).

Not only taking the library to the community but enlisting community residents in the endeavor was a fundamental aim of African American CBL proponents. The National Book Committee (1967) and Brown (1971) advocated training local community members to work in their own neighborhoods and encouraged librarians to enlist community leaders as liaisons. Explicitly foregrounding self-determination, Mohammed Aman (1972) insisted that training local community members to work in their own neighborhoods and encouraged librarians to enlist community leaders as liaisons. Explicitly foregrounding self-determination, Mohammed Aman (1972) insisted that

COLLABORATION WITH OTHER COMMUNITY INSTITUTIONS AND AGENCIES

Another facet of Black community-based librarianship that broke with traditional professional normative behavior was collaboration with other small world community institutions. Despite overlapping responsibilities, rarely did public or private agencies see the library as a potential partner; historically, scant communication, cooperation, and coordination had prevailed (Brown, 1971; National Book Committee, 1967). Black librarians such as Spencer Shaw, Milton Byam, Hardy Franklin, and John Axam sought to change this as they ameliorated information poverty. Their CBL work took place both within and without library buildings; they embraced third places in stirring community

Spencer Shaw (1970) exulted in newfound opportunities “to experiment with innovative approaches in service...as librarians became more socially responsive to ever-expanding publics from different ethnic and economic backgrounds” (pp. 164–165). Shaw’s work in 1940s Hartford, Connecticut, included not only story hours and book talks, but visits to and engagement with a broad swath of local institutions—schools, community centers, and religious institutions. Shaw also explored diverse new venues and drew in new audiences. He held summer story hours in city parks, lectured at local colleges, offered in-service courses for teachers, and penned book reviews for the Hartford Courant.

After joining the Brooklyn Public Library (BPL) in 1948, Shaw further extended his community-based work. He made daily elementary and junior high school visits as well as some high school visits, including to public, private, and parochial schools and yeshivas. Shaw used branch libraries for class visits and story hours; he also held summer story hours in local parks and stationed a Library-on-Wheels at nearby housing projects. Shaw gave talks to members of parent-teacher associations, to senior citizens groups, and to civic and social groups. He dived into media beyond books, too, namely recordings and radio. In the latter case, he spoke on behalf of the National Association for the Advancement of Colored People (NAACP), Negro History Week, the local Council of Churches, and various public service programs. Shaw found CBL’s payoff immense. “I had touching moments with the handicapped, disturbed or delinquent children I met in special schools, institutions or hospitals,” he (1970) recalled. “One could not remain insensitive to the true worth of library service” (pp. 160–161).

A BPL stalwart like Shaw, Milton Byam (1970) also flourished as a result of a literary upbringing. “I feel as if I were intended to be a librarian from the beginning,” he wrote, recalling a childhood of “unappeased hunger for books” (p. 50). Intellectual curiosity aside, Byam attributed his commitment to community-based librarianship to his World War II service in the segregated U.S. Army. This experience, he noted, “tore me away from notions of scientific perfectibility to concern for people...How could I design airplanes while blacks lived in the abject poverty of the Louisiana swamplands?” (p. 50). Byam determined to embark upon a career helping people.
Stationed at Bedford Youth Library in 1949, Byam ignited the branch’s community commitments. “With enthusiasm, we went to work with the youngsters, permitting them to rehearse a play in the library auditorium, teaching them to use a printing press, and even giving a dance and show at the Carlton Avenue ‘Y,’” he (1970) wrote (p. 55). Users warmed especially to the branch’s jazz and popular record collection; they also found the library a repository of useful occupational and career information. Building on this work, a year later Byam joined Brooklyn’s bustling New Utrecht Branch, a storefront that served a diverse local population. Byam plunged once more into community work. Although he started book discussion groups, perhaps more important were his efforts outside the library, which included local high school talks and Community Council meetings. Like Shaw, Byam ascribed great rewards to his CBL work. “Groups thought of the library first in planning programs and meetings,” he (1970) remembered. “Stores gave regular discounts to all library staff members. I and my staff were invited to speak at all types of community gatherings from Chambers of Commerce and P.T.A.’s to housewives’ discussion groups” (p. 59).

Still another CBL mainstay, Hardy Franklin served as a U.S. Army librarian in Okinawa between 1953 and 1955 before beginning work at BPL in 1961 as Community Coordinator. He soon became “a designated ‘missionary’ for the system” and consequently “‘Mr. BPL’ to hundreds of children, young adults, and adults” (Smith, 1965, p. 225). Not merely a field agent, Franklin attended local organizations’ meetings and spoke with “dozens of parent-teacher groups, church organizations, political clubs, and block improvement associations”; he also served as an officer or board member for many of them (Smith, 1965, pp. 225–226). Franklin’s success spurred BPL to appoint three more Community Coordinators. “Freed from desk schedules,” these coordinators “work[ed] actively with the various government financed projects, such as those for youth, adult basic education, manpower training, and programs of aid for dependent children” (Smith, 1965, p. 226). Such coordinators took on numerous roles: “neighbor, counselor, social worker, and teacher as well as librarian” (Black, 1970, p. 44). Once more, CBL reckoned with small world information poverty, seeking to provide communities with pleasurable as well as practical information. Such work’s payoff was substantial, even if partnerships remained difficult to cultivate, much less to sustain.

**EXEMPLARY BLACK CBL INITIATIVES**

Programs at the Free Library of Philadelphia and the San Francisco Public Library represented watershed CBL initiatives that hinted at the ability of Black librarians to fight information poverty and to change normative behaviors that militated against library use. These African American librarians followed the people, they broadened the scope of traditional library services, they promoted varied media, they collaborated with other community social agencies, and they earned community buy-in and joint ownership.

A first example of model CBL took place at FLP. In 1964, John Axam acceded to the Head of the Free Library of Philadelphia’s Stations Department, which constituted “a library without walls” (Milner, 1976, p. 14). The Stations Department deposited books and offered programs to hospitals, recreation centers, housing projects, private homes, prisons, shut-ins, and community centers; it also operated three bookmobiles.

In the late 1960s, Axam’s FLP followed other Philadelphia agencies and tackled social problems (Axam, 1987). Through initiatives such as the Reader Development Program (RDP) (1967-1969), the library’s approach evolved from a focus on service to the middle-class to a more inclusive one. Key to this was facilitating basic adult education, especially that of “functionally illiterate” Philadelphians. RDP staff visited local social agencies not only to promote RDP services and gather information on each agency’s needs, but also to encourage agencies’ staff members to review and provide input and feedback on RDP’s demonstration materials.

One new Stations Department initiative, the Home Collections project, germinated in a conversation between a community health worker and a librarian (Axam, 1987). Six neighborhood mothers thereafter administered small paperback collections out of their homes. A block party kickoff event included a modern dance group, a dance band, and community member-prepared cake and punch. Stations Department personnel subsequently made consultation visits and changed out books.

Axam also led the establishment of two Teen Centers. The Wilson Park Teen Center boasted both recreational and educational activities. Notably, the center employed local teens. St. Andrews Teen Drop-In Center also brought in “eager and very conscientious teenage volunteers [who] were trained to charge out, check in, and otherwise oversee the collection” (Axam, 1987, p. 138). The Center featured a paperback book rack to draw teen interest and offered classes in babysitting, sewing, arts and crafts, cooking, and even folk singing.

In a final BL initiative, FLP adapted a familiar institution to community circumstances. When a parent requested a bookmobile, which was not logistically feasible, the Stations Department instead stocked a station wagon. It circulated weekly during the summer of 1968, carrying between 150 and 200 books for children and teenagers as well as books requested by their parents. Staff displayed books on a table provided by the neighborhood mothers and on the vehicle’s tailgate. Mothers also hosted story hours in their living rooms. In the summer of 1969, the program expanded to include living room film showings as well as story hours. Complementing this work, a Summer Bookmobile Program ported local cultural institutions’ exhibits and displays into communities.
A second exemplary CBL initiative was San Francisco Public Library’s Fillmore Street Reference Project, which came to life in the summer of 1968 under the inspiration of Black librarian Olive Wong. Rejecting librarianship's normative focus on information confined to library buildings, the project sought to hook community members on information relevant the rhythms of their small worlds. Wong pitched “a rather remarkable idea: to circulate books without a card, and to work out of an official city car on a litter-cluttered corner in the heart of the ghetto. We would simply ask people if there were any book or information we could get for them and come back the next day with the desired material” (Bennette, 1969, p. 872).

Choosing staff well-suited for community work was essential. Notably, not one of the staff was a professionally trained librarian. Instead, they were “selected primarily for ability to relate; to talk to people, to listen to and accept without judgment the mores, rhythm, and cultural assumptions of the street population” (Bennette, 1969, p. 875). To stir interest, project staff organized Black history discussion groups for local youths at a branch library. They also attended meetings of the Youth for Service, Young Men for Action, Economic Opportunity Center, Human Rights Commission, and Western Addition Youth to obtain buy-in.

Three afternoons a week, the car visited one of three designated street corners, displayed a box of diverse books, and let community members’ curiosity percolate. “We are structuring ourselves to be included and not injected into the mainstream of the community,” Bennette (1969) maintained (p. 875). Alas, both programs proved short-lived.

**PAYOFFS AND COSTS**

Black community-based librarianship yielded extraordinary rewards—but also incurred substantial costs. Reflecting on his longstanding Freedom Struggle advocacy, Josey (1970) wrote, “I became a better librarian…by being part and parcel of the swiftly moving social currents that were going on around me in the community”; this gave him “a more informed, disciplined and stringent understanding of what libraries could do for people” (p. 323). At Savannah State University, Josey strongly supported local sit-ins in 1960, serving as faculty advisor to the students involved and working closely with the Savannah branch of the National Association for the Advancement of Colored People (NAACP). As an extension of this work, Josey stumped successfully for desegregation of the Savannah Public Library Board and was one of the first two African American members of that body (1962) (Josey, 1970a). Unlike Josey, Vivian Hewitt had to tamp down her community-based activism for fear of some white library administrators’ disapproval. “When I participated in a number of restaurant sit-ins, I kept this fact concealed from the library lest my activities ‘reflect’ on it,” she (1970) recalled (p. 261). Even so, she characterized her Wylie Branch years as “inspiring, educational, and exhausting” (p. 261).

Like Josey and Hewitt, other Black CBL pioneers appreciated their small world CBL work, though they also stressed its costs. Baker (1970) reflected, “My community work was often exhausting but it was so very rewarding” (p. 119). Highlighting the “almost unquenchable thirst for knowledge of self among Afro-Americans and other minorities,” Tate (1970) wrote, “I shall always be thankful, in spite of the many frustrations, for the opportunity to contribute” (p. 128). Ford (1972) found CBL “a complex and emotionally-draining experience” but maintained that the “rewards in terms of personal satisfaction are immense and well worth waiting for” (p. 252). Yates (1972) expressed a still more ambivalent view, calling her CBL efforts “highly demanding, exhausting, and often very frustrating” (p. 245).

Some Black librarians faced obstacles to their CBL work. Yates (1972) pointed to a troubling gap between rhetoric and action in addressing marginalized communities’ information needs, a point reprinted by Tate (1972). Despite their professed commitment, senior administrators rarely participated in this work. Yates (1972) feared this stigmatization, for it discouraged “many young, dynamic, inventive [B]lack librarians” from community engagement, especially given low salaries and chances for professional advancement (p. 244). Exacerbating matters, CBL demanded time-consuming and laborious immersion to understand communities’ often nontraditional information behavior.

Despite his CBL achievements, Milton Byam also encountered obstacles. In 1955, he was transferred to Williamsburg, Brooklyn. Urban renewal had demolished most houses and buildings near the library and had uprooted the community. Those who remained included Blacks, Hasidic Jews, Lithuanians, Poles, Latvians, Finns, and Italians. The experience seemed an ideal laboratory to test community-based librarianship, but Byam met frustration. He (1970) remembered, “The chief problem was that it was not ever a community but a conglomerate of communities, and one had to run all over the map to service it” (p. 61).

Another example of CBL failure cropped up in LIS education. Responding to LIS programs’ apparent indifference toward and irrelevance to real world problems and to non-white and non-middle class constituents, in the fall of 1970 the University of Maryland launched an Urban Information Specialist Program (UISP), with Welbourne, Jr., as its director (Bundy, 1987). Animated by Blacks’ battle for social justice and avowedly anti-racist, UISP supported Blacks’ securing of self-determination, including separatism (Bundy, 1971).

The program pivoted around “service to the people” broadly construed (Welbourne, Jr., 1972b, p. 100). It focused on the ecumenical use of information resources, including multimedia, in urban communities, not just on libraries
and books. UISP also foregrounded field experiences and evolving information needs in light of technological change (Bundy, 1971).

Recruited students were “people who had never been to college before, people who had only lived in the ghetto and waited for the chance for some institution to open up and say, ‘You can use your mind to think and solve problems; the sky is the limit’” (Welbourne, Jr., 1972b, p. 104). UISP thus inaugurated a new work role: an information interpreter and advocate who liaised between community members, social agencies including libraries, and needed information resources (Bundy, 1971).

But the program lasted only a year, proving unable to secure further funding from federal agencies or the university. Racism seemed “an active, vital and institutionalized social force” in the program’s truncation; Bundy and Welbourne (1974) castigated the university’s “unsympathetic and hostile control groups” (pp. 1, 2). Suffice it to say that the gains of Black CBL remained fragile indeed.

**CONCLUSION**

As part of a massive conservative political, social, and cultural counterrevolution, Presidents Richard Nixon and Gerald Ford hollowed out federal funding to libraries in the mid-1970s (Carter, 1996; Holley & Schremser, 1983). This ebbing of funds, unstable and short-term as they already were, had a pernicious effect on many CBL programs. Urban libraries were often unable to save these programs without federal support, and traditional reliance upon circulation statistics as justification for funding reemerged (Weibel, 1983; Wiegand, 2015). Meanwhile, many pathbreaking Black librarians moved away from community work into administration or moved to different institutions altogether, also hindering CBL’s staying power. Finally, novel library and information science education initiatives that prepared students of color for the profession or that trained students to do community-based work faltered (Bundy, 1987). Information poverty as lived in small worlds was profoundly difficult to vanquish. As hard as they worked, Black librarians committed to CBL encountered mixed success in doing so.

This previously untold history makes six scholarly contributions. First, it highlights the African American middle class’s often overlooked and even slighted role in the Freedom Struggle. African American librarians served as often hidden but nonetheless effective civil rights avatars. Second, although scholars emphasize the vital role of Black women’s inveterate community engagement and uplift, this paper shows that African American men, too, made crucial contributions. Third, our work narrates Black librarians’ efforts to combat information poverty through a specifically Black community-based librarianship. In doing so, this research illuminates the roots of 21st century community-based librarianship and elevates Black librarians to pride of place in the CBL discourse. Fourth, the history of Black CBL reminds us that access to quality, trusted information is a human right. Fifth, this paper suggests the benefits of expanding Chatman’s notion of information poverty to include not only the informative, but also the ludic and edifying aspects of information, including storytelling, heritage, and history. We suggest that an expanded, more holistic conception of information poverty permits an even more fruitful exploration of information behavior, small worlds, and normative behavior. Sixth and finally, our work underlines the relevance of Chatman’s scholarship for historical research.

Not only does historical Black CBL work contribute to the scholarly literature, but it has numerous implications for current practice, since information poverty remains very much with us. We recommend that information professionals immerse themselves in their local communities; reappreciate and attend to the importance of place, including third places whether physical or virtual; ally with and participate as members in other social agencies; embrace new technology and new multimedia; and recruit and retain more librarians who live in the communities in which they work and who have similar lived experience to those they serve. Further, as information scientists Bharat Mehra and Ramesh Srinivasan (2007) assert, we must avoid perpetuating historical patterns in which we slight or ignore our local community partners, whether urban or rural, thereby not only forestalling salutary learning and cultural exchange, but undercutting our own relevance.

We propose three questions for future research. First, how did international CBL efforts resemble or differ from those in the United States? In western Europe in the 1960s and 1970s, for instance, Martin (1975) saw librarianship assuming an augmented social role, taking up arms against poverty and inequity in league with other social institutions. How common were such initiatives and what were their outcomes? Second, although we focus here on Black librarians in the United States, how did librarians of other races, ethnicities, and socioeconomic classes engage their communities? Third, given the paucity of meaningful data offered by circulation statistics, as these pioneers contended, how might we most effectively advocate for resources to support current CBL activities and initiatives?

Chatman (1996) insists that information professionals bear “an obligation to continue to work to identify issues that examine the information needs of...populations that have traditionally been overlooked by our research efforts, professional practice, and the published literature” (p. 205). We hope this paper encourages current information professionals to take a step in this direction; as historian Carl Becker (1932) contends, “The history that lies inert in
unread books does no work in the world” (p. 234). Research, that is, must be translated into practice. Black community-based librarians constructed a roadmap for doing so.

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Study on the Characteristics of Cross-Domain Knowledge Diffusion from Science to Policy: Evidence from Overton Data

Ren, Chao  School of Information Resource Management, Renmin University of China | renchao@ruc.edu.cn
Yang, Menghui  School of Information Resource Management, Renmin University of China; Key Laboratory of Data Engineering and Knowledge Engineering, Ministry of Education, China | yangmenghui@ruc.edu.cn

ABSTRACT
The cross-domain knowledge diffusion from science to policy is a prevalent phenomenon that demands academic attention. To investigate the characteristics of cross-domain knowledge diffusion from science to policy, this study suggests using the citation of policies to scientific articles as a basis for quantifying the diffusion strength, breadth, and speed. The study reveals that the strength and breadth of cross-domain knowledge diffusion from scientific papers to policies conform to a power-law distribution, while the speed follows a logarithmic normal distribution. Moreover, the papers with the highest diffusion strength, breadth, and fastest diffusion speed are predominantly from world-renowned universities, scholars, and top journals. The papers with the highest diffusion strength and breadth are mostly from social sciences, especially economics, those with the fastest diffusion speed are mainly from medical and life sciences, followed by social sciences. The findings indicate that cross-domain knowledge diffusion from science to policy follows the Matthew effect, whereby individuals or institutions with high academic achievements are more likely to achieve successful cross-domain knowledge diffusion. Furthermore, papers in the field of economics tend to have the higher cross-domain knowledge diffusion strength and breadth, while those in medical and life sciences have the faster cross-domain knowledge diffusion speed.

KEYWORDS
Science and policy; cross-domain knowledge diffusion; diffusion strength, breadth and speed; Overton.

INTRODUCTION
In recent years, the phenomenon of cross-domain knowledge diffusion from science to policy has become increasingly evident (Nay & Barré-Sinoussi, 2022). This refers to the process of introducing scientific research findings into policy development and implementation to address specific problems and challenges (Hodges et al., 2022). In this process, scientific research results need to be transformed into specific policies and practical measures to meet the needs of policy makers and implementers (Watson, 2005). According to Overton data, in 2021, over 660,000 policy documents were published worldwide, of which 44,875 policies cited 468,194 scientific articles (Szomszor & Adie, 2022). This indicates that policy makers are increasingly relying on scientific research findings to formulate policies. This phenomenon can be understood as a manifestation of the scientific and refined nature of policy making and highlights the universality and importance of cross-domain knowledge diffusion from science to policy.

While cross-domain knowledge diffusion of science to policy has become a global trend and has had significant impacts on social and economic development, there is still insufficient attention given to this phenomenon in the academic community, particularly in the field of quantitative research. This may be due to various factors such as a lack of research data, time lags between policy and science, and differences in research methods between policy-making and scientific research (S. O. Funtowicz & Ravetz, 1990). However, this fact cannot conceal the truth that we still lack the ability to accurately grasp the underlying characteristics of cross-domain knowledge diffusion of science to policy. A precise comprehension of the cross-domain knowledge diffusion characteristics of science to policy is of significant importance in promoting an effective linkage between science and policy, enhancing the scientific validity and feasibility of policies, driving scientific development and innovation, and optimizing the allocation of policy and scientific resources (Pielke, 2007).

Therefore, using Overton's data as a basis, this paper aims to address the following questions related to this phenomenon: (1) How can we explore the characteristics of cross-domain knowledge diffusion of science to policy from massive data? (2) What are the current characteristics of cross-domain knowledge diffusion of science to policy? To tackle those questions, this paper collected policy data and the scientific papers cited by them. Based on the citation relationships between policies and papers, a citation network was constructed. Diffusion strength, diffusion breadth, and diffusion speed were proposed as indicators to measure the characteristics of cross-domain knowledge diffusion of science to policy. The structure of this paper includes an introduction in Section 1, related work in Section 2, Section 3 introduced the data and methods, presentation and discussion of the results of the cross-domain knowledge diffusion of science to policy was conducted in Section 4, and a conclusion in Section 5.
RELATED WORK

The investigation of the relationship between policy and science has a long history (Boswell & Smith, 2017). In previous research, S. Funtowicz (2006) distinguished several conceptual models of the relationship between science and policy decision-making, including the modern model, the precautionary model, the frame model, the boundary model, and the extended participation model. Those studies are significant in understanding the relationship between policy and science. However, some scholars argue that policy and science are highly unrelated fields. For instance, the two-community theory highlights the substantial gap between scientists and policy-makers and separates science research from the policy process (Caplan, 1979).

But in the current era, especially since the outbreak of the COVID-19 pandemic, the relationship between policy and science has become increasingly close (Yin et al., 2021). Taking the development of COVID-19 policies as an example, on the one hand, COVID-19 policies can influence the direction of science (Gao et al., 2021). The stay-at-home orders and remote work caused by the pandemic have led to a significant decrease in efficiency and output for most scientists, which could have important impacts on their careers. At the same time, life sciences, clinical sciences, and some basic sciences will have the best development prospects after the pandemic, while disciplines that require field research and frequent work-related travel will continue to be affected (Myers et al., 2020). This will have a profound impact on the historical process of scientific research. On the other hand, scientific research provides scientific advice and guidance for the formulation of COVID-19 policies, and governments around the world hope to develop the most reasonable policies based on scientific evidence (Moatti, 2020). Research has found that the popular topics in Chinese scientific research during the early stages of the pandemic were extremely similar to related policies, with scientific research results being transformed into COVID-19 policies an average of 8.36 days after publication (Cheng et al., 2021). Similarly, Yin et al. (2021) accurately understood the co-evolutionary relationship between scientific research and policy during the COVID-19 pandemic by tracking the citation relationship between policy and science.

The exploration of the relationship between policy and science has important implications for our understanding of the cross-domain knowledge diffusion of science to policy. In particular, quantitative research on the relationship between policy and science is crucial for characterizing this phenomenon. As demonstrated in previous research (Yin et al., 2021), the use of policy documents citing scientific papers can help to explore the co-evolution of policy and science. This citation relationship can also be used to describe the cross-domain knowledge diffusion of science to policy. Policy documents citing scientific papers means that the viewpoints expressed in the scientific papers are spreading to the policy documents. The citation network of policy documents to scientific papers can be expanded to a cross-domain diffusion network of scientific papers to policy documents. To characterize this network, this paper draws on previous studies that analyze diffusion characteristics based on citations in bibliometrics.

Research on diffusion characteristics based on citations is derived from the study of knowledge diffusion in bibliometrics. British scholar Rowlands proposed the concept of "journal impact factor", which measures the diffusion of knowledge by treating journals as knowledge units (Rowlands, 2002). This innovation introduces a new citation parameter related to the concept of diffusion. Subsequently, informatics scientists such as Fairthorne and R. Rousseau conducted further research (Fairthorne, 1969), proposing relevant quantitative indicators and calculation methods such as diffusion strength, diffusion breadth, and diffusion speed (Rousseau, 2005). These metrics are used to analyze the characteristics, trends, and connections of knowledge dissemination and communication processes, expanding the scope of analysis from journals to disciplines, patents, and other types of documents (Ding et al., 2021).

In addition, quantitative research on the cross-domain knowledge diffusion of science to policy requires extensive data support. We know that the Overton database includes a large amount of policy data from various countries, from which policy documents and scientific papers cited by these policies are extracted, providing a data foundation for us to explore the characteristics of cross-domain diffusion from science to policy (Szomszor & Adie, 2022). Therefore, based on the Overton data and drawing on relevant research on knowledge diffusion characteristics, this paper conducted a quantitative analysis of the characteristics of cross-domain diffusion from science to policy from three aspects: diffusion strength, diffusion breadth, and diffusion speed.

DATA AND METHODS

Data

This article draws on policy document data from the Overton database, which is currently the largest policy database in the world, providing over 1,000 different sources of policy documents from different countries around the globe (however, relevant policy data from mainland China is not included due to data acquisition issues). The study retrieves all the metadata of policies published globally throughout the year 2021 from the Overton database, totaling 588,786 entries. Each record includes information such as policy release time, title, full-text PDF link, policy release type, policy classification, keywords, and citation relationships (Szomszor & Adie, 2022). Among
them, keywords are the main themes of a document. Overton analyze the phrases and entities used in the document and then compare them to data derived from pages on Wikipedia to find which ones have the most in common. In addition, Overton look for discipline areas the same way they do topics, but documents are matched against examples from each category in the IPTC’s Media Topics controlled vocabulary instead of against Wikipedia pages. Media Topics are the categories used by many newspapers and magazines to organize their articles (Szomszor & Adie, 2022). According to the author’s expertise, the Overton Database is currently hailed as the most comprehensive and sophisticated global database, seamlessly integrating policy and science. The entities extracted by this database have attained an exceptional level of accuracy, setting a benchmark in the field. When it comes to policy classification and topic extraction, the Overton Database stands out as one of the most precise and reliable databases worldwide, leaving a remarkable impact in the realm of policy databases (Szomszor & Adie, 2022).

Among the 588,786 policy documents analyzed, a total of 1,164 government, international organizations, and think tank entities from 211 countries and regions were identified. Out of these documents, 44,875 referenced scientific papers, resulting in 468,194 unique scientific papers cited by policies. To study the cross-domain knowledge diffusion from science to policy, we extracted the DOI numbers of the cited scientific papers from these 44,875 policy documents and retrieved the corresponding metadata from the OpenAlex database, which is a large and free academic resource index containing over 200 million scientific publications. The metadata for the scientific papers includes information such as the title, publication date, journal, author details, citation count, references, keywords, and subject. The keywords and discipline were obtained from the Microsoft Knowledge Graph, who was inherited by OpenAlex (Priem et al., 2022). Therefore, this study explores the characteristics of cross-domain knowledge diffusion from science to policy based on the analysis of 419,936 scientific papers cited by the 44,875 policy documents. The OpenAlex database draws the majority of its data from the highly comprehensive Microsoft Knowledge Graph (MAG). With its extensive data coverage, MAG serves as an invaluable source. For instance, we were able to extract 468,194 paper DOIs from policy data, subsequently retrieving 419,936 papers within the OpenAlex database. Remarkably, both OpenAlex and MAG databases exhibit outstanding accuracy in critical tasks such as author name disambiguation, publication categorization, and embeddings. These exceptionally precise outcomes form a solid foundation to support the research presented in this paper, underscoring the reliability and significance of the findings (Färber & Ao, 2022).

**Methods**

In this paper, we adopt diffusion strength, diffusion breadth, and diffusion speed, which are commonly used in the analysis characteristics of knowledge diffusion, to investigate the characteristics of cross-domain knowledge diffusion from science to policy (Rousseau, 2005). The specific indicators and measurement methods are shown in Table 1.

<table>
<thead>
<tr>
<th>Diffusion Dimension</th>
<th>Description</th>
<th>Measurement Index</th>
<th>Index Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffusion Strength</td>
<td>The frequency of cross-domain diffusion from science to policy</td>
<td>Absolute Strength (AS)</td>
<td>The number of times a paper is cited by policy documents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relative Strength (RS)</td>
<td>The ratio of absolute strength to the total number of times all papers are cited</td>
</tr>
<tr>
<td>Diffusion Breadth</td>
<td>The coverage of cross-domain diffusion from science to policy</td>
<td>Absolute Breadth (AB)</td>
<td>The number of policy organizations that cite the paper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relative Breadth (RB)</td>
<td>The ratio of absolute breadth to the total number of policy organizations</td>
</tr>
<tr>
<td>Diffusion Speed</td>
<td>The speed at which scientific papers are cited by policy documents</td>
<td>Diffusion Spend Days (SD)</td>
<td>The number of days between the policy document publication date and the scientific paper publication date of the citation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speed of Absolute Strength (SAS)</td>
<td>The ratio of absolute strength to the citation interval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speed of Relative Strength (SRS)</td>
<td>The ratio of relative strength to the citation interval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speed of Absolute Breadth (SAB)</td>
<td>The ratio of absolute breadth to the citation interval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speed of Relative Breadth (SRB)</td>
<td>The ratio of relative breadth to the citation interval</td>
</tr>
</tbody>
</table>

**Table 1. The diffusion indicators and measurement methods**

Diffusion strength refers to the counts a scientific paper is cited by policy documents. The more counts it is cited, the greater its impact on policy, including absolute and relative strength. Absolute strength is used for analyzing and comparing data within the same set, while relative strength is used for analyzing and comparing data from different
sets. For example, if paper A is cited by m policy documents and there are n citation relationships in the dataset, the absolute diffusion strength of paper A is m, and the relative diffusion strength is m/n.

Diffusion breadth refers to the number of policy institutions that cite a scientific paper, representing the coverage of the paper. The more institutions that cite the paper, the greater its coverage. This includes both absolute breadth and relative breadth, which are comparable to diffusion strength. For instance, if paper A is cited by l different policy-making departments and the dataset of policy citations contains s policy-making departments in total, then the absolute diffusion breadth of paper A is l, and the relative diffusion breadth is l/s.

Diffusion speed refers to the rate at which a scientific paper is cited by policy documents. The shorter the time between publication and citation, the faster the speed. This includes both diffusion strength and diffusion breadth, which respectively measure the speed of the paper's spread to policy institutions and the spread to policy-making organizations. For example, if paper A is cited by policy B, and the publication date of paper A is January 2nd, 2021, while policy B's publication date is January 28th, 2021, the citation interval for paper A is 28 days. The strength diffusion speed is m/28, and the breadth diffusion speed is l/28.

In the calculation process, a scientific paper may be cited by multiple policy, so there may be multiple values for the diffusion spread days (SD) of a paper. We take the average of these values as the SD of the paper. For example, if paper A has three citation pairs (paper A, policy B), (paper A, policy C), and (paper A, policy D), with corresponding citation intervals of 10 days, 30 days, and 50 days, then the SD of paper A is ((10 + 30 + 50))/3 = 30. Using this calculation method, this study obtained nine indicators, including absolute and relative strength, absolute and relative breadth, diffusion spread days, absolute and relative strength diffusion speed, and absolute and relative breadth diffusion speed, for 419,936 scientific papers, in order to explore the cross-domain characteristics of scientific papers towards policies.

RESULTS AND ANALYSIS
After obtaining 419,936 indicators of cross-domain diffusion strength, diffusion breadth, and diffusion speed of scientific papers, this study presents and analyzes the results in three parts: data distribution of diffusion characteristics, analysis of diffusion strength and breadth, and analysis of diffusion speed. In the data distribution part, we investigate the distribution patterns of the indicators and the correlations among them. In the other parts, we explore the attribute and content characteristics of the top 1% scientific papers with the highest diffusion strength and breadth, as well as the fastest diffusion speed. Attribute characteristics refer to information such as the authors, institutions, and journals of the papers, while content characteristics refer to the discipline classification and keywords of the papers.

Data distribution of diffusion characteristics
We first examined the data descriptions and distributions of the nine indicators of cross-domain diffusion in 419,936 scientific papers, including AS, RS, AB, RB, SD, SAS, SRS, SAB, SRB in Table 1. The results of the data descriptions are shown in Table 2 and distribution analysis is in Figure 1. Table 2 shows the data descriptions of the nine indicators, including the count, mean, standard deviation, minimum, maximum and quartiles of each indicator.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Count</th>
<th>Mean</th>
<th>Std</th>
<th>Min</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS</td>
<td>419540</td>
<td>1.560778</td>
<td>2.130005</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>541</td>
</tr>
<tr>
<td>RS</td>
<td>419540</td>
<td>2.38E-06</td>
<td>3.25E-06</td>
<td>1.53E-06</td>
<td>1.53E-06</td>
<td>1.53E-06</td>
<td>3.05E-06</td>
<td>0.000826</td>
</tr>
<tr>
<td>AB</td>
<td>419540</td>
<td>1.279918</td>
<td>0.952066</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>59</td>
</tr>
<tr>
<td>RB</td>
<td>419540</td>
<td>2.38E-06</td>
<td>1.77E-06</td>
<td>1.86E-06</td>
<td>1.86E-06</td>
<td>1.86E-06</td>
<td>1.86E-06</td>
<td>0.00011</td>
</tr>
<tr>
<td>SD</td>
<td>419540</td>
<td>3.54517</td>
<td>3871.72</td>
<td>0.5</td>
<td>1026.333</td>
<td>2396</td>
<td>4731</td>
<td>80524</td>
</tr>
<tr>
<td>SAS</td>
<td>419540</td>
<td>0.003825</td>
<td>0.034819</td>
<td>1.24E-05</td>
<td>0.000246</td>
<td>0.000534</td>
<td>0.001391</td>
<td>4</td>
</tr>
<tr>
<td>SRS</td>
<td>419540</td>
<td>5.84E-09</td>
<td>5.31E-08</td>
<td>1.90E-11</td>
<td>3.76E-10</td>
<td>8.14E-10</td>
<td>2.12E-09</td>
<td>6.10E-06</td>
</tr>
<tr>
<td>SAB</td>
<td>419540</td>
<td>0.003181</td>
<td>0.03066</td>
<td>1.24E-05</td>
<td>0.000228</td>
<td>0.00048</td>
<td>0.001206</td>
<td>4</td>
</tr>
<tr>
<td>SRB</td>
<td>419540</td>
<td>5.92E-09</td>
<td>5.71E-08</td>
<td>2.31E-11</td>
<td>4.25E-10</td>
<td>8.92E-10</td>
<td>2.24E-09</td>
<td>7.44E-06</td>
</tr>
</tbody>
</table>

Table 2. The data descriptions of diffusion characteristics

The first four graphs in Figure 1 show the distribution of the four indicators of AS, RS, AB, RB in a log-log coordinate system, indicating that the data distribution almost follows a straight line, which means the data of AS, RS, AB, RB in cross-domain knowledge diffusion of scientific papers follow a power-law distribution. The remaining five graphs in Figure 1 show the distribution of the five indicators of SD, SAS, SRS, SAB, SRB in a log-linear coordinate system, indicating that the data distribution almost follows an approximately normal distribution, which means that the data of SD, SAS, SRS, SAB, SRB in cross-domain diffusion of scientific papers follow a log-normal distribution. We also tested the data distributions using the Kolmogorov-Smirnov test and found that AS,
RS, AB, RB fit the power-law distribution and SD, SAS, SRS, SAB, SRB fit the log-normal distribution. The power law distribution of the strengths and breadths of cross-domain knowledge diffusion suggests that a select few highly cited papers have a substantial influence on policy. This phenomenon, known as the Matthew effect (Merton, 1968), implies that certain papers may be more frequently cited by policies, resulting in a greater impact on policies (Wang, 2014). Moreover, the logarithmic normal distribution of the speed in cross-domain knowledge diffusion indicates that there is variability in the speed at which papers spread, with some papers spreading more quickly than others. Additionally, the long tails of logarithmic normal distributions suggest the existence of a few extremely fast-spreading papers, which may significantly contribute to the diffusion process. Conversely, the majority of papers spread at a slower pace. The presence of both power law and logarithmic normal distributions highlights the nonlinear and non-uniform nature of cross-domain knowledge diffusion of science to policy, and the potential existence of a Matthew effect stemming from a small number of extreme or high-end values.

The intensity, breadth, and speed of cross-domain diffusion of scientific papers to policy exhibit a pronounced Matthew effect, wherein a small number of papers are extensively and widely cited in policy domains. Simultaneously, these select few papers experience a rapid and widespread diffusion to policy circles, while the majority of papers have a slower rate of diffusion. This Matthew effect refers to the phenomenon in which a small subset of highly influential or widely cited papers attracts greater attention and citations, thus further amplifying their impact and citation count (Merton, 1988). Several factors contribute to this phenomenon: those few scientific papers that prominently permeate across domains into policy circles often make significant contributions to problem-solving, theoretical development, or empirical analysis, and they may address issues of substantial social impact. The authors of these papers may be renowned experts in their fields or possess a distinguished academic reputation. Moreover, these papers enjoy enhanced visibility and benefit from wider dissemination channels in both academic and policy spheres, being published in high-impact journals, receiving media coverage, or being recognized as noteworthy research achievements.

Figure 1. the distribution patterns of the diffusion indicators
Due to the non-normal distribution of the nine diffusion indicators, this study utilized the Spearman correlation coefficient to measure the correlation among the indicators. The results are shown in the correlation matrix in Figure 2. The absolute and relative indicators of diffusion were found to be highly correlated, with a correlation coefficient of 1. This indicates that they exhibit the highest positive similarity when changing, as determined by the relative indicator calculation method. The correlation coefficient between diffusion strength and diffusion breadth was 0.76, indicating that they are highly positively correlated. This suggests that the changes in the strength and breadth of scientific papers' cross-domain knowledge diffusion to policy are consistent. Specifically, the number of times a paper is cited in a policy and the coverage of the paper in policy institutions are highly positively correlated. The correlation coefficient between SD and SAS, SRS, SAB, SRB is below -0.93, indicating that they are highly negatively correlated. This negative correlation is also determined by the calculation method of SAS, SRS, SAB, SRB. It is worth noting that although SAS, SRS, SAB, SRB are calculated as ratios of AS, RS, AB, RB and SD, their magnitude is mainly determined by SD, rather than AS, RS, AB, RB. The correlation coefficient between AS, RS and AB, RB is 0.97, indicating that they are highly positively correlated. This means that the speed of scientific papers' cross-domain diffusion to policies and the speed of scientific papers' diffusion to policy institutions are highly positively correlated. The correlation coefficients between the other indicators are relatively low. This is especially true for the correlation coefficient between SD and AS, RS, AB, RB, which is close to 0.09. This indicates that there is almost no linear relationship between the diffusion strength and breadth of scientific papers' cross-domain diffusion to policies and the diffusion spend days in which the paper is cited in policies.

### Analysis of diffusion strength and breadth

Due to the high positive correlation between diffusion strength and breadth, this study also found that the characteristics of papers with high diffusion strength and those with high diffusion breadth are extremely similar. Therefore, we analyzed diffusion strength and breadth together.

In this section, we investigate the attribute and content features of the top 1% most highly diffused scientific papers in terms of diffusion strength and breadth. The attribute features are presented in Table 3 and include the top ten countries, institutions, authors, and journals with the highest frequency of publications in both absolute diffusion strength and breadth. For example, "USA (1517)" indicates that 1517 papers in the top 1% scientific papers of highest absolute diffusion strength and breadth are from the USA. From Table 3, we observe that the majority of scientific papers of highest absolute diffusion strength and breadth are from Western countries, with the USA having the largest number of papers. This may be due to Overton's focus on Western countries' policies, making papers from these countries more likely to be cited by local and neighboring countries. Regarding institutions, the scientific papers of highest absolute diffusion strength and breadth are mainly from world-renowned universities, especially those in the USA, such as Harvard University and MIT. There are also international organizations, such as Organization for Economic Co-Operation and Development. Concerning authors, the majority of highly diffused scientific papers are authored by outstanding scholars who come from world-renowned universities, whom are primarily distinguished scientists in economics and environmental sciences, but also some
are experts in law and public health. Concerning journals, scientific papers of highest absolute diffusion strength and breadth are from top-tier social science research journals in economics and social development worldwide. Additionally, some papers are from medical journals, such as The Lancet, and comprehensive journals, such as Science, Nature and Proceedings of the National Academy of Sciences of the United States of America.

<table>
<thead>
<tr>
<th>Diffusion Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
</tr>
<tr>
<td>USA (1517)</td>
</tr>
<tr>
<td>UK (682)</td>
</tr>
<tr>
<td>Germany (269)</td>
</tr>
<tr>
<td>Australia (218)</td>
</tr>
<tr>
<td>France (213)</td>
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<tr>
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<tr>
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<td>China (142)</td>
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<tr>
<td>Belgium (123)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Diffusion Breadth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
</tr>
<tr>
<td>UK (735)</td>
</tr>
<tr>
<td>Germany (292)</td>
</tr>
<tr>
<td>Netherlands (228)</td>
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<tr>
<td>Canada (209)</td>
</tr>
<tr>
<td>France (199)</td>
</tr>
<tr>
<td>Switzerland (147)</td>
</tr>
<tr>
<td>China (129)</td>
</tr>
</tbody>
</table>

**Table 3. Attribute Features of the Papers with the Highest Diffusion Strength and Breadth**

The content characteristics of a paper include the discipline classification to which it belongs and the keywords that represent its main themes. In this study, we used data provided by OpenAlex to create pie charts depicting the proportion of discipline classifications for papers with the highest diffusion strength and diffusion breadth, as well as word clouds for their main keywords, as shown in Figure 3.
Figure 3. Content characteristics of papers with the highest diffusion strength and diffusion breadth.

Figure 3(a) and (b) respectively show the proportion of disciplines of papers with the highest diffusion strength and the word cloud of the main themes of these papers; Figure 3 (c) and (d) respectively show the proportion of disciplines of papers with the diffusion breadth and the word cloud of the main themes of these papers. From Figures 3(a) and 3(c), it can be seen that the discipline classification with the highest proportion for papers with the highest diffusion strength and diffusion breadth is economics, which is much higher than other classifications. The next most common classifications are business, medicine, and environmental science, with social sciences being the most prevalent. Natural sciences have a very low proportion, and medicine and life sciences, which are mainly focused on COVID-19, have a slightly higher proportion. From Figures 3(b) and 3(d), it can be seen that the main themes of papers with the highest diffusion strength and diffusion breadth focus on four main areas: public health issues (COVID-19, public health, healthcare), climate issues (climate change), employment issues (wage, unemployment), and social development issues (developing country, population, inequality). These issues were the main focus of policy-making in various countries worldwide in 2021, especially with the global pandemic of COVID-19 having far-reaching impacts on the economy, society, and environment of countries around the world. Therefore, many countries had to formulate policies to address these issues, and scientific papers on these topics have greatly contributed to policy diffusion.

Analysis of diffusion speed

We also investigated the attribute and content characteristics of the top 1% of scientific papers with the smallest diffusion spend days, the fastest diffusion speed of strength and breadth. The attribute information is shown in Table 4, and the content information is shown in Figure 4.
Table 4. Attribute features of the fastest spreading scientific papers

From Table 4, it can be seen that the majority of the top 1% of scientific papers with the fastest diffusion speed are almost from Western countries, with the USA having the highest number. Regarding institutions, the fastest spreading scientific papers mainly come from well-known universities in the USA, UK and National Institutes of Health. However, Johns Hopkins University were not included in Table 3, although their medical specialties are excellent. Combined with the National Institutes of Health being included, we speculate that the fast spreading of COVID-19-related papers in policies may have caused this. In terms of journals, papers with the fastest diffusion speed were mainly published in open access journals, including some preprints in the biomedical field (medRxiv), medical journals (BMJ, The Lancet, Eastern Mediterranean Health Journal and The New England Journal of Medicine), some social science journals (Social Science Research Network). This may be due to the impact of COVID-19, with papers related to COVID-19 spreading rapidly in policy circles.
The discipline classifications and word cloud of the top 1% of papers with the fastest spread are depicted in Figure 4. Figure 4(a) shows that medicine has the largest proportion in the top 1%, followed by political science and business. Overall, medicine and life sciences have the largest proportion, followed by social sciences, which differs significantly from the discipline classifications of papers with the highest diffusion strength and breadth shown in Figure 3. Figure 4(b) illustrates that the main themes of the fastest spreading papers focus on two aspects: public health issues (such as public health, epidemiology, vaccination, and virus) and social development issues (such as population). Among them, papers related to COVID-19 public health issues have the largest number, indicating that interdisciplinary papers on public health issues related to COVID-19 spread to policy at the fastest speed. This finding further confirms that COVID-19 has had a significant impact on the speed of papers spreading to policy in 2021, and papers focused on public health issues (in medicine and life sciences) tend to have a faster diffusion speed.

CONCLUSION
The global trend of cross-domain knowledge diffusion from science to policy has been increasingly evident, especially in light of the COVID-19 pandemic. Many countries heavily rely on scientific papers for policy-making. To explore the cross-domain knowledge diffusion from science to policy, this study uses policy data with citation relationships from the Overton database. Diffusion strength, diffusion breadth, and diffusion speed indicators are proposed to quantify the characteristics of cross-domain knowledge diffusion from science to policy. The analysis is conducted from three aspects: data distribution of diffusion characteristics, analysis of diffusion strength and breadth, and analysis of diffusion speed, and several significant findings has uncovered.

Firstly, the intensity and breadth of cross-domain knowledge diffusion from science to policy follow a power-law distribution, indicating that only a handful of papers have a profound impact and receive extensive citations. This can be attributed to the exceptional contributions made by these papers in problem-solving, theoretical advancements, empirical analyses, or their focus on topics of great social importance. Moreover, these influential papers are often published by prestigious universities, renowned scholars, and reputable journals, granting them heightened visibility and broader dissemination channels, thus reinforcing their strong diffusion intensity and breadth.

Secondly, the speed of cross-domain knowledge diffusion adheres to a logarithmic normal distribution, signifying considerable variability in the rate of dissemination among papers, with some spreading more rapidly than others. This variability may stem from the urgency of the issues addressed in these papers or the direct practical value of their research methods and findings for policy-making. In essence, these observations highlight the nonlinear and uneven nature of knowledge diffusion from science to policy. A small number of highly impactful and extensively cited papers wield significant influence on policy, aligning with the fundamental principles of the Matthew effect.

Furthermore, a strong positive correlation exists between diffusion intensity and breadth, indicating that highly cited papers often have a broader impact. Conversely, there is a significant negative correlation between diffusion speed and breadth, as well as intensity, suggesting that papers with faster dissemination tend to have relatively lower breadth and intensity. This may be attributed to rapidly spreading papers exerting unique influence in specific fields or policy topics, rather than having widespread impact across different domains or subjects.

Finally, the research reveals the variations in diffusion characteristics and content across different fields. Papers with the highest diffusion intensity and breadth predominantly originate from the field of economics, whereas those with the fastest diffusion speed primarily come from the field of medicine. Papers with the highest diffusion intensity and breadth primarily focus on social sciences, encompassing climate issues, employment challenges, public health concerns, and social development problems. On the other hand, papers with the fastest diffusion speed mainly emerge from the fields of medicine and life sciences, followed by social sciences, with a particular emphasis on public health issues and social development matters. These observations underscore the disparities and importance of research outcomes from diverse disciplines in the cross-disciplinary diffusion of knowledge from science to policy. Economics papers exhibit higher citation and diffusion levels due to their close connection with socioeconomic issues in policy-making. Papers from the field of medicine experience faster diffusion due to their direct focus on human health and public health matters, especially during emergencies and disease outbreaks. Meanwhile, papers from the field of social sciences address social problems and human behavior, playing critical roles in policy-making and societal transformations, thereby demonstrating higher diffusion intensity and breadth.

This study discusses the characteristics of cross-domain diffusion of science to policy and contributes to the understanding of the two-way interaction between science and policy, which has never been studied before. It also provides theoretical guidance for science to help with policy-making. However, the research results may be biased due to the limited coverage range of the data, which mainly includes policy data from Europe and America and may not fully represent the global data. Meanwhile, 2021 is the year of the global pandemic of COVID-19, and the findings of this paper may have been influenced by this phenomenon.
ACKNOWLEDGMENTS
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The New Information Retrieval Problem: Data Availability

Sharma, Sarika  
University of Texas-Austin, USA  | sksharma2@utexas.edu
Wilson, James  
University of Washington, USA  | jcw35@uw.edu
Tian, Yubing  
University of Washington, USA  | ytian94@uw.edu
Finn, Megan  
University of Washington, USA  | megfinn@uw.edu
Acker, Amelia  
University of Texas-Austin, USA  | aacker@ischool.texas.edu

ABSTRACT
The goals of open science are driven by policies requiring data management, sharing, and accessibility. One way of measuring the impact of open science policies on scientific knowledge is to access data that has been prepared for re-use. But how accessible/available are data resources? In this paper, we discuss a method for exploring and locating datasets made available by scientists from federally funded projects in the US. The data pathways method was tested on federal awards. Here we describe the method and the results from analyzing fifty federal awards granted by the National Science Foundation to pursue data resources and their availability in publications, data repositories, or institutional repositories. The data pathways approach contributes to the development of a practical approach on availability that captures the current ways in which data are accessible from federally funded science projects—ranging from institutional repositories, journal data deposit, PI and project web pages, and science data platforms, among other found possibilities. This paper discusses some background and motivations for such a method, the method, research design, barriers encountered when searching for data resources from projects, and how this method can be useful to future studies of data availability.

KEYWORDS
Data availability; Open Science Policies

INTRODUCTION
Several national policies and legislative efforts in the last few years speak to the significance of machine-actionable data management and availability. For instance, the CHIPS Act passed in 2022 mandates that awards granted by funding agencies make data available for sharing. The now well-known “Nelson Memo” from the Office of Science and Technology Policy (OSTP) office states that data immediately be made available upon publication. These efforts, and others globally, speak to the significance—and policy momentum—building around the aims of the open science movement that seeks to open and share science data to foster innovation. Federal policies aim to make data available at the end of projects as a promise of most efforts. But data from grants may end up in any number of places—personal websites, publication venues, cyberinfrastructures, and data repositories. Presumably, data from research funded by national funding agencies are a public good and available for access.

For researchers interested in research data management, the role of the professional data librarian, and data reuse the rise of policies to make data available has introduced a new avenue and problem: the accessibility to datasets that are considered a public good. Data accessibility is a combination of where to find data, how to find data, how data is structured, and how data sources link together on the web. Policies that mandate data availability thus raise an interesting question for LIS scholars: if policies require availability, how exactly are data resources found and accessed? This paper elaborates on one such method: data pathways.

In response to the growing efforts by federal agencies that pressure researchers to make data available and the distribution of data into many venues, in this paper, we discuss the development of the data pathways method to locate the availability of data resources generated from federally funded grants. The data pathways approach presented here aims to build out prior work that connects the location of data to the data management plans written for federally funded awards (Bennett et al., 2021). The paper reports on locating the most common “paths” of access to data resources, most typically datasets (though other data resources are possible).

The demand to understand how accessible data are from federal grants from the pathway approach has emerged from an interest in ascertaining how researchers comply with federal policies including the resources used to make data available. The FAIR principles, endorsed by Research Data Alliance (RDA) in 2018, outline four guidelines to support the reuse of scholarly data, including Findability, Accessibility, Interoperability, and Reusability. What makes these principles distinct is their focus on machine action, as the authors of the FAIR principles explain: “Distinct from peer initiatives that focus on the human scholar, the FAIR Principles put specific emphasis on enhancing the ability of machines to find and use the data automatically, in addition to supporting its reuse by individuals,” (Wilkinson et al., 2016). The FAIR Principles are operationalized into the FAIR Data Maturity Model which explicitly states that for data to be FAIR that “rich metadata is provided to allow discovery” and even says...
that a dataset should be evaluated upon “how much metadata is provided and how well the provided metadata supports discovery” (RDA 2020, p.12-13). However, our findings and the findings of our previous research on data pathways (Bennett et al., 2021) demonstrate that discovery remains a vexing challenge and suggests that more specificity around the discoverability of data may be essential if FAIR is to achieve its goals. Using the methods outlined here shows that machine actionability is likely to be challenging if the data cannot be found and accessed. Findability of data is constrained by web information retrieval.

In this data pathways method, the process to search for data and the information ecosystem for data storage and retrieval is equally as important as what data are found. This approach assumes that there are multiple realities for data availability governed by a combination of social and technical factors including but not limited to the scientific research project, the institutional context of research including funding and labor dedicated to data management, security issues of data; retrieval issues such as access, download, format, and software interoperability. This approach also sheds early light on information retrieval issues to search and find data resources.

LITERATURE REVIEW
Data from federally funded projects is available via publications, domain repositories, project websites, and platforms. But data availability is not guaranteed, and many factors influence (and impede) data availability. Data availability measures whether or not datasets are available from research projects. Several research studies have analyzed data availability using qualitative methods that assess how, where, when, and what factors influence the availability of scientific data. Such qualitative approaches have ranged from survey methods (Kim & Adler, 2015; Kim & Stanton, 2013; Tenopir et al., 2011), email request studies (Savage and Vicker, 2009; Hardwicke et al., 2018; Tedersoo, Küngas, Oras et al., 2020), and document analysis of scientific publications where authors agree to make their data available (Federer, Belter, Joubert et al., 2018; Graf et al., 2020) to examine the loop between what is said about data availability and the realities of whether data are available.

Survey methodology has produced a body of knowledge about how policies influence data sharing. Survey methods cast a wide net of researchers to determine whether the policy is a factor that shapes sharing and availability. What is learned from this literature is that researchers are more willing to provide data upon request (Tenopir, Allard, Douglas et al., 2011). Policies impose different kinds of pressure to make data available. Journal policies, disciplinary norms, and scholarly altruism are three factors that positively impact sharing (Kim and Stanton, 2013).

In contrast, normative pressures by funding agencies and perceived career risk had no association with data sharing (Kim and Stanton, 2013). In a similar study drawing on survey methods, individual attitudes may be at odds with journal and government mandates regarding data availability (Kim and Adler, 2015). Survey methods teach us that policies do not equally motivate researchers to make their data available.

Document analysis measures compliance with federal and journal policies that require data availability. Document analysis is a method that solicits planning documents from scholars to assess plans to make data available. A content analysis of data availability plans showed that compliance increases over time and that sharing data via publication continues to be the norm (Federer, Belter, and Joubert, 2018). Similar to the findings above, another study that analyzes statements found that most researchers plan to make their data available upon request (Graf et al., 2020). Document analysis provides insights into how scholars plan to make their data available but not whether they enact those plans.

Other studies utilize a combination of document analysis and email studies to examine data availability. Studies in this area aim to close the loop between what is said about data availability and the actual location of the data. One study found that despite PLOS One’s journal requirement to make datasets available, many authors did not provide access to data (Savage and Vicker, 2009). Similar findings emerged from a larger sample of publications from a popular psychology journal. Scholars analyzed data availability statements pre- and post-policy implementation of a data availability policy. Researchers searched for datasets listed in data availability statements but were largely unsuccessful (Hardwicke et al., 2018). The study found that post-policy compliance increased data availability, but data reusability remained low due to the quality of curation. In another recent study, researchers analyzed data availability statements from high-impact journals by looking for the datasets from publications and then contacting the data creators (Tedersoo, Küngas, Oras et al., 2022). Those researchers also concluded that data availability statements do not provide an accurate snapshot of how to access data (Tedersoo, Küngas, Oras et al., 2022).

Overall, the data availability research from scholarly communication researchers like Tenopir, Kim, Hardwicke, and Tedersoo and from scientists themselves is clear: scientists claim to want to share data and to comply with policies, but their willingness to share when asked directly is not as universal. Thus, measuring the health of data availability could benefit from introducing another method.
This paper shifts from engaging with scientists via survey, email, or document collection to finding the data ourselves. We contribute to a critical analysis of data availability, in which data availability is approached not as a measure of compliance but as a realistic approach to assessing web retrieval of data.

**DATA PATHWAYS: RESEARCH DESIGN**

We investigate data availability as an information retrieval problem. Our pragmatic approach to data retrieval focuses on analyzing the pathway to find datasets from research funded by the NSF. The NSF is an independent federal agency established in 1950 that maintains a large portfolio to fund basic and applied research. In 2011, the agency implemented a data management plan policy that required all proposals seeking federal grants to describe how data would be managed and made available after the completion of the research project (Pasek, 2017). Thus, we assume that data will be available from the project.

The research design of our study aims to trace a pathway to find data. We draw on information provided by the NSF to get the context of a research award and the information necessary to conduct a search. To test the retrievability of data, we start by collecting information about federal research grants from the NSF. The NSF provides historic information about awarded projects (such as the PI’s name and their institution) including links to final reports, outcomes, and increasingly products like publications or data resources that result from the completion of awards. We assume that federally funded awards generally (but not universally) will result in scientific knowledge production and that data will be available for those outputs. Those outputs include publications, information resources, samples, specimen materials, software, and code that will be preserved and made accessible.

To pilot the pathway method, we had a team of six: the second author was one primary coder, the first author was the second coder who also served as a “code lead” for the synthesis, and the last three authors were external members for vetting and review. First, the external members developed a list of grants from the NSF. An awards list from the NSF was downloaded from five research areas: Civil Mechanical, Manufacturing and Innovation (CMMI), Division of Biological Infrastructure (DBI), Oceanography (OCE), Secure and Trustworthy Cyberspace (SATC), and Science and Technology Studies (STS). Eight awards were randomly selected from each funding area from 2011-2018. In total 56 grants were analyzed.

![Figure 1. This screenshot from the nsf.gov features a successfully funded research project (Award # 1226726) and metadata about the nature of the research.](image-url)
Figure 2. This screenshot features award #1226726. The abstract and publications produced as a result of this research are listed on the summary page. Upon completion both publications as a result of the award and project outcomes report are published below the award information. To find different pathways to potential datasets, we leveraged critical information from project award pages to seek out and find different data products.

Following the awards selection, coders were given instructions to find data from the award. The coders relied on the NSF award search page that lists a series of publications produced as a result of the research and also contains a project outcomes report (Figure 1 and Figure 2). The pathways method relied on the documentation available to the public to search for awards funded by the independent funding agency. Coders used information from the awards page to then observe web retrieval of data. This included focusing on what information was available to find data, the search that was conducted, the websites visited, the links that were clicked, success or unsuccess of finding data, and any challenges that arose when looking for data.

RESULTS: PATHWAYS PRODUCED

In this section, we describe the five pathways that were defined by the coders during their efforts to search for federal datasets (Figure 3). Coders utilized all five pathways to ensure all searches were exhausted to find data. All five pathways originate from the information stated on the nsf.gov awards page. The first pathway focused on finding data from the publication listed on the awards page. The second pathway focused on the principal investigator PI(s) as the source of data retrieval. The third pathway focused on the project level strategy to retrieve data. The fourth pathway focused on the organizational host or the network of scientists as the site for data retrieval. The fifth pathway defined a search strategy based on the keyword search related to the science project on web engines. Lastly, a location perspective was taken on data retrievability. Coders focused on the institutional repository as the site to retrieve data.
Figure 3. This pathway is an iterative workflow of the possible data paths that coders took to find datasets from federally funded awards. Coders delineated five pathways or search strategies. Each strategy began with information provided from the NSF awards page. The information from the NSF was then used to conduct searches. Each pathway represents how coders took the information from the awards page and used it to search for datasets.

Pathway 1: Publication Pathway
The most common pathway found by coders to find datasets was the publication-centric pathway. This pathway began by collecting information or DOIs from publications on the award page. From there, coders used several strategies to find datasets in publications. Coders used institutional databases to search for the publication title and DOIs using their search bars. When coders could not find journals through authoritative sources, coders used the search engine Google or Google Scholar. Coders noted whether publications were open access or gated by a paywall. Coders assessed publications for datasets or statements about the availability of datasets. Coders took information from publications and used the information to search for datasets. Coders documented how journals organized publication records online to ascertain if any pattern led to data resources. Coders found links to data in the acknowledgments section, supplementary materials, and the data availability statement.

Pathway 2: Data Creator Pathway
A second pathway coders defined was a data creator pathway. This pathway was used when no publications were listed on the awards page. The data creator pathway began with the PI name found on the awards page. Coders grabbed information about the PI including name and affiliation. This search typically produced links to a university or college webpage featuring information about the PI. In some cases, a link to a personal webpage hosted by the PI was found on the institutional webpage. Coder’s searched both web pages for evidence of data created from the award. While institutional webpage profiles did not result in datasets, personal web pages in some cases presented links for data to be downloaded. Faculty pages also listed other kinds of information that allowed coders to search for data such as curriculum vitae, research project summaries, lab members, awarded grants, and publication citations. Other information not included by the NSF award page was retained. Coders were led to other website such as Google Scholar profile pages, ResearchGate profile pages and other aggregating websites. These websites are also useful to see if datasets are made available.
Pathway 3: Project Pathway
If coders did not find data from the publication pathway or the data creator pathway, the project pathway was conducted. Coders extracted the project name and/or project facility and used them as keywords to search projects websites. In some cases, facilities and project websites contained publications that would be searched if they were not featured already on the nsf.gov website. Information from project websites were retained to conduct searches.

Pathway 4: Phenomenon-Centric Search
Another approach defined by the coders was a phenomenon-centric approach. This pathway focuses on searching for datasets based on the scientific research topic. Coders extracted keywords about the research from the abstract on the awards page. Those keywords were entered into a search engine to find repositories or networks of researchers working on a similar research topic.

Pathway 5: Search by Institutional Repository at PIs organization
Lastly, coders defined an institutional repository approach. Institutions hold a wealth of outputs from research and preserve those outputs. Coders went to institutional repositories adjacent to the home institution of the PI. Coders searched within institutional repositories using the PI’s name or project. Institutional repositories typically are not the most fruitful sites to find data resources but occasionally yield additional publications. In some cases, an institutional repository may hold datasets from individuals affiliated with the award such as junior scholars, research assistants, and doctoral students.

Summarizing pathways
The data pathways approach provided several insights in searching, locating, and identifying data resources from projects published in the NSF awards database. The pathways reflect the rhizome-like/peripatetic nature of searching for datasets. The different pathways to finding data from federal grants were comparable to the root system of rhizomes. The mother node in this case was the information located on the NSF awards page. The NSF awards page provided the information to go to other nodes such as journal database or a PI’s website. The aggregate information provided by the NSF was a crucial part to the pathway. If few details were provided, coders would have to find information from the web and then seek out nodes towards datasets. The information provided by the NSF is vital to begin the search for datasets. From there the pathways were comprised of many nodes (webpages from organizations, publications at databases, database for publications to repositories, data publications to cloud services, and/or PIs webpages). In some cases, the nodes led to other nodes and in other cases the nodes were dead ends.

Comparing pathways
The most common pathway that led to finding datasets from federal awards was the publication pathway. We observed that publications listed on the awards page contained links to the storage sites for the datasets and/or availability statements to ascertain where datasets are located. In successful cases, the publication listed on the awards page was entered into the database. Once the publication was found, an embedded link in the publication could lead out to the dataset. This link led to either a data repository (such as GenBank) or a federal agency repository. In some cases, a data availability statement directed readers to a repository or anticipated deposit site. The link or the statement to the dataset could be located in the supplementary materials section, the data availability section, or the acknowledgements. In the acknowledgements section, in some cases, PIs listed more than one source of funding that contributed to the publication. This was the most parsimonious pathway to find data.

Another successful pathway we observed to find a dataset was to head to the PIs website. Once a publication was searched and no links were found, coders went to the PIs page to discover datasets. Datasets were triangulated by reading the proposal award. In one case, we found a sophisticated case of data availability. A PI had datasets available for download on their lab webpage. This PI requested that a download form be completed before access was given to the requestor.

The least successful path were pathways 3, 4, and 5. The coders assumed that project level and organizational level websites would produce a list of datasets but to the contrary, such websites rarely contained datasets but instead featured publications as the outcomes from the project and/or facility.

Pathways and the Location of Data
We found differences in data availability across research areas (Table 1). We found datasets from approximately four out of ten awards from oceanography and biology. Awards analyzed in the area of security research resulted in only three awards that made data available. No awards from engineering and science and technology studies resulted in the retrieving data. In total, data was available from 11 awards out of the 56 awards that were analyzed.

We found a combination of storage sites for data. Data was found in domain repositories; generalist repositories; platforms like GitHub and Google Drive; and institutional repositories at universities. Coders use pathway one, two and three to find data.
<table>
<thead>
<tr>
<th>Research Area</th>
<th>Number of Awards that Stored Retrievable Data</th>
<th>Location of Datasets</th>
<th>Pathway to find data</th>
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</thead>
<tbody>
<tr>
<td>Oceanography</td>
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<td>GitHub; Google Drive; Sequence Read Archive</td>
<td>1 and 2</td>
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<td>-</td>
<td>-</td>
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<td>Science and Technology Studies</td>
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<td>-</td>
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<td>1 and 2</td>
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<tr>
<td>Biology</td>
<td>4</td>
<td>Smithsonian Collections, Proteome, Dryad, GitHub, Zenodo; Institutional Repository at University</td>
<td>1, 2 and 3</td>
</tr>
</tbody>
</table>

Table 1. Research areas had varying levels data availability. In total, datasets from 11 out of 50 awards were found. Data was made available via cloud based services, data repositories, institutional repositories, or supplemental materials in publications.

Helpers Along the Way
We observed several helper websites that provided information on where to find data. Helper websites included journal publishers, science aggregating websites, and google scholar. Journal publishers provided links to the different sections (such as introduction, literature review, figures and tables, results, acknowledgements, supplemental materials etc.) of the journal article. Coders could jump to sections in order to look for data sources or links to data sources. DOIs were helpers that let coders know that publications listed on the NSF award page were connected to the publication found in the database. The quest to find data was very dependent on whether embedded links worked.

We found websites that aggregated NSF funding and publications by researchers augmented search processes. For instance, we encountered science aggregating websites like Dimensions.ai (See https://www.dimensions.ai, a website hosted by Digital Science). This website was encountered during a google search for a publication. On this site, we found awards, patents and publications related to an individual researcher. While the platform provided a wealth of information, we were unsure how the software was compiling information from the NSF awards database.

We also observed that the NSF Public Access Repository (NSF-PAR) provided a repository of publications from funded awards. This helper website was encountered via Google Search. It was not evident that these publications were available on the NSF’s repository through the awards page.

Obstacles Along the Way
Many obstacles were encountered during the pathways approach. Coders found outdated web pages, deadlinks, technical issues around formats for storing data, closed access to publications, and the lack of certainty around PI affiliation, and the lack of certainty around the individuals on the grant as obstacles that hindered our search for data.

Webpage and Links
One of the most common challenges we observed were issues related to longevity and persistence of web resources. Outdated webpages and outdated internal links were common on PI websites hosted by .edu domains. Some PI websites were clearly not updated and were relics of the past. Broken internal links led to “not found page”. Interlinks, backlinks, and hyperlinks were not always reliable.

Inaccessibility to Journals
Coders encountered limited accessibility to journals associated with publications. Coders observed that that despite having access to sophisticated resources hosted by large universities, some journals were not accessible. Coders tried to engage in workarounds to find publications. Publications were accessible via Google Scholar, the PIs personal webpage, the PIs or co-author’s webpage on researchgate.com. Publications were also available via third part websites.

Data from Unique Outputs
Many awards produced a range of outputs that complicated the pathways to find data. Coders became well versed in finding data statements or look for data in the supplemental material from journal articles. However, coders were not
sure how to search for data from outputs such as an online museum, a video and/or a book. Coders went to the PIs websites and institutional repository to search for data with no success.

**Data Formats**
When coders did find datasets, proprietary data formats from software prevented access to the dataset. In another case, data files were corrupted and not accessible.

**Institutional Affiliations**
Coders found the information from the NSF award’s page to reflect the information at the time of the grant. Searches were complicated outdated information provided by the NSF. Coders found several webpages for one PI and figured out that some PIs had moved to another institution. PIs also had more than one webpage. The most PIs had a webpage by their institution and an embedded link to their person webpage.

**Generative Aspect of Grant Funding**
Another obstacle coders encountered was understanding the full scope of the research project and the individuals involved on the project. Coders observed that grants led to many different kinds of research projects with many different individuals. PIs listed on the NSF awards page were not always the first authors of publications, and in some cases PIs were not even listed as authors on the publications from the award. This made it challenging to triangulate how other researchers were involved on the award and whether coders missed publications from other researchers affiliated with the award. Exhaustive searches were completed on all the individuals that were listed as first authors in the publications.

Coders also found that data retrievability was based on first author of a publication. Coders found that the point of retrieval for a dataset was the first listed author on a publication. Coders used this strategy to conduct a pathway search on all listed first authors of publications listed on the awards page. In one case, the first author was a graduate student advisee of the PI. The award funded that student’s dissertation.

Coders found that in the acknowledgements section of some publications, first authors listed multiple funding sources that led to the publication. Coders had to ascertain whether datasets from publications were governed under the NSF or other agencies that provided funding.

**Limitations**
The data retrieval pathways we defined and summarized has a few limitations. We developed a standardized approach here but believe that a closer look into this process is warranted. A more systematic design to follow pathways could be beneficial. We think the approach could be improved by developing map of the retrieval pathways and visualization networks. Further, we only tested 56 awards, more awards from different research areas need to be tested in order to delineate pathways. A larger sample size across many research areas could provide deeper insights into the pathways of how data are accessed. We also did not contact individuals to get access to data. This was another pathway that could be explored.

**Discussion**
By applying the pathways approach to find data, our findings suggest that data retrievability is a complex, time-consuming task. The findings are relevant to the growing interest to apply machine-actionability to data availability by federal agencies and stakeholders. Machine-actionability refers to the use of a structured, digital system of information organization for data planning and availability for machines to be able to read. A machine-actionable plan is based on the logic of coordinating data availability through automation. Principles like FAIR aim to make data first class objects. Our findings showcase that this logic may be challenging to implement.

First, automating findability is challenged by the distributed network of web services as sites for data storage. Increasingly datasets are found on the web outside of formal repositories such as a researcher’s website or a project’s website. Our work shows that web resources are persistent over time. Some webpages are abandoned or change across time and place. While datasets are increasingly found on the web most data are still embedded in publications. Access to publications is vital to finding datasets from federal grants. Third, an award from the NSF is generative. PIs extend funding to many individuals across many projects that result in many data stewards. Grant funding may be pooled with other funding. This complicates who has jurisdiction over the data and who can make it available. Further, grant information provided from the funding agency is not up to date. Searches need to conduct an extra layer of search to get the details of a grant correct before searching for the data. This summary showcases that machine actionable data is only possible if all of the identifiers and the underlying infrastructure that change across time and space is accounted for and managed.

**CONCLUSION**
Schatz (1997) once wrote “immediate access to all scientific literature has long been a dream of scientists”. This dream is now alive and well at the NSF regarding datasets. We tested this aspiration at the NSF by putting forth a
data pathways method. In future work, we plan to further the pathways method by creating visualizations of different paths to understand the bottlenecks and passages to data.

ACKNOWLEDGMENTS
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A Study of COVID-19 Information Behaviors among Black Americans

Stewart, Brenton J.  
Louisiana State University, USA | brentonstewart@lsu.edu
Ju, Boryung  
Louisiana State University, USA | bjru1@lsu.edu
Walker, Jessie J.  
Washington University in St. Louis, USA | jessiew@wustl.edu

ABSTRACT
Many Black Americans expressed skepticism and hesitancy about the Covid-19 vaccine. The objective of this research is to examine whether there is a relationship between Covid-19 vaccine status, Covid-19 vaccine knowledge, and information seeking about the coronavirus. A national online questionnaire of 222 Black identified individuals completed the instrument in the Summer of 2021. We conducted data analysis using ANOVA and nonparametric correlation tests among the variables. Findings show that individuals who have received the COVID-19 vaccine exhibited greater COVID-19 vaccine-related knowledge compared to people who declined the vaccine, or were hesitant adopters. There is no significant difference in the level of knowledge between those who are hesitant about the vaccine and those who declined it. Finally, there is a moderate positive correlation between COVID-19 vaccine knowledge and engagement in COVID-19-related information seeking. We conclude with strategies to improve the Black American health information environment by way of practice, policy and action.

KEYWORDS
Information seeking; information use; health information; Covid-19; vaccine knowledge

INTRODUCTION
The Association for Information Science and Technology Annual Meeting 2023 posits “how can we release the transformational power of information research and translate our findings into positive differences to how lives are lived?” We suggest the initial step in this effort is to produce information research that centers diverse communities and their information practice. When certain populations are overlooked, marginalized, and/or erased, our distinctive disciplinary domain will never realize its potential to transform the human condition across diverse populations and geographies. In the United States the ongoing novel coronavirus pandemic has had a disproportionate impact on the Black/African American community. During the early phase of the pandemic, for example, Black residents in Chicago comprised over 50% of COVID-19 cases and over 60% of related deaths. In the southern state of Louisiana over 70% of the COVID-19 deaths were among Black Americans however; the Black population in both jurisdictions was no more than 32.2% (Yancy, 2000). This unbalanced disparity is not wholly unexpected as marginalized populations have “historically borne a disproportionate burden of illness, hospitalization, and death during public health emergencies, including the 2009 H1N1 influenza pandemic and the Zika virus epidemic (Akintobi et al., 2020). While information science researchers have begun to study various information practices related to the novel coronavirus spanning New York denizens, public library leaders, and Black college students in the United States (Bossaller, et. al 2022; Stewart, 2021; Wu 2021) there is very little research in information science that centers the information behavior of the general Black American population and the current pandemic.

Moreover, the current paper is a baseline study where we seek to investigate the relationships among COVID-19 vaccine status, levels of COVID-19 vaccine knowledge and Covid-19 information seeking among Black Americans. The paper concludes with a discussion of targeted strategies to increase information dissemination.

BACKGROUND
Black Americans were one of the most hesitant populations to accept a COVID-19 vaccine (Thompson et al., 2021; Mackey et al., 2021; Willis et al., 2023). Such hesitancy, according to research literature, is grounded in historical and social inequities, which likely intersect with geography and outcomes experienced by the community. A meta-analysis of COVID-19 vaccine hesitancy found that nearly 42% of the Black community were vaccine hesitant; this is in contrast to a general hesitancy rate of 26.3% in the United States, the study found (Khubchandani, J., & Macias, Y., 2021). Vaccine hesitancy is the focus of several studies that seek to better understand factors that may influence Black Americans reluctance to vaccinate. Savoia and colleagues (2021) found racial discrimination as one significant factor; Black participants had a 21% higher odds of vaccine indecision versus individuals who did not report these experiences with discrimination. Other factors are a relative lack of trust in “government and the medical professionals” notably the hesitancy here is “more about the government's motives rather than its competence (McFadden et al., 2022). Vaccine related behaviors and trust in information sources are additionally likely factors in vaccine hesitancy. Woko, Siegel, and Hornik (2020) found that Black participants held “less positive beliefs about vaccinations” and this ethos correlated with vaccine intentions. Curiously however, the study notes that trust in information resources is correlated to vaccine beliefs but low trust levels in COVID-19 information, does not
explain vaccine hesitancy in Black participants; this outcome suggests there are other factors at play in the lived experiences and information behavior and practices of Black Americans.

Previous studies have suggested that “knowledge” may form “an important factor shaping” decisions about vaccinations; misinformation about vaccines and any impending “consequences of vaccinations” can affect the decision-making process across a multitude of vaccines for both children and adults (Zingg and Siegrist, 2012; Swed, S. et al 2023). A recent study highlighted the stark disparity in COVID-19 knowledge and attitudes among racial/ethnic groups in the United States. Generally, people of color had lower scores than white Americans. For example, Black American knowledge scores averaged 14 out of 18, which the researchers defined as low; in contrast to 16 for Whites which denoted high. Additionally, 70% of whites had a high COVID-19 knowledge score; only 35% of Blacks had similar scoring (Alobuia et. al, 2020). We encountered very few studies, in information science, situated on Black information seeking practices related to the coronavirus. Stewart’s 2022 analysis of Black American college students found that health information seeking related to COVID-19 coalesced around social media and the internet. Symptoms, protective measures, at risk populations and the coronavirus’s impact on the Black community were the primary information needs. Similar results were noted in another study of minority populations’ information seeking found that among Black Americans cultural identity affected the community’s information perception on Covid-19 (Kim, Cham-Olmsted, and Chen 2022). Interestingly, the study also found that “perceived information value was positively associated with vaccination status” among participants (Kim, Cham-Olmsted, and Chen 2022). There is currently a dearth of knowledge on Black American information behavior in the context of the novel coronavirus. Therefore, in this paper, we propose to investigate relationships among COVID-19 vaccine status and COVID-19 vaccine knowledge and relationships among COVID-19 vaccine status and COVID-19 information seeking among Black Americans.

RESEARCH METHODS
We conducted an online survey of 222 Black identified individuals in June of 2021. A quantitative data analysis was performed via analysis of variance (ANOVA) and nonparametric correlation tests to identify any significant relationships among the variables: COVID-19 vaccine status, levels of COVID-19 vaccine knowledge, and COVID-19 related information seeking.

Study participants
All individuals were African American/Black, resided in the USA, are older than 18, and voluntarily participated in the study through the Qualtrics Panel Services. Among the 222 respondents who identified their gender, there were 110 male respondents (49.55%) and 112 female respondents (50.45%). The respondents represent a wide range of age groups, including 19 or younger (24 respondents, 10.81%), 20-29 (87, 39.20%), 30-39 (57, 25.66%), 40-49 (22, 9.90%), 50-59 (18, 8.10%), and 60 and older (14, 6.33%). In terms of educational background, the participants include those with a high school degree or less (68, 53.04%), some college education (74, 38.14%), a bachelor's degree (34, 17.53%), a master's degree (12, 6.19%), a doctoral degree (2, 1.03%), and a professional degree such as a JD or MD (4 respondents, 2.06%). Of the total of 222 respondents, 28 did not provide information on their educational background.

Measures and null hypotheses
Our research question was addressed using three measures. In this study, we define COVID-19 Vaccine Status (VAX Status) as the status of individuals' COVID-19 vaccinations. To measure this variable, participants were asked to indicate their vaccination status by selecting one of three response options: Vaccine Received, Declined, or Hesitant at the time of survey completion. COVID-19 Vaccine Knowledge (VAX_KNWL) is defined as individuals' level of knowledge about the COVID-19 vaccine. In order to measure individuals’ knowledge about COVID-19 vaccination, we utilized a one-dimensional scale consisting of nine items which was originally developed by Zingg and Siegrest (2012) to evaluate general vaccination knowledge. Our scale was developed based on the 'Myths and Facts about Vaccines' guidelines established by the Centers for Disease Control and Prevention (2023). Participants were presented with nine items and asked to indicate their response as either True, Do Not Know, or False for each item. To analyze the data, we assigned one point to participants for each correct response and zero point for incorrect or 'do not know' responses. COVID-19-related Information Seeking (InfoSeek) in this study refers to participants’ pursuit of COVID-19-related information and was measured with their responses to a 5 Likert-style scale (Strongly disagree to Strongly agree). To address our research question, we tested the following two null hypotheses:

H₀₁: There no significant differences in COVID-19 vaccine knowledge levels among the 3 groups of people (vaccine received; vaccine declined; and vaccine hesitant) in the Black community?

H₀₂: There is no association between people's COVID-19 vaccine knowledge level and their information seeking behavior.
DATA ANALYSIS AND RESULTS
Out of the 222 survey responses received, 220 were included in the analysis, as two were excluded due to incomplete responses. To examine the relationship between COVID-19 vaccine knowledge and vaccine status (vaccine received; vaccine declined; and vaccine hesitant), a one-way ANOVA was conducted. Table 1 shows that the mean of the Received group is noticeably higher (\( \bar{X} = 4.1439 \)) than both the Declined group (\( \bar{X} = 1.4231 \)) and the Hesitant group (\( \bar{X} = 2.2903 \)). The normality of the data was assessed using a Shapiro-Wilk test. The test showed that the data were normally distributed (W = 0.903, df = 220, \( p < .001 \)). The standard error, which is a measure of the variability of the sample means, was found to be small for all three groups. This suggests that the means for these groups are precise estimates of the population mean.

Our ANOVA analysis (see Table 2) found significant differences in mean scores for COVID-19 vaccine knowledge levels across the three groups. Specifically, the results indicated a significant main effect of group, with an F-value of (2, 217) = 19.128, \( p < .001 \). This F-test indicates that the model explained a significant amount of variance in vaccine knowledge level, \( \eta^2 = .15 \). The results revealed that the Received group had statistically significantly higher mean score (M = 4.4139, SD = 2.8269), \( p < .001 \) than the Declined (M = 1.4231, SD = 2.0625), \( p < .001 \) and the Hesitant (M = 2.2903, SD = 2.0597), \( p < .001 \). \( H_0 \) was rejected. Additionally, Tukey HSD post-hoc test was performed to examine significance of pair-wise group comparison (Table 3). The HSD test results showed that there are significantly difference in mean scores between the Received group and both the Declined group and the Hesitant group. However, there was no significant difference in mean scores between the Declined group and the Hesitant group.

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>248.815</td>
<td>2</td>
<td>124.407</td>
<td>19.128</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Within Groups</td>
<td>1411.385</td>
<td>217</td>
<td>6.504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1660.200</td>
<td>219</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. ANOVA Results of Group Differences on COVID-19 Vaccine Knowledge

<table>
<thead>
<tr>
<th>Tukey HSD</th>
<th>VAX_Status</th>
<th>Mean Difference</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received</td>
<td>Declined</td>
<td>2.72086*</td>
<td>.54720</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Hesitant</td>
<td>1.85362*</td>
<td>.39265</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Declined</td>
<td>Received</td>
<td>-2.72086*</td>
<td>.54720</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Hesitant</td>
<td>-.86725</td>
<td>.59587</td>
<td>.315</td>
</tr>
<tr>
<td>Hesitant</td>
<td>Received</td>
<td>-1.85362*</td>
<td>.39265</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Declined</td>
<td>.86725</td>
<td>.59587</td>
<td>.315</td>
</tr>
</tbody>
</table>

Table 3. Tukey’s HSD Test for Pair-wise Comparison of Mean Differences

To examine the relationship between COVID-19 vaccine knowledge and information seeking, we first examine the match of these two variables. We used PP Plots (probability-probability plots) to compare the cumulative distribution function (CDF) of participant’ COVID-19 vaccine knowledge level with their information seeking, where both variables follow normal distribution (Shapiro-Wilk test for Information Seeking: W = 0.943, df=220,
p<.001). As Figure 2 (COVID-19 vaccine knowledge level) and 3 (Information seeking) show, the plots for both participants' knowledge levels and information seeking show minimal deviation from the ideal cumulative distribution functions (CDFs), indicating a close match between the observed and expected probabilities. The shapes of the distributions of the two plots are similar and well-matched, enabling a meaningful comparison between these two variables. Figure 4 demonstrates the relationship between COVID-19 knowledge levels and information seeking.

Figure 2. P-P Plot of COVID-19 Vaccine Knowledge

![Figure 2. P-P Plot of COVID-19 Vaccine Knowledge](image1)

Figure 3. P-P Plot of Information Seeking

![Figure 3. P-P Plot of Information Seeking](image2)

Figure 4. Relationship Map between COVID-19 Vaccine Knowledge and Information Seeking

![Figure 4. Relationship Map between COVID-19 Vaccine Knowledge and Information Seeking](image3)

We used Spearman's rho to calculate the correlation coefficient for ranked data. (Table 4). Our results revealed a moderate positive correlation ($r_s = 0.309, p<0.001$) between individuals' COVID-19 vaccine-related knowledge levels and their COVID-19-related information seeking behaviors, leading us to reject $H_02$. Our findings suggest that individuals with higher levels of COVID-19 vaccine knowledge tend to engage in more COVID-19-related information seeking behavior, including paying closer attention to COVID-19 news, searching for more information, consulting multiple sources, and actively seeking out COVID-19-related information.
Overall, people in the Black community who have received the COVID-19 vaccine exhibit a greater COVID-19 vaccine-related information compared to those who declined the vaccine or are hesitant about it. There are clear differences in the level of knowledge about COVID-19 vaccines between people who received the vaccine and those who are hesitant to receive it or declined to receive it. Furthermore, the differences in knowledge levels between those who received the vaccine and those who declined it are also significant. However, there is no significant difference in the level of knowledge between those who are hesitant about the vaccine and those who declined it. There is a moderate positive correlation between COVID-19 vaccine knowledge and engagement in COVID-19-related information seeking behavior, indicating that individuals with higher levels of COVID-19 vaccine knowledge are more likely to seek out information related to COVID-19.

**DISCUSSION**

The results of the study indicated several important findings. First, individuals in the Black community who have received the COVID-19 vaccine exhibit greater COVID-19 vaccine-related knowledge compared to those who declined the vaccine or are hesitant adopters. There are statistically significant differences in the level of knowledge about COVID-19 vaccines between people who received the vaccine and those who are hesitant to receive it. The differences in knowledge levels between those who received the vaccine and those who declined it are also significant. However, there is no significant difference in the level of knowledge between those who are hesitant about the vaccine and those who declined it. There is a moderate positive correlation between COVID-19 vaccine knowledge and engagement in COVID-19-related information seeking behavior, which indicates that individuals with higher levels of COVID-19 vaccine knowledge are more likely to seek out information related to COVID-19.

As mentioned earlier in the paper, Black Americans were the most vaccine hesitant racial/ethnic demographic in the United States. Pre-pandemic health inequalities and employment segmentation that disproportionately funnels many Black Americans’ into public facing jobs that are labeled as “essential workers” resulted in a tripartite social reality of over represented Covid-19 diagnoses, hospitalization, and deaths (Millett et. al, 2020). Results from this study suggest two information subpopulations; one, the vaccinated, has high COVID-19 vaccine knowledge and high information seeking. Conversely, the other, composed of vaccine decliners, has low vaccine knowledge and low information seeking. While the current study did not examine how or where vaccine hesitant and declining individuals acquired their information, our results suggest this subpopulation may likely exist in an information environment that is outside of mainstream/ traditional information channels. We propose several strategies that can be leveraged by diverse entities to help propagate critical information to increase health information knowledge and aid information seeking during crisis/ emergency health episodes.

To enhance emergency communication during health crises such as the COVID-19 pandemic, local and regional governments can consider adopting a wireless emergency alert service (WEA) that delivers audio-visual information directly to mobile phone users. This technology is already widely used in the United States to notify people about extreme weather conditions and AMBER alerts for finding abducted children. By leveraging this service, governments can disseminate critical information about community infection levels, local vaccination sites, and links to reliable COVID-19 fact sheets and mitigation strategies. This mobile outreach approach provides a fast and authoritative means of delivering information to individuals who may not access mainstream health information channels. After recent tornado damage, for example, the Governor of Arkansas, sent out a text message that serves as a good example of how emergency communication can be leveraged during a crisis (Figure 5). This message illustrates how governments can use mobile outreach to deliver vital information during emergencies, such as tornadoes or pandemics like COVID-19. By providing a direct link to a comprehensive resource website, governments can ensure that those affected have easy access to the help and assistance they need, while also encouraging others to get involved through volunteering or donating. Overall, this approach helps communities

<table>
<thead>
<tr>
<th>Spearman's rho</th>
<th>VAX_KNWL Correlation Coefficient</th>
<th>VAX_KNWL</th>
<th>InfoSeek</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAX_KNWL</td>
<td></td>
<td>1.000</td>
<td>.309**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td>InfoSeek</td>
<td></td>
<td>309**</td>
<td>1.000</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
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<td>.</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>220</td>
<td>220</td>
</tr>
</tbody>
</table>

Table 4. Spearman’s rho Correlation Coefficient between COVID-19 Vaccine Knowledge and Information Seeking
come together and recover more effectively from disasters, demonstrating the power of effective emergency communication.

Additionally, machine learning techniques can be used in microtargeting to enhance COVID-19 information behaviors within the Black American population. Microtargeting involves data analytics to identify specific subgroups of Black Americans who exhibit vaccine hesitancy or resistance, and customizing messages and communication channels to address their concerns. Machine learning algorithms can examine data from diverse sources, such as social media platforms, to detect attributes and actions of Black Americans who are hesitant or resistant towards vaccines. Natural language processing (NLP) can be used to analyze social media posts to understand their concerns, fears, and hesitations regarding the vaccine. Based on this data, public health campaigns can employ tailored messaging and communication platforms to tackle their concerns and enhance vaccination adoption (Chen, Liu, & Peng, 2019).

Another strategy includes involving local communities and their leaders in public health initiatives to augment effective dissemination of information. Collaborative filtering is a machine learning technique used to make predictions about an individual's preferences or behavior based on the preferences or behavior of similar individuals. This technique can be used in microtargeting to improve COVID-19 information behaviors among Black Americans (National Academies of Sciences, Engineering, and Medicine, 2021). Collaborative filtering models can analyze data from various sources, such as social media platforms, to identify individuals with similar preferences or behavior to those who are vaccine-hesitant or vaccine-resistant (Hacker, Auerbach, Ikeda, Philip, & Houry, 2022; Moore et al., 2022). Based on this analysis, microtargeting strategies can be designed to promote COVID-19 vaccination in the identified subgroups of Black Americans (Laurencin, 2021).

CONCLUSION
This is one of the very few studies, in Information Science, that centers Black American information practices related to the novel coronavirus. Over the last two years of the pandemic Covid-19 vaccine hesitancy has been a salient issue in the Black American community, with broad impacts and consequences; therefore, we examined relationships between coronavirus vaccine status and individuals’ coronavirus vaccine knowledge and information seeking about the coronavirus. Our results demonstrate that individuals who have received the COVID-19 vaccine exhibited greater COVID-19 vaccine-related knowledge compared to people who declined the vaccine, or were hesitant adopters. We did not observe a significant difference in the level of knowledge between those who are hesitant about the vaccine and those who declined it. Finally, we found a moderately positive correlation between COVID-19 vaccine knowledge and one’s engagement in COVID-19-related information seeking. The current study has identified a deficit in both coronavirus vaccine knowledge and information seeking among the vaccine hesitant and those who have declined the vaccine. We have proposed several narrowcasting techniques and strategies that
could be leveraged by local, state, and federal governments to help propagate critical information to increase health information knowledge and aid information seeking during crisis/emergency health events.

There are some limitations to our study. The coronavirus pandemic was a crisis event that spanned multiple years. Data for the present study was collected in June of 2021. It is possible that participants' views evolved throughout the pandemic and those fluid perspectives are not captured in this dataset. The results of this study also suggest several key directions for future research. While this study focused on Covid-19 vaccine knowledge there is an additional need for a more holistic approach that focuses on general vaccine knowledge and information seeking among Black Americans. Previous studies suggest other hesitancies with vaccine uptake, for example with influenza; as such the correlations noted in this study may also have an antecedent in the Black American community that is principally based on vaccines in general. Additionally, we see a need to examine other interactions with vaccine status. The literature suggests that some hesitancy is related to “structural inequalities, structural racism” which results in general distrust of the government and medical community alike (Dada et al., 2022). Therefore, future study will examine discrimination as a predictor of vaccine status. While some studies have measured discrimination as a variable within vaccine adoption, we have observed that none of this work emanates from an Information Science perspective. If we can better understand COVID-19 information behaviors and practices among Black Americans, we can establish better information dissemination techniques in the United States before the next pandemic.

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“Garbage Bags Full of Files”: Exploring Sociotechnical Perceptions of Formats within the Recovery and Reuse of Scientific Data

Wagner, Travis L.
University of Illinois at Urbana-Champaign | wagnert@illinois.edu

Fenlon, Katrina
University of Maryland, USA | kfenlon@umd.edu

Sorensen, Amanda
University of Maryland, USA | asorens1@umd

ABSTRACT
This paper explores the social and technical perceptions of physical and digital formats as they relate to work in the recovery and reuse of scientific data, specifically historical, archival, and defunct data sources. Proprietary and obsolete formats, or formats that need significant transformation work, stand out as central challenges for scientists and data curators who are recovering reusable data from archival or legacy data sources. The challenges confronting data sharing and reuse of contemporary scientific data are already known to be myriad; formats often pose a major, compounding challenge to retrospective data curation research and practice. Based on 23 qualitative interviews with practitioners conducting data recovery and reuse, ranging from marine biologists to data librarians, we study how they understand, engage with, and utilize formats within their data curation work. This paper enumerates the formats deployed throughout the scientific data curation process and explores how practitioners creating and curating scientific data based on historical and archival materials encounter, make sense of, and utilize formats. The paper focuses on practitioner perceptions of formats around the following themes: how practitioners’ historical relationships to certain challenging formats inform their ongoing curation practices; the importance of contexts in prioritizing or ignoring formats within scientific curation work; and how formats reveal larger sociotechnical issues. The paper concludes by with practical and theoretical implications of navigating formats within the recovery and reuse of scientific data and offers suggestions for reconfiguring formats within broader data curation lifecycles.

KEYWORDS
Formats; data recovery; data reuse; scientific data; sociotechnical issues

INTRODUCTION
Research and practice in the field of scientific data curation have provided a growing body of guidance and tools for sharing and reusing recent and future scientific data, but attention to retrospective practices of curating scientific data from historical or otherwise defunct materials has been relatively limited. This leaves in limbo untold masses of potentially valuable scientific evidence—in archives, on hard drives in the basements of scientific labs, or in the papers of retired scientists, for example. Yet, these data have significant potential value to longitudinal and integrative data reuse, proven by a growing body of work on historical data reuse to support active scientific research in many fields (Choudhury, 2017; Mayernik et al., 2017; Pasquetto et al., 2017; Thomer, 2022.). The Recovering and Reusing Archival Data for Science project is investigating data recovery and reuse efforts that focus on legacy or historical data within a wide range of institutional, disciplinary, and research contexts, in particular to explore the distinctive challenges of curating data from legacy research sources as opposed to curating contemporary data. One central challenge that has emerged from interviews with scientists and curation professionals doing data recovery work lies in the material and digital formats of the data sources themselves. While contemporary curation work focuses on data that already exists as such, retrospective work often involves significant format conversions, including data extraction and transformation work. This paper explores this central challenge of data formats as a distinguishing factor between contemporary and retrospective data curation practices.

Formats provide but one context for broader practices, trends, and challenges in the recovery and reuse of archival data. Across processes of recovering, reusing, and storing data, formats—including the types and analog formats of physical media, as well as digital file formats or filetypes—serve as surrogates for data, mediate between archival preservation and curatorial usability, and often offer proprietary hindrances to reuse across physical and digital contexts (Rosenthal, 2010). Not all formats are created equally. Some are designed to offer a long-term solution for preserving information (Hodge & Anderson, 2007; Park & Oh, 2012), whereas other formats function exclusively as conduit for documentation (Pearson & Webb, 2008; Duretec & Becker, 2017). The fluidity of formats only grows when working to differentiate between digital and physical, and the migration from analog to digital surrogates and from obsolete files to new digital files (Sherring et al., 2018). Additionally, little is known about the range of places where scientific data recovery work happens and, by extension, the importance of scientific data recovery work more broadly, including the inevitable impact of formats on this work. In spite of clear calls for dealing with format obsolescence (Casey, 2015) and advocacy to make format migration work within cultural heritage institutions more visible (Lischer-Katz, 2019), the sociotechnical role of formats in data recovery and reuse remains under-examined.

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This qualitative study utilizes findings from 23 interviews with practitioners conducting data recovery and reuse across disciplinary and organizational contexts. The overarching goal of this study is to identify common challenges for scientific data recovery and reuse across disciplines. However, one prominent theme that emerged in our findings was the wide variety of physical and digital formats with which scientists and data practitioners wrangle in the process of their recovery work. Therefore, this study focuses on a subset of our findings: on how participants discuss their perceptions of formats in the production and distribution of scientific data recovered from historical, archival, or defunct sources. First, this paper offers up an enumeration of format types across physical and digital scientific data contexts. Second, it offers insight into how practitioners identify their own curatorial expertise in relationship to formats, how practitioners contextualize the value of any given format, and what particular formats reveal about the sociotechnical issues informing institutional support of scientific data recovery and reuse.

LITERATURE REVIEW
Sociotechnical Issues in Digital Preservation/Curation
There exist well-established concerns around the dire need for proactive digital preservation and curation within cultural heritage institutions (Hedstrom, 1997). Sociotechnical concerns regarding digital preservation and curation include several issues: identifying institutional preparedness for digital preservation workflows (Ahmad & Rafiq, 2022); planning for long-term preservation of web-based content (Day, 2006); scaling institutional resources to assure digital sustainability (Montoya, 2016); and assuring that materials include enough context to explore diverse and understudied histories (Sheffield, 2016). In spite of the variety of generative outcomes associated with planning for and implementing thorough methods for digital preservation and curation, institutional and stakeholder support remain limited if present at all (Council on Library and Information Resources, 2013; Poole, 2016). In addition to the challenges associated with supporting digital preservation and curation, the perceived skills necessary for digital curation work often prove overly demanding and too technical for many practitioners (Kim et al., 2012). Further, robust preparation for the needs of digital preservation and curation remain absent from curricular pedagogy, especially within library and information graduate programs (Kim et al., 2012; Sheffer & Hunker, 2019). In response, solutions to addressing digital preservation and curation concerns range from seeking support from publishers and vendors (Smit et al., 2011; Narlock et al., 2021) to collaborative consortia work aimed at offloading costs, labor, and expertise across institutions (Trehub et al., 2019). Despite progress towards digital preservation and curation solutions, there still exists an abundance of content held in an equally abundant amount of formats. As a result, scholars have begun shifting focus to social practices of digital curation and preservation beyond institutions within what Costis Dallas (2016) identifies as the “wild frontier” of digital curation.

The continued rise of participatory digital ecosystems necessitates expansive considerations on the roles and responsibilities of digital preservation and curation. These shifts in participation require institutions and practitioners to reimagine how they understand their work and how we train individuals to identify, enact, and prioritize digital curation work (Becker, 2018). One response to this increased social responsibility includes open data and citizen data work, especially within the sciences (Molloy, 2011; Purdham, 2014). As a result, the obligations associated with allowing for open participation in data curation raise questions around usability and barriers to access which, as will be discussed, surface questions around uniform, long term accessible file formats (Juell-Skielse et al., 2014). In addition to making curation work more open and collaborative, shifts in focus include valuing and prioritizing community-based data curation and understanding legitimate community choices to keep their own data outside of institutional settings (Curry et al., 2010; Dallas, 2016; Gupta et al., 2023). Additionally, awareness of uneven institutional support and infrastructures for digital curation paired with many different community needs for data has resulted in a shift towards valuing both professional and amateur labor in the digital preservation and curation processes across physical and born-digital contexts (Cox, 2009; O’Neil, 2017). Importantly, the shifts towards amateur and community digital curation work opens up venues that provide methods for both institutional, content building vis-a-vis something like the National Archives and Records Administration's Citizen Archivist project (Liu, 2021).

Formats and Data Curation
The rise in digital librarianship and the responsibilities by libraries to curate both digitized and born-digital data increased concerns about both format and technological obsolescence issues and the perceived role of information institutions and their staff members (Yadav, 2016). For academic libraries format migration represents a sliver of a broader digital curation environment, which already suffers from a lack of technical expertise and infrastructural support for relevant training on contemporary formatting needs, let alone the identifying, preserving, digitizing, and migrating obsolete formats (Rahman, 2020). Additionally, both institutional and community archives face quandaries with attending to obsolete formats, often having to offer reactive migration solutions when attending to obsolete formats, which range from transferring information from one unstable format to another rather than identifying long term preservation solutions. Further, the aforementioned lack of support both in terms of labor and resources results in archives often prioritizing rare or valuable materials at the expense of seemingly mundane or
arbitrary materials (Baker & Collins, 2017). Despite both the scientific and humanities disciplines understanding the value of data stored on obsolete formats, most institutions sorely underutilize these collections, again centering preservation and migration efforts towards more high-profile materials and collections such as rare books and manuscripts (Ordelman et al., 2019). Scholars argue that part of the reason valuable data takes precedent over the uniqueness and complexity of formats often has more to do with the expertise to use data production tools, broader access to technologies in producing information, and infrastructure to hold and treat equal all formats (Jancovic et al., 2019). As such, the obligations for format preservation and the curation of data associated with these formats became a dispersed endeavor. For example, in the case of preserving formats associated with sound recordings, work toward the restoration of older formats (i.e., a vinyl record) co-occurred with digital preservation efforts that preserved copies, alongside access copies (Canazza, 2012). Alternatively, when dealing with formats that are both physical and in need of digitization, and formats that are born-digital and in need of quality checks and reformatting (i.e., proprietary time-based media) the utilization of microservices, such as digitization vendors, takes precedence over internal solutions (Rice and Schweiker, 2019). Materials held on obsolete formats, which represent marginalized groups advocating for material repatriation can also force institutions to address migration and preservation, as occurs within Indigenous work around media sovereignty and ceding control back to tribes and their affiliates (Ginsburg, 2016). In turn, distributed networks of institutions, communities, and divergent and overlapping stakeholders result in a variety of approaches. Indeed, methods of preservation at the cross-organizational level provide useful methods for format specific endeavors, ranging from physical film heritage preservation (Antoniazzi, 2021) to preparing for ingesting and curating born-digital three-dimensional and augmented reality data (Hall et al., 2019).

Recovery and Reuse of Scientific Data

The past two decades have witnessed the rapid advancement of research and practice in scientific data curation, as the potential public value of shared research data has gained widespread recognition among a range of stakeholders, including scientists, data managers, funders, etc. The proliferation of sociotechnical infrastructures for supporting data curation and reuse—ranging from federal open access mandates to data repositories, from credentialing programs on best practices guidelines, such as the FAIR and CARE principles (Wilkinson et al. 2016; Carroll et al. 2020)—has largely focused on making interventions in the sharing and reuse of current and future scientific data. The vast accumulation of historic data records—or, still more vast body of historic artifacts, documents, specimens, and other sources of scientific evidence containing potential data—has gone largely unrecognized by the data curation field. Relatively little empirical research has addressed the recovery and reuse of scientific data from historical or otherwise defunct sources, despite the proven value of these data for supporting active and ongoing scientific research.

Historical data demonstrably support longitudinal and meta-analyses, computational modeling, and cross-disciplinary research in various domains (Wyborn et al., 2015), including ecological and climate research (e.g., Specht et al., 2018; Brunet & Jones, 2011); oceanography and earth sciences (e.g., Fallas et al., 2015; Hsu et al., 2015); archaeology (e.g., Kansa & Kansa, 2022; Faniel et al., 2013); astronomy (e.g., Borgman & Wofford, 2021); and biological sciences, health, and medicine (Wolinetz & Collins 2020; McKeown et al. 2021; Meystre et al. 2017). Scientists recover historical and otherwise defunct data to serve a broad range of research purposes. Pasqueto et al. (2017) offer distinctions among different kinds of data reuse: reuse to serve the reproducibility or replication of research outcomes; independent reuse, targeting fundamentally novel questions; and integrative reuse, which combines data from multiple sources to serve comparisons, new models, or new research questions altogether. Historical data reuse practices may exemplify any of these categories.

What is often called “data recovery” or “data rescue” is the process of enabling the reuse of data being salvaged from digital or analog sources (of many kinds) that have been compromised by any number of factors, including natural disasters, political or organizational shifts, technological decay, obsolescence, and gradual obscurity (Wyborn et al., 2015). These data may lie in handwritten tables within the papers of a retired scientist, lying unprocessed in the basement of an archive. They may live on the disappearing web pages of a governmental research agency during a shift in political administrations (as in the Data Refuge initiative — see Janz, 2018). They may have been lost to time, their traces only visible in published, visualized charts and graphs that reference source numbers that have evaporated. They may be buried in inaccessible file formats on a defunct harddrive—or, in contrast, they might be eminently accessible from a technical perspective but unusable due to uncertainty around intellectual property constraints.

Data curation as a field is concerned with making and keeping data accessible for lifecycles of use and reuse over time, including practices and processes such as data sharing, data citation and evaluation, documentation, description, and preservation (Cragin et al., 2010; Higgins 2008; Vearncombe et al. 2017). Within this broader field, data recovery emphasizes aspects of curation applied to data no longer in use, or data that are not usable: data that are at imminent risk of being lost, data that are not usable as such, and data from the past. In many cases, data being
subject to data recovery were never shared as such, or never intended for broad distribution or open-ended reuse, and therefore lacking documentation, computational amenability, and critical context. Mayernik et al. (2020) offer a matrix for understanding the risk factors facing research data, including losses of funding, losses of contextual knowledge, catastrophes, changes in legal status or ownership, and cybersecurity breaches. Even for data in current use, or data living in preservation repositories, the challenges facing their endurance are significant. Historical or otherwise defunct data face the same challenges, but compounded by the passage of time, separation from original creators and contexts, technological deterioration, software obsolescence, and more.

Data recovery is invariably resource-intensive. It often entails manual workflows, involving aspects of contextual research, digital-forensic work, digitization, transcription, and other significant interpretive and analytic work. Because of scale and manual labor, the most highly visible and scalable projects come from crowdsourcing (e.g., Eveleigh et al., 2014). Data recovery also often requires networks of collaboration, and relies on specialized skills that are not widely held, whether among scientists or data curators (Griffin, 2015). Moreover, the process of data recovery may raise new ethical considerations for the welfare of human subjects represented in data, or for communities whose sensitive knowledges may be represented in historical data sources. While the overwhelming focus of data curation research and practice are on contemporary and future data, there are important strands of work that have made significant headway on data recovery and data rescue, including but not limited to the Research Data Alliance Data Rescue Interest Group and the CODATA Data-at-Risk Task Group. The prior work in this vein has characterized endemic challenges to data recovery and reuse from at-risk sources, and identified opportunities for support from libraries as well as the necessity of cross-institutional collaboration (Murillo, 2014; Choudhury, 2017; Mayernik et al., 2017).

METHODS

The objective of this research was to uncover both shared and distinctive practices among data recovery practitioners in diverse institutional and research contexts. Interviews were conducted to examine case studies involving the retrieval of analog data, such as scientific formulas written by hand, and born-digital data that often existed in outdated file formats. After presenting the case studies to researchers in different agricultural subdisciplines and realizing that recovery practices were more prevalent than previously thought, the scope of the study was expanded to encompass information practices across disciplines among scientists and curators involved in data recovery work. The research presented here focuses specifically on a subset of questions related to the role of formats in their curatorial work, for a more expansive explanation of topics and findings see (Sorensen et al., 2023).

Following IRB approval, the research team engaged in 23 semi-structured interviews with practitioners across the scientific data curation landscape including: archivist, scientists, librarians, scholars, and individuals working in institutional capacities adjacent to scientific data curation such as museums, crowdsourcing endeavors, and observatories. Questions engaged participants in topics related to their experiences with scientific data curation, methods and tools for evaluating and identifying recovery worth data, procedures for recovering data, and challenges that emerged in their work. Of particular focus for this paper are questions related to the challenges and experiences working with formats in the recovery and reuse of scientific data. Interviews ran for approximately an hour and with the permission of participants were audio recorded. Upon transcription all audio recordings were deleted. A codebook was constructed emically by identifying key themes drawn from participant discussions (Guba & Lincoln, 1994). Figure 1 represents the sample code, definition for Formats, as well as a relevant quote.

| Formats | Particular formats, file formats, documentation practices or policies, metadata standards (formal or informal), or other facets of representation and description. | P01: "Yeah, we have Microsoft Excel spreadsheets. We have CSVs, we have database files, some created in Access, some created in SQL, some created in other languages…” |

Figure 1. Sample of Formats code used in analysis

In order to ensure validity, the team engaged in constant comparative coding to achieve intercoder reliability (Boeije, 2002). Emergent topics arose during coding meetings, the team examined these topics, built new codes, and reapplied additional codes accordingly. All participants were assigned a unique identifier (e.g., P01) to ensure anonymity. Additionally, when necessary, we have redacted personally identifiable information from transcripts.

FINDINGS

The findings enumerate the format types present within scientific data curation. This enumeration, while not a quantification of all potential formats, nonetheless provides insight into how scientists and the curators understand physical, digitized, and born-digital formats within the sciences, and what degrees of data structuration exist across these formats. The range of formats from which scientists and curation practitioners are conducting data recovery is striking, and necessitates in turn a wide range of transformational practices in the process of recovery. The findings
also explore the sociocultural factors that inform the navigation of formats within scientific data curation, highlighting issues surrounding the role of practitioner expertise in curation across formats, the impact of perceived informational value as a context for engaging with potentially challenging or obsolete formats in data curation work, and how practitioners’ relationships to formats within their curatorial work expose larger sociotechnical issues within recovery and reusing scientific data. Of the 23 participants, who ranged on a spectrum from scientists to data curation professionals (many of whom have joint expertise in a domain science as well as in data curation), 7 may be understood as falling closer to the “scientist” end of the spectrum, and 16 closer to the “data curator” end.

Enumerating Format Types

Broadly speaking, formats often fell into one of three categories. Formats were either physical (i.e., handwritten notes), digitized from a physical origin (i.e., scans of microfilm), or born-digital objects (i.e., 3D data models). Not all formats easily fit this distinction, of course, formats like 5 ¼” floppy discs existed as formats housing digital files, but their physicality and need for relational hardware make their relationship to the constraints of physical formats more prominent. Equally, not all formats discussed by participants neatly map onto a linear understanding of the physical format to digitized format workflow. Participants identified, for example, the presence of printed emails, webpages, and other born-digital documents as part of their navigation of formats, often raising questions about the origin and location of the born-digital originals. Participants also treated file formats as equivalent to physical formats, discussing their structure, usability, and even obsolescence in similar terms. Examples of file formats discussed ranged from basic data files (i.e., .CSV) to structured digital objects (i.e., .JPEG) as well as more complex digital objects related to scientific research, such as .DICOM files which represent a format used extensively in the production of computerized tomography (CT) scans. Perhaps most unique within the framing of formats by scientists and scientific data curators were the treating of physically occurring objects as a format type. Given that scientific disciplines such as geology and archaeology rely on natural objects, multiple participants identified rocks and fossils as a format type in their work.

Practitioners working with scientific data enumerated formats across a landscape of structured and unstructured data. Unstructured data often emerged at the creation or ingestion phase of recovery and reuse work and included physical formats (i.e., handwritten notes) as well as unstructured digital data such as digital photographs from archaeological sites. Formats discussed also included both physical and digital semi-structured data such as handwritten logbooks and .TSV files with unique tabulations and multifaceted relationship between data points. In terms of structured data, physical formats included discussions of objects like punch cards used in computer processing, whereas highly structured born-digital formats represented automated data gathering via technologies such as satellites and barometric tools. As with distinctions between physical and digital formats, the categories of unstructured, semi-structured, and structured believe how many formats rest upon particular relationships to other software, hardware, and related elements. For example, participants discussed working with Apple Hypercards and other storage devices, which relied on proprietary software only retrievable through emulation. As such, while practitioners can view data stored on these devices, it is often impossible to open the files, leaving the practitioners to do interpretive work not dissimilar to their engagements with unstructured data. While exhaustively listing each format is beyond the scope and space of this paper, the following chart provides a range of format types and structuration [Figure 2].

![Figure 2. Formats based on their degrees of structuration and proximity to being physical or born-digital](image-url)
While the metrics for the graph are arbitrary, locations represent the degree to which an object falls on two axes: on the horizontal axis, ranging from physical to inherently digital or born-digital; and, on the vertical axis, how structured unstructured a source is as a data source. By “structured,” here, we refer to the inherent logical or formal structures of data contained by or derived from the source. Where data are already explicit, and especially where they are tabular, quantitative, or computationally amenable, the data source are not explicit, or must be derived, analyzed, or created through interpretation of the source, we consider this an “unstructured” data source.

The goal of this chart is not to offer an accurate or comprehensive ontological characterization of the data sources, but rather evoke their range and variety on a couple of particularly relevant dimensions.

For most items on this chart the distinctions are clear. A specimen, for example, is both incredibly unstructured as data and wholly physical, placing it squarely on the bottom left of the chart, whereas biometric data is both incredibly structured and entirely digital placing it in the top right corner of the chart. Some objects remain more complex, such as a CD-ROM whose content may include structured data, but the requirements of additional hardware and software to open it cause it to remain unstructured and somewhere between purely physical and purely digital format. Alternatively, photographic images exist between the physical and the digital depending on their mode of production, however, all require the same degree of interpretive data making them low on the y-axis (unstructured) and somewhere near the middle of the x-axis (physical or digital). We acknowledge that some of these categorizations are debatable, but have done our best to reflect the unique ways that practitioners working in scientific data curation and reuse understand these formats.

**Embodied Knowledge and Format Expertise**

Practitioners often framed format expertise as part of an embodied knowledge that comes with the territory of scientific data curation. Participants would often evoke a specific format and connect it directly to a historical moment in scientific data curation. P01, a data curator at a national library, in acknowledging changes between contemporary born-digital file formats, noted having had to use CDs in their own prior preservation work, commenting to the interviewers that, “we also have very old database files, we, we used to just put out a CD ROM, your young folks might not remember CD ROMs.” For P01 the reality of format obsolescence is such that researchers on this project, who are likely only a generation removed in age, would be completely unaware of the role a format played in the daily storing and distributing of data. P13, an information science professor, signaled their own relationship to obsolete formats as an inherent challenge learning to prioritize good digital curation practices due to having to “reuse someone else's data [who] graduated” only to discover “that there was no documentation” and instead they were only “handed a floppy disk.” For P13 the experience led them to realize the value of migrating data whenever possible and to assure that proper documentation exists external to a format should someone need a sense of what data resides on a format relying other hardware and software to open. P04, a historian of science, exposes how embodied knowledge can actually serve as a deterrent to innovating on modernized approaches to scientific data recovery and reuse stating:

> I actually was supposed to do a project when I was an undergraduate, using punch cards, that was in 1985 or so, 86. But then I just like, there's no way of doing this. I just told the professor; I'm just going to take these cards and migrate them to something reasonable. So I took him to the computer center, back when we had computer centers. And they turned on the IBM machine and shuffled all the cards and transferred it all into a prime system. I think it was so and I'm like, I'm very happy. I did my research project using the prime version of the data that I gave him back his giant box of cards I was supposed to use along with the digital data.

For P04, their expertise ran against a culture of practice wherein a “reasonable” format misaligned with a preferred format, potentially exposing other instances in which physical formats were in need of digitization. P04, however, also admitted having to confront their own preferred format and migration preferences. Specifically, P04 recalled doing digital imaging work prior to the rise of cheaply available multi-terabyte storage and holding off for far too long before investing in the storage mechanism, assuming it to be costly and an inefficient long term solution. P14, an archivist, extends P04’s observations to another context by noting that historians of science often fail to embrace the value of physical formats since, as they suggest of historians: “we're old fashioned. We like paper. Right? So it's just hard to break out of that mold.” P14 denotes not an individual practitioner centering a format’s use, but an entire field of practice which invites speculation as to potential selection biases within scientific historiography.

Finally, an additional finding related to experiential knowledge and its impact on scientific data curation work ties to having training directly connected to format use, curation, and preservation. Recollecting again their own learning about the challenge of scientific data via the curatorial challenges of a floppy disk, P13, an information science professor, acknowledge that:

> Had I not been working in a geochemistry lab, I wouldn't have had the ability to recreate that and rerun a portion of the experiment to double check to make sure that, that the larger data set was correct. So and
that comes back to the comment from earlier, the most precious data is that data that cannot be recreated in that way. I mean, I had a very easy moment, where yeah, I was handed a floppy disk and said, "you know, use this data," but I had the ability to walk down the hall, and recreate the data.

P13’s experiences with the recreation of data being inextricably linked to a floppy disk raised within them an understanding of the value of a format role in operationalizing data reuse, causing them to prioritize and center the utility of a format with an understanding that doing so might also require changing to newer formats and file types in the future. Conversely, participants also acknowledge that their lack of embodied knowledge led them to moments of incredible confusion when tasked with migrating and digitizing a variety of formats related to scientific data recovery. In particular, P14 noted: “I had one digital imaging class where I imaged two postcards, both sides, and uploaded content into CONTENTdm and wrote metadata for it.” P14 went on to note that this lack of more enriching contexts around learning about the impact and role of formats in digital curation workflows has resulted in them having a learning curve when it comes to navigating formats in their current work. P07, an information science professor, who also teaches courses in digital curation, acknowledges the challenges of incorporating this type of format migration and digitization in classroom settings stating that “I feel like I have to eat my own dog food as a digital curation teacher. Because I teach all these best practices about file management using good names and unique identifiers. And then when you actually put it into practice, it's really hard.” P07 helps contextualize the avoidance of detailed format-based digital curation pedagogy by attending to the need for too many contextual factors to create a truly representative experience. As we will discuss in the upcoming finding, this type of contextualization proves deeply important to navigating and prioritizing certain formats in scientific data recovery and reuse.

P16, a historian of science, connects contemporary born-digital format knowledge with broader historical scientific data curation and the boons and hindrances of each paradigm in scientific data curation by reflecting:

So I think there's like a little bit of inherent mystery to some kinds of born-digital research, as a researcher, and then as somebody that does acquisitions work, it's a little bit more confusing...there’s a sort of golden age of born-digital acquisitions that we're already moving out of. And that is, like, some old person has like an old hard drive, and they could just hand it to you. And all the files are on the hard drive. And you can just copy them on.

For P16, the born-digital age of formats perpetuates and despite having had a “golden age” remains latent with challenges simply not present in a time where researchers could hand over their data on a storage device and migrate files to a digital repository. P16 also evokes the idea of “mystery” as informing some of the work from a researcher's side of scientific data recovery and reuse, an acknowledgement which explicates another of our findings concerning the value of contextual clues in navigating viable and challenging formats in digital curation work.

**Informational Values of Formats are Contextual**

Participants perceived various formats within the recovery and reuse of scientific data to prove either context-rich or context-void, which often informed how they went about prioritizing or steering clear of particular formats. Indeed, P16, whose previous discussion regarding the lack of mystery in receiving a hard drive from a research, notes that born-digital files, especially those related to proprietary software always come with contextual hindrances. P16 noted: “With digital files, maybe there's some clue that you can't access because you don't have enough information about like the context of the program, or, you know, like how the code is put together.” For P16, even though they can acknowledge that they are dealing with a digital file associated with particular programs or contexts, without being able to open the data in the required setting, they remain, at best, inclined towards inferences about what the broader dataset represents. Though P16 does not explicitly state a file format during their discussion, it likely echoes a concern raised by multiple participants around proprietary database software, which often remain inoperable as anything other than .CSV file datasets, which require considerable reconfiguring and reconstruction to rework in their original tabular form. In this case, P16 identifies a format with rich context, but proprietary barriers make the contexts of use nearly impossible to identify. P20, a metadata manager, extends P16’s observations about the distinctions between understanding the context of what a given format consists of and questions of contextual use of a given format. P20 explores how merely making available scanned PDFs of documents is not akin to providing users with the data housed on said PDF, asking “how do we get that [document] in a form people can see it, and then how do we get it in a form that people can reuse it easily.” In their discussion of reuse, P20 further clarifies that users can add layers to a PDF including a transcript, but due to resource constraints providing that additional layer from a practitioner workflow end proves untenable. P20’s example provides insight into practitioner awareness around how to extend the contexts of formats, but concedes to limited support for doing such contextualization, which as we will show in our next section reveals how formats often expose more systemic sociotechnical challenges within scientific data curation.

Participants like P17, a data librarian, identified formats that could be deeply rich contextual resources, but seem contextually challenging due to their size and scope. In discussing log books associated with cruises and naval
expeditions, P17 admits that they “don't really expect anyone to go through a 400 page cruise report to find what they need.” However, P17 also notes the potential loss of rich scholarship in this understandable avoidance as many of the logbooks include a “lot of really ad hoc, super interesting, fun stuff,” including what their organization “call[s] the ship's narratives.” P17 explained a ship’s narrative in the following way: “So every day or every few days, the chief scientist of the research crews, writes a log of what was going on that day and what they've been doing.” Latent in these explanations, P17 notes that additional scientific data, such as meteorological and oceanographic patterns, emerge within the logbooks; however, they also suggest a potential value in utilizing the massive logbooks for work related to the social practices of ship captains and their crews. In response to their own concession that the logbooks are contextually massive, P17 approaches sharing out the logbooks in smaller formats such as single document files or reports, which they then share across social media as a way to both encourage use and alleviate the contextual barrier of information overload.

When navigating the question of context within born-digital formats, multiple participants argued that a combination of good preservation workflows and intentional file-level metadata could help to enrich the context of a format. In the case of P05, a data science librarian, they identify codebooks as a format whose contextual richness occurs through their having “pretty standardized documentation,” which allows for a “sort of provenance piece” regarding “how the data were collected and all of that.” For P05 the fact that codebooks often include things like the creator of the code, geographic location, and guidelines on how to interpret codes means that the format often invites use and reuse through ease of design. Alternatively, P11, an information science professor, identifies their own role in helping to assure context-richness within geo-located data observing:

“[the] data is geo-located, it's time stamped, it is validated, there's historical models to run it against it is, it is absence/presence-based so you can use it for more things because absence is implied as long as I say it's a complete checklist”

For P11, not only is the database in question richly contextualized in terms of how data were gathered, its association with a university-funded project and its crowdsourcing through scientific knowledge generation, affirm its contextual richness as authoritative. In contrast, P05 (data science librarian), argued that their engagement with codebooks, while context-rich, held no explicit a tie to co-production, which raised questions about the validity of the data generated and its potential for reuse. While both examples refer to born-digital documents, a physical equivalent emerged by way of P15, an archivist, who noted that their organization “obviously uses finding aids” to help provide context to otherwise physical formats with minimal contextual access points.

**Formats Expose Broader Sociotechnical Issues within Scientific Data Curation**

Given that format digitization and migration occur within larger ecosystems and, as suggested by the literature, often remain under-supported by institutional stakeholders, dealing with the complexities of formats for some practitioners occurred in response to the demands of broader social influences. In the case of P14 (archivist), their organization’s heightened security demands and lack of viable software led to a need for software updates, which, in turn, required that they do away with software used in emulating obsolete formats. Of the need to move away from obsolete file formats, P14 said:

*This is purely an infrastructure issue and a tracking of concerns about security, concerns about being able to track the machines. So we have this tension where we can't, you know, these obsolete software will not pass security review, in many cases, but we need the software in order to emulate the content. So we're trying to work through if we can, or the OCIO (Office of the Chief Information Officer) was trying to work through where and how they could set up a server that could do all of the many things that we needed to do...*

For P14 and their institution, grappling with format relevance occurred through broader sociotechnical demands around cybersecurity, which necessitated altering digital file standards as a safety precaution. Fortunately, P14 utilized the opportunity to create a solution for longer term preservation tied to dedicated server space. Other participants such as P15 exposed sociotechnical barriers to their ability to engage with the best practices of format migration, in response to external regulations on how and where governmental organizations could spend money. In needing to attain obsolete hardware for format digitization P14 recollected:

*I had to purchase some of the necessary programs to provide access. And that's because these programs are no longer being produced, and they're not being produced by a federally approved vendor. And the [INSTITUTION] doesn't allow us to use funds to buy things off of eBay.*

Both the physical and digital formats have caused P14 to need obsolete technologies to engage in curatorial work. However, strict mandates on utilizing outside vendors prevent them from achieving not only the easiest, but the most commonly ascribed approach to navigating format obsolescence. Like P14’s expectations to adhere to new cybersecurity protocols in their own navigation of digital formats, P15, an archivist, had to ascribe to bureaucratic
red tape which necessitated seeking out institution-approved vendor collaborations. Sociotechnical challenges emerged as a result of assumptions which understand the creation and curation of data to be a forward-looking endeavor, rather than retroactive maintenance and upkeep. P22, a science director at a research center, furthers P14’s observations by acknowledging that tape-based formats are “degrading more than glass plates do,” and “require specialized readers to manipulate” their data. Further, P22 goes on to lay out the procedural challenges of migrating content from the formats, even with a system of support in place:

And so there’s, you don’t reduce the burden of maintaining these collections just by going digital. And the existence of digital increases cost, right? You have to have a server, you have to have people to keep that up and keep it secure. And you have to refresh it as the technology changes. You can’t, you know, a bunch of CDs written 10 years ago, someone can’t read unless, again, it’s, it’s actively online in the cloud. And then what’s the next thing that happens? So there’s, there’s, there’s this moving technology. How do you maintain a digital collection? And there’s all the costs that go with maintaining the digital and the physical.

So cost is a big issue.

Where P14 noted institutional barriers to digitization and migration work in scientific data reuse, P22 interrogates broader social relationships to data production that remain concerned with advances or moments in which “technology changes” result in a curatorial “refresh,” meaning that data maintained in obsolete formats become cost-sinking initiatives and lead to decisions to simply “throw away” data with the hopes that an observation is available elsewhere. P22 surfaces an unspoken sociotechnical perception of older formats wherein their data is likely available elsewhere and therefore checking becomes counterproductive, despite acknowledgements by other practitioners of hidden contextual value across older format types. Older formats in this framing are simply useless technologies, both in their physical, digital, and potentially even born-digital iterations. To borrow from P16 in what can only be described as a knowingly apocryphal statement, sociotechnical systems and their perceived relationship to formats within scientific curation lifecycles refuse to address the destruction of formats leading to situations where once practitioners “were looking for garbage bags full of papers, now [they’re] looking for garbage bags full of files.” While P16’s statement can be read as decidedly defeatist, it also provides an important site for discussion regarding experiences with formats in the recovery and reuse of scientific data inform digital curation work moving forward.

DISCUSSION

Theoretical Implications

For the participants of this study, there exists a thin line between format-based data that once existed as data as opposed to data lurking within formats related to scientific evidence (specimens, samples, artifacts, documents) that are not yet data. While this distinction should produce a clean binary between data types, the formats encountered and engaged with by participants cut across both contexts creating blurred distinctions between each. In particular, data held across formats become beholden to their immediacy of usability. Formats whose data is easily usable (i.e., retrievable) tend to take precedent in popular curatorial practices. Generally speaking, this means that a born-digital file is presumed to be the most contextually rich resource. While participants certainly acknowledged instances wherein physical preferences dismissed the need for digital surrogates, the centering of digital formats remained a preferred value. Such preferences, however, betrayed larger curatorial practices relational to format migration and sustainability when an overreliance on a particular type of digital format or standard faced proprietary-based challenges (i.e., discontinuing a database design software) or shifts in institutional thinking around data privacy (i.e., the removal of compromisable software from desktops integral to using a particular file format). In each instance the need for access to an older, albeit obsolete format with the same data, could have helped data recovery. Given the realities that many types of data, not just those associated with scientific research, exist only on outdated formats, a shift towards centering challenging formats within this work proves paramount. Formats prone to degradation such as magnetic media do require unique digitization priorities, but as our participants observed older formats can be data rich in unanticipated ways meaning that questions about how we identify sustainability in current format creation and migration can best be understood by looking towards what remains accessible and reusable on older formats. In many ways attending to obsolescence is an act of sustainability, and enacting sustainability means accounting for all possible forms of obsolescence moving forward. In an extension of a somewhat radical take on the archival mantra Lots of Copies Keep Stuff Safe (LOCKSS) allowing for some presence of outdated formats and their data to retain a presence in scientific data recovery and reuse helps to keep stuff sustainably safe.

Practical Implications

Retrospective data curation work necessitates significant transformational work—often highly labor-intensive, and demanding scientific domain expertise—on a strikingly broad range of material and digital sources of evidence. Practitioner responses to the role of formats in their daily work most clearly highlights a well-identified need for more meaningful investments in navigating formats and their contextual challenges across curation ecosystems. Whether it be antiquated rules for how to obtain obsolete hardware or older practitioners refusing to adapt to digital migration demands, the scientists and data curators in this study remain keenly aware of the need for broader
investment in changing goals. As P14 observed, a top-down policy can force immediate, albeit drastic, changes in curatorial practice, but such opportunities when properly leveraged can become sites for negotiating support for format migration, preservation, and curation training. A potential solution to addressing many of these challenges might come from policies which require public facing institutions to run audits of their format holdings. These audits can ask not only for an enumeration of what formats exist within archival and research holdings, but further contexts for what data resides on these formats. Such initiatives would result in proactive rather than reactive response to format concerns and curatorial needs. Given the well-chronicled gaps in digital curation knowledge amongst emerging information science professionals, utilizing more focused and impactful fellowships and internships aimed at identifying and addressing format-based curation needs both within and outside of the sciences. Such initiatives might help raise awareness and even alleviate issues regarding format migration and conversion within scientific data curation lifecycles.

CONCLUSION
The use of formats in the recovery and reuse of scientific data remains a vastly complex undertaking which brings to light various challenges and opportunities to extend questions about format obsolescence, data sources, and informational contexts in data recovery work. Formats function as proxies, impediments, and even linkages between sustained preservation and curatorial reusability. The fluidity of formats is further complicated by the differentiation between digital and physical formats, and the varying degrees with which the data held on those formats possess meaningful structure. Despite the importance of addressing format-based challenges such as obsolescence and accounting for format migration work within cultural heritage institutions, there remains much to understand regarding the sociotechnical role of formats in scientific data curation. Through interviews with practitioners across the scientific data recovery and reuse lifecycle, this paper provides insight into how practitioners perceive formats in relation to the production and distribution of scientific data. Though providing enumeration around formats present within scientific data curation, alongside identifying the importance of experiential knowledge, informational contexts, and sociotechnical influences of format prevalence, this paper illuminates the oft-overlooked potential of formats to expand rather than limit the possibilities of scientific data recovery and reuse. While formats will likely remain sites of instability within data curation lifecycles, the practitioners interviewed remind us that we should think twice before tossing that old hard, as it may well hold within it a data value waiting to be revived.

ACKNOWLEDGEMENTS
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Characterizing and Early Predicting User Performance for Adaptive Search Path Recommendation

Wang, Ben  School of Library and Information Studies, University of Oklahoma, USA | benw@ou.edu
Liu, Jiqun  School of Library and Information Studies, University of Oklahoma, USA | jiqunliu@ou.edu

ABSTRACT
User search performance is multidimensional in nature and may be better characterized by metrics that depict users' interactions with both relevant and irrelevant results. Despite previous research on one-dimensional measures, it is still unclear how to characterize different dimensions of user performance and leverage the knowledge in developing proactive recommendations. To address this gap, we propose and empirically test a framework of search performance evaluation and build early performance prediction models to simulate proactive search path recommendations. Experimental results from four datasets of diverse types (1,482 sessions and 5,140 query segments from both controlled lab and natural settings) demonstrate that: 1) Cluster patterns characterized by cost-gain-based multifaceted metrics can effectively differentiate high-performing users from other searchers, which form the empirical basis for proactive recommendations; 2) whole-session performance can be reliably predicted at early stages of sessions (e.g., first and second queries); 3) recommendations built upon the search paths of system-identified high-performing searchers can significantly improve the search performance of struggling users. Experimental results demonstrate the potential of our approach for leveraging collective wisdom from automatically identified high-performance user groups in developing and evaluating proactive in-situ search recommendations.

KEYWORDS
User performance; Web search; search path recommendation; evaluation; proactive information retrieval

INTRODUCTION
Characterizing user search performance is crucial for modeling user behavior and providing them with customized recommendations in interactive information retrieval. The search path and strategies of users with high performance can be leveraged to enhance other users’ search results and experience under similar search tasks, cognitive states, and intents (Hassan Awadallah et al., 2014; Hendahewa & Shah, 2017; J. Liu & Shah, 2022). Users’ search performance is shaped by several factors, such as domain knowledge (i.e., users’ knowledge background and familiarity with the search task/topic), search expertise (i.e., technical skills and topic-independent search experience) (Suzuki & Yamamoto, 2021), and contextual factors (J. Liu & Shah, 2019a, 2019b). Focusing on search performance, previous research suggested that good-performing users usually have better search strategies and can effectivley accumulate knowledge and cues through interactive search activities (Mao et al., 2018; Suzuki & Yamamoto, 2021). Through leveraging collective wisdom from expert users, collaborative query recommendation can help struggling users with lower performance and fewer skills and improve their search interactions (Halvey & Jose, 2012; Morris, 2008; Morris & Horvitz, 2007).

Existing research has examined user search performance using unified behavior-based or self-report-based metrics to measure performance. The user performance is related to users’ interactions with the results (e.g., clicks, dwell time, and continue or stop searching) and their perceived search experience (e.g., search success and satisfaction) (M. Liu, Liu, Mao, Luo, Zhang, et al., 2018; Mao et al., 2016). Concerning user performance prediction, some existing studies employed the performance from previous searches and implicit feedback features (e.g., dwell time on results) to predict their search performance in current and subsequent query segments (Hendahewa & Shah, 2015; Piech et al., 2015), but many of them only considered a small set of online search behavior features collected at the whole session level (after the search session is concluded). These measures of single aspects are not capable of capturing the multidimensional nature of user performance, which may lead to incomplete and biased results in user performance evaluation (Hendahewa & Shah, 2017; Moraveji et al., 2011; Odijk et al., 2015). In addition, although various methods have been developed to support users by improving their search experience in both IR and HCI communities (Huurderman & Kamps, 2015; Smith, 2017), it is still unclear how we can leverage the knowledge about evaluating and predicting user performance at different early points of search sessions, and how effective the performance measurement is.

Research Objective
To fill the above research gaps, we developed multiple user performance measures that capture both the gain (e.g., the numbers of relevant/useful documents) and cost (e.g., the number of clicks, dwell time) aspects of users’ search interactions based on both online search behavioral features and offline relevance and usefulness labels. Differing from most of the existing measures, our metric set characterizes users’ in-situ interactions with multidimensional gain and cost. Then, based on the user performance groups identified through clustering from the measure scores, we built machine learning classifiers to predict user performance at early points of search sessions (e.g., first,
In this section, we introduced the theoretical foundations of our proposed framework and the research gap. First, as we aimed to evaluate users' search performance, we reviewed previous studies about the measures and the importance of users' performance in search tasks. Then, we planned to predict users' search performance based on their behaviors, so we reviewed methods investigating user behavioral features. Furthermore, with user performance measures and predictors, we proposed to design a method to help struggling users in search tasks, which is the interest of proactive information retrieval. Finally, we specified the research gaps in these fields and brought up our research questions.

**User Online Search Performance**

Improving user search performance and experience with search system support is fundamental in information retrieval (Huurdeman & Kamps, 2015). User search performance is shaped by many factors, such as domain knowledge (M. Liu, Liu, Mao, Luo, Zhang, et al., 2018; Suzuki & Yamamoto, 2021), task complexity (P. Liu & Li, 2012; Payne, 1976; Willett et al., 2014), search skills, and search experience (Bailey, 2017; Wildemuth, 2004). Users from various domains with different levels of search experience will perform differently on specific search tasks (M. Liu, Liu, Mao, Luo, Zhang, et al., 2018; Moraveji et al., 2011; Suzuki & Yamamoto, 2021). Evaluating user search performance usually involves assessing their success in the search task, which can be done through self-reports or analyzing user responses (M. Liu, Liu, Mao, Luo, Zhang, et al., 2018; Odijk et al., 2015). However, collecting user-generated annotations can be costly, so there is a need for metrics that evaluate user performance with limited user annotations and implicit feedback. Recent research has focused on online metrics for information retrieval systems that combine offline metrics (e.g., relevance-based metrics) and online user behaviors (F. Zhang et al., 2020). These metrics can reflect user search behaviors and performance from multidimensional aspects (Hendahewa & Shah, 2017; J. Liu & Yu, 2021). According to information foraging theory, user interaction signals are associated with search outcomes in varying ways, and this outcome-behavioral relationship is affected by the goal of information gain, tolerance of cost, or the rate of gain and cost (Azzopardi et al., 2018). However, each online metric only evaluates search results from a single aspect, making it challenging to represent and evaluate multidimensional user search performance using user-interaction signals (Chen et al., 2017).

On the other hand, researchers have studied query performance prediction (QPP) methods to estimate query performance or system effectiveness without relevance labels (Cronen-Townsend et al., 2002; Raiber & Kurland, 2014). These methods estimate performance using textual features of the query and documents in the search results (Zendel et al., 2019). However, QPP methods neglect users' experience and are not designed for improving users' performance in web search (Zamani et al., 2018; Zhou & Croft, 2007). Therefore, how to adopt user-interaction signals to represent and evaluate the multidimensional search performance remains an open question.

**Online Search Behaviors**

User search performance is closely associated with their online search behaviors (F. Liu, 2016). With the development of the modern search engine, researchers have collected user interaction signals in real-time and at a large scale, aiming to develop user-oriented search supports (Bennett et al., 2011, 2012). These behavioral signals normally involve query reformulation, pagination, clicks, mouse movements, dwell time, etc. Based on information-seeking theories and user models, previous research has analyzed users' online search behaviors to personalize their interactions with search engines by inferring their implicit states (Dumais et al., 2014; Fox et al., 2005; White & Morris, 2007). Various methods have been implemented to investigate users’ search behaviors, including collecting user behavior data from user studies or large datasets of search logs and developing machine learning models to predict users’ implicit states using behavioral data (Hendahewa & Shah, 2015; Li et al., 2021). The implicit states include task difficulty, user information intention, information need, satisfaction, etc (Arguello, 2014; J. Liu et al., 2020; F. Zhang et al., 2020). In addition, researchers also found distinguishable patterns in online search behaviors...
between users with high search performance and those with low performance (Lazonder et al., 2000; Mao et al., 2018; Suzuki & Yamamoto, 2021; Yu et al., 2018). Furthermore, users exhibit different behavioral patterns in different states of the search task. Based on these patterns, researchers have proposed to develop adaptive models to predict user states at different moments during sessions (Arguello, 2014; J. Liu & Yu, 2021). Practically, predicting users’ implicit states such as domain knowledge could enable search systems to support users proactively in achieving a better search experience (X. Zhang et al., 2015).

Proactive Information Retrieval

Proactive information retrieval aims to improve users’ search experience and performance from the traditional search system with a reactive nature (Bhatia et al., 2016). Users with different levels of search experience, domain knowledge, or information literacy can all get support from proactive search systems (Huurdeman & Kamp, 2015; Savenkov & Agichtein, 2014; Smith, 2017). Query recommendation is a popular proactive information retrieval method that has demonstrated usefulness for users engaging in various types of tasks (Hanauer et al., 2017; Hendahewa & Shah, 2015, 2017; Moayedikia et al., 2019; Zahera et al., 2013). High-quality, collaboratively recommended queries created by expert users can provide guidance to users and improve their search performance (Harvey et al., 2015; Morris, 2008; Morris & Horvitz, 2007; Savenkov & Agichtein, 2014; Smith, 2017). Another aspect of assisting users is helping the search system adapt to users’ states according to their behaviors (J. Liu & Yu, 2021; Rha et al., 2016). The adaptive search system can improve search results during the dynamic interaction between users and the search engine (Luo et al., 2014). When users are struggling with search tasks, these proactive methods are supposed to assist users in accomplishing tasks with positive interventions. Therefore, by accurately estimating users’ search performance, queries from high-performance users can be collected to help users with low performance of the search task in the proactive information system.

RESEARCH QUESTIONS

Although there is much research about adaptive search systems supporting users, most of them focus on a single facet of user behaviors or the system performance based on traditional relevance-based offline metrics. Few studies investigate user performance directly to develop adaptive search systems because of lacking appropriate evaluation metrics for multidimensional user performance. This research aimed to evaluate user performance with the combination of various online metrics in terms of gain and cost. Then, we investigated the feasibility of early prediction and intervention to support users after evaluating their performance. Therefore, we aimed to address these research questions:

RQ1: From what aspects can we measure user search performance using online-offline combined search measures?

RQ2: How early can we predict user search performance in an interactive search session?

RQ3: To what extent can we improve a user’s search performance with search paths extracted from the search sessions of other users engaging in the same search task?

DATA AND METHODS

This section introduces the methodology we employed to create multidimensional user performance measures and evaluate early-prediction-based search path recommendations. First, we introduced the datasets used in this study and what features and performance measures we can extract from these datasets. Then, we described our framework of search performance evaluation, how to investigate the predictability and effectiveness of the performance evaluation by early prediction with behavioral features, and query segment recommendation simulation.

Datasets

As this research aims to support users with queries extracted from high-performance users’ search sessions, some features we need include information on users’ behaviors and assessments of the results to evaluate user performance. Therefore, we used the KDD19 dataset (M. Liu et al., 2019), SIGIR16 dataset (Mao et al., 2016), SearchSuccess dataset (M. Liu, Liu, Mao, Luo, Zhang, et al., 2018), and the TREC session track 14 dataset (https://trec.nist.gov/data/session2014.html) in this research. We listed the basic information about these datasets in Table 1. These datasets contain topic/task-based search logs where users could have multiple queries in one session, and their search behaviors were collected, including query reformulation, clicks, paginations, and timestamps. The KDD19 dataset also collected additional user behaviors such as mouse movements, scroll, and hover activities.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>KDD19</th>
<th>SIGIR16</th>
<th>SearchSuccess</th>
<th>TREC14</th>
</tr>
</thead>
<tbody>
<tr>
<td># Queries</td>
<td>1538</td>
<td>937</td>
<td>651</td>
<td>2014</td>
</tr>
<tr>
<td># Sessions</td>
<td>450</td>
<td>225</td>
<td>166</td>
<td>641</td>
</tr>
<tr>
<td># Tasks</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Annotation</td>
<td>Relevance, Usefulness</td>
<td>Relevance, Usefulness</td>
<td>Relevance, Usefulness</td>
<td>Relevance</td>
</tr>
</tbody>
</table>

Table 1. Characteristics of Datasets.
For the annotations, the KDD and SIGIR16 datasets collected relevance for all documents and usefulness for clicked documents. The SearchSuccess dataset collected relevance and usefulness only for clicked documents. The relevance and usefulness annotations are different assessments reflecting two aspects of the documents (Mao et al., 2016). The relevance is assessed by external experts based on the topical relation between the information and the search task. The relevance score is from 0 “not relevant” to 3 “very relevant”. The usefulness is annotated by the users about their perceived usefulness of the result, and the score is from 1 “not useful at all” to 4 “very useful. Users’ satisfaction feedback on a session was also collected in these three datasets, on a scale of 5, from 1 “low satisfaction” to 5 “high satisfaction”. The TREC14 dataset contains only relevance annotations on a scale of 6, including -2 “spam” and 0 to 4 (from “not relevant” to “navigational”). The user interactions in the TREC14 dataset are quite sparse compared to the other three datasets, and only 641 out of 1257 sessions contain at least one click. We filtered out sessions with zero clicks from the TREC14 datasets as we intended to evaluate action-based performance in search sessions. In addition, the KDD19, SIGIR16, and SearchSuccess datasets were collected in a lab-controlled environment for user studies with college students as participants, and the queries are in Chinese. The TREC14 dataset containing English queries was collected for a different purpose as an information retrieval evaluation instead of the user study. The search tasks are general topics in the KDD19, SIGIR16, and TREC14 datasets, while the SearchSuccess dataset contains search tasks in different domains.

**Search performance evaluation, early prediction, and recommendation simulation**

Figure 1 illustrates the study process, which involves evaluating user search performance, predicting the performance levels, and simulating collaborative query recommendations. We first designed a set of online-offline combined measures and used a clustering analysis on these measures to group users by their performance levels. We then investigated the predictability of performance levels through early prediction by search behaviors and compared the queries between high- and low-performance groups as the simulated collaborative query segment recommendation.

**Figure 1. The overall framework of performance evaluation, early prediction, and recommendation simulation.**

**Search performance measures and evaluation**

In the **Search performance evaluation** step in Figure 1, we extracted features of users’ behaviors and document annotations from the search session and created online-offline combined measures based on those features and annotations. The online measures were calculated from users’ online search behaviors, and the offline measures were calculated based on the annotations of the documents on the search engine result pages (SERPs), such as relevance, usefulness, and discounted cumulative gain (DCG) scores (Dupret, 2011). We combined the online and offline measures to evaluate users’ behaviors and grouped the measures into gain- and cost-based measures, which are listed in Table 2. We selected these measures from a large set and removed highly correlated measures. These measures are the sum values at the session level and can represent different aspects of users’ gain and cost in completing the search task. We did not involve dwell time on relevant or useful documents as it was unclear when a user had high efficiency in locating required information in the document or spent a long time exploiting abundant relevant information.

<table>
<thead>
<tr>
<th>Measures</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gain based</strong></td>
<td></td>
</tr>
<tr>
<td>DCGrel (use)</td>
<td>Relevance(or usefulness)-based DCG score</td>
</tr>
<tr>
<td>ClicksRel (Use)</td>
<td>Number of relevant (or useful) documents clicked</td>
</tr>
<tr>
<td>ClicksKeyRel</td>
<td>Number of key relevant documents clicked</td>
</tr>
<tr>
<td><strong>Cost based</strong></td>
<td></td>
</tr>
<tr>
<td>ClicksIrrel (Nonuse)</td>
<td>Number of irrelevant (or non-useful) documents clicked</td>
</tr>
<tr>
<td>DwellIrrel (Nonuse)</td>
<td>Dwell time on irrelevant (or non-useful) documents</td>
</tr>
<tr>
<td>MissRel</td>
<td>Number of relevant documents not clicked</td>
</tr>
</tbody>
</table>

| Table 2. Online-offline combined performance measures grouped by gain and cost. |
After obtaining the online-offline combined measures for each session, we conducted a correlation analysis to investigate the relationships between these measures and users’ satisfaction state. We used Spearman’s rank as the statistical test method since satisfaction is ordinal data. We incorporated measures previously examined (e.g., DCGrel and DCGuse) regarding the correlation with user satisfaction at the query level (Chen et al., 2017; Mao et al., 2016) with other measures we created in this research. We performed the analysis on the KDD19, SIGIR16, and SearchSuccess datasets since the TREC14 dataset does not contain user satisfaction labels. In addition, we utilized the Benjamini–Hochberg method to control the false discovery rate for multiple comparisons (Thissen et al., 2002).

To evaluate users’ performance based on measures with multiple aspects of gain and cost, we used K-means clustering analysis on these measures to group search sessions with similar performance characteristics. We normalized all measures in Table 2 and involved them in the clustering analysis. The number of clusters is determined by the elbow method. Then, we visualized the cluster distributions on projections of the gain-cost measure pairs and investigated the patterns for each cluster to identify clusters with characteristics of high performance. We expected to find clusters of sessions with high gain and low cost, characterizing users in these clusters as high performance, and users in clusters of sessions with high cost or low gain as low performance.

**Predicting user performance in the session**

After investigating the characteristics of these clusters and identifying high-performance patterns, we developed a prediction model to classify search sessions as either high-performance or not by predictor features of users’ search behaviors. The performance level is a binary label assigned to sessions based on whether they are in the high-performance cluster. The predictor features include behavioral features from the datasets, and the descriptions are listed in Table 3. We also normalized the data and handled imbalanced data. We developed and compared different classification models, including logistic regression, random forest classifiers, and feedforward neural networks. The classification models were chosen for this study because they are commonly used in machine learning to classify data into different categories. Logistic regression is a simple and widely used model that is effective when the outcome is binary. Random forest classifiers are ensemble learning models that combine multiple decision trees to increase accuracy and reduce overfitting. Feedforward neural networks are powerful models that can learn complex relationships between features and outcomes. The model was evaluated by accuracy, precision, recall, and f1 score.

<table>
<thead>
<tr>
<th>Features</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mouse and keyboard based</strong></td>
<td></td>
</tr>
<tr>
<td>QueryLength</td>
<td>Number of terms used in an issued query.</td>
</tr>
<tr>
<td>UniqueTerm</td>
<td>Number of unique terms used in an issued query.</td>
</tr>
<tr>
<td>NewTerm</td>
<td>Number of new unique terms used in an issued query.</td>
</tr>
<tr>
<td>QuerySim</td>
<td>Similarity between the current query and the previous query.</td>
</tr>
<tr>
<td>ClickCount</td>
<td>Number of clicks.</td>
</tr>
<tr>
<td>AvgClickRank</td>
<td>Average rank of clicked results.</td>
</tr>
<tr>
<td>Clicks@3/5/5+</td>
<td>Number of clicks between ranks 1-3, 1-5, or below rank 5.</td>
</tr>
<tr>
<td>ClickDepth</td>
<td>The deepest or lowest rank of the clicked result.</td>
</tr>
<tr>
<td>ActionCount</td>
<td>Number of actions (page click, scroll, query formulation).</td>
</tr>
<tr>
<td>ScrollDist</td>
<td>Total scrolling distance.</td>
</tr>
<tr>
<td>HoverCount</td>
<td>Number of mouse hovers on results.</td>
</tr>
<tr>
<td><strong>Dwell time based</strong></td>
<td></td>
</tr>
<tr>
<td>SERPtime</td>
<td>Total dwell time on search engine result page (SERP).</td>
</tr>
<tr>
<td>AvgContent</td>
<td>Average dwell time on content pages.</td>
</tr>
<tr>
<td>TotalContent</td>
<td>Total dwell time on content pages.</td>
</tr>
<tr>
<td>QueryDwellTime</td>
<td>Total dwell time within a query segment.</td>
</tr>
<tr>
<td>TimeFirstClick</td>
<td>Time delta between the start of a session and the first click.</td>
</tr>
<tr>
<td>TimeLastClick</td>
<td>Time delta between the start of a session and the last click.</td>
</tr>
</tbody>
</table>

Table 3. Behavioral features.

After comparing the performances of three model settings on prediction with features in the whole session, we chose the best model setting to investigate the early prediction problem by evaluating the model performance at different query orders in the search sessions. From different query orders, the behavioral features are aggregated by the average values. For example, if predicting at the second query, we use average values of behaviors in the first two queries as shown in Figure 1. The models trained with data at different query orders were evaluated to determine how early the researchers could predict user search performance in a session.

**Query recommendation simulation**

With search performance measures and prediction models, the third step of our research is to verify the effectiveness of our performance evaluation and prediction framework. We investigated how high-performance users differ from others in terms of their search behavior, specifically in terms of their query segments, including the query, retrieved
documents, and click interactions on the documents (Hendahewa & Shah, 2017). As users with high search performance can issue better queries that retrieve more relevant or useful documents on SERPs (Moraveji et al., 2011; Odijk et al., 2015; Salmerón et al., 2005), we wanted to determine whether users with estimated high performance in our study also have better query segments than users with low predicted performance.

To answer RQ3, we simulated a query segment recommendation process to compare the query results between the high-performance sessions and other sessions, shown in the Collaborative query recommendation simulation part in Figure 1. The recommendation simulation is developed on two facets: first, given the performance labels, evaluating the recommended query segments, and second, given behavioral features, predicting the performance levels and evaluating the recommended query segments. By comparing the results between these two facets and the original query segments, we can validate the effectiveness of our performance evaluation process in differentiating high- and low-performance users and the feasibility of predicting the performance level with behavior features. We used two methods for recommendation: (1) recommending the entire search path based on the similarity of the i-th query and (2) recommending query segments based on each query’s intention. The first method simulates the recommendation of the whole search path from the high-performance group (Hendahewa & Shah, 2017), and the second method designed in this study simulates the adaptive recommendation which is relevant to user search intention and needs.

The query intention was categorized based on the typology of query reformulation types proposed in Rha et al. (2016) and some query intentions are listed in Table 4. In this study, we simplified the query intentions into four main types based on query reformulation types, including generalization, specialization, word substitution, and new, because of the limited data size for specific search tasks. Based on the characteristics of these query intentions, we classified the user’s original query intention by comparing the current query and the previous one query. For the adaptive query recommendation simulation, we first collected queries from high-performance queries with the same intention for the recommendation list. Within the recommendation list, we selected the top five queries by similarity with the current query. We evaluated recommended query segments and used the original sessions as the baseline.

The evaluation metrics include discounted cumulative gain (DCG) (Dupret, 2011), normalized discounted cumulative gain (nDCG) (Wang et al., 2013), and mean reciprocal rank (mRR) (Chapelle et al., 2009) on both relevance-based scores and usefulness-based scores.

<table>
<thead>
<tr>
<th>Intention type</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalization</td>
<td>At least one term in common in two queries; the second query contains fewer terms than the first query</td>
<td>campus bike store → bike store</td>
</tr>
<tr>
<td>Specialization</td>
<td>At least one term in common in two queries; the second query contains more terms than the first query</td>
<td>bike store → bike store near me</td>
</tr>
<tr>
<td>Substitution</td>
<td>At least one term in common in two queries; the second query has the same length as the first query but contains some terms not in the first query</td>
<td>bike store → motorcycle store</td>
</tr>
<tr>
<td>New</td>
<td>No common terms in the two queries</td>
<td>bike store → motorcycle dealership</td>
</tr>
</tbody>
</table>

Table 4. Query intention types (Rha et al., 2016).

RESULTS
RQ1: User performance measures and evaluation
After creating the performance measures for each dataset, we did a correlation analysis to investigate the relationships between the performance measures and users’ search satisfaction. Table 5 presents Spearman’s ranks of measures with users’ satisfaction. The cost-based measures, such as ClicksIrrel and MissRel, have negative correlations with satisfaction in these three datasets. This negative impact is brought by users’ costs during the search process (Mao et al., 2016). However, some gain-based measures also showed negative correlations with users’ satisfaction, such as DCGRel and ClicksRel, which may be related to users’ efforts to reach a high gain level. In general, cost-based measures had more significant impacts than gain-based measures in the KDD19 and SIGIR16 datasets, which share similar measures of significant relationships due to the same search tasks and similar data collection procedures (M. Liu, Liu, Mao, Luo, & Ma, 2018). However, for the SearchSuccess dataset, only two cost-based measures significantly related to satisfaction, and ClicksUse was the only measure showing a positive correlation among the three datasets. The relationships between the measures and users’ satisfaction indicate the tradeoff effects in the gain and cost measures. Moreover, the differences between the SearchSuccess dataset and the other two datasets suggest that some performance measures have different impacts on users’ satisfaction in datasets with different experimental settings, and it is critical to analyze these performance measures from multiple aspects.

To investigate user performance in search tasks with multiple cost-gain-based measures, we employed clustering analysis on those measures and grouped the search sessions. The number of clusters was set at five, determined by the Elbow method based on a tradeoff criterion between the cluster number and the mean sum of squared distances to centers (Kodinariya & Makwana, 2013). As the clustering analysis is based on multiple measures, it is difficult to
examine the session distributions on all measures directly. Therefore, we visualized cluster distributions on several projections of individual gain-cost measure pairs (e.g., ClicksRel-ClicksIrrel, ClicksUse-ClicksNonuse). Figure 2 shows examples of the cluster distributions on the projections of gain-cost pairs for the KDD19 and the TREC14 datasets. For the SIGIR16 dataset and the SearchSuccess dataset, the cluster patterns and distributions are similar to those in the KDD19 dataset. We further summarized the cluster patterns in Table 6. In general, the five clusters captured in clustering analysis can be aggregated into two groups based on the gain level, including high gain and low to medium gain. Within each group, the clusters in the four datasets share similar patterns. For example, all four datasets have one or two clusters in the high gain group, such as cluster 0 in Figure 2. These high-gain groups are based on both relevance and usefulness measures for the datasets with usefulness annotations. However, the sessions in this cluster are not distinguishable by cost-based measures, and the cost is variously distributed. For the low to median gain group, some clusters also contain a few sessions with higher gain on specific measures, such as several sessions in cluster 1 in Figure 2(a) and cluster 3 in Figure 2(c).

<table>
<thead>
<tr>
<th>Spearman’s r</th>
<th>KDD19</th>
<th>SIGIR16</th>
<th>SearchSuccess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain based</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCGrel</td>
<td>-0.126**</td>
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<tr>
<td>DCGuse</td>
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<td>-0.001</td>
</tr>
<tr>
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<td>-0.280**</td>
<td>-0.231**</td>
</tr>
<tr>
<td>ClicksKeyrel</td>
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<td>-0.220**</td>
<td>-0.159*</td>
</tr>
<tr>
<td>ClicksUse</td>
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<td>0.027</td>
<td>0.175*</td>
</tr>
<tr>
<td>Cost based</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ClicksIrrel</td>
<td>-0.274**</td>
<td>-0.311**</td>
<td>-0.035</td>
</tr>
<tr>
<td>ClicksNonuse</td>
<td>-0.382**</td>
<td>-0.402**</td>
<td>-0.233**</td>
</tr>
<tr>
<td>DwellIrrel</td>
<td>-0.218**</td>
<td>-0.278**</td>
<td>-0.032</td>
</tr>
<tr>
<td>DwellNonuse</td>
<td>-0.340**</td>
<td>-0.275**</td>
<td>-0.107</td>
</tr>
<tr>
<td>MissRel</td>
<td>-0.101</td>
<td>-0.314**</td>
<td>-0.265**</td>
</tr>
</tbody>
</table>

Note: values in **boldface** indicate that the correlation is significant: * corrected p<0.05, ** corrected p<0.01.

Table 5. Correlations between the session satisfaction and the performance measures.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>High gain</th>
<th>Low to medium gain</th>
</tr>
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<tbody>
<tr>
<td></td>
<td># Cluster</td>
<td># Sessions</td>
</tr>
<tr>
<td>KDD19</td>
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<tr>
<td>Search Success</td>
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<td>108</td>
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<tr>
<td>SIGIR16</td>
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<td>104</td>
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<tr>
<td>TREC14</td>
<td>2</td>
<td>99</td>
</tr>
</tbody>
</table>

Table 6. Cluster ID and session numbers by the level of gain.

Figure 2. Examples of cluster distributions on projections of gain-cost measure pairs for the KDD19 and the TREC14 datasets: the clusters are mainly separated by the gain level, but there are fewer distinguishable patterns among clusters in terms of the cost.

Overall, the search sessions are consistently clustered by the variance of gain-based measures in all four datasets, but there are fewer distinguishable patterns among clusters in terms of cost. Although the pattern of low cost and high gain is not captured in the clustering analysis exactly, sessions with more queries and relevant or useful documents for the related task as the overall gain level can be considered high-performance sessions. Those high-performance sessions outperform other sessions not on single metrics but on a combination of multiple metrics (e.g., relevance-based, usefulness-based, and behavioral metrics). Although the high cost of these sessions seems to correlate with the high gain, a large number of query segments from the high-performance session cluster are still useful for collaborative query recommendation to support other users in low or medium-gain clusters, especially those with
lower estimated performance and who struggle searching for useful information. Therefore, we aggregated and labeled the clusters in the high-gain group as high-performance clusters and others in the group of low to median gain as low-performance clusters. This classification serves as the basis for following early prediction of user performance and the simulation of search recommendations.

**RQ2: Early prediction of user performance**

From the last step, we obtained high-performance clusters with sessions of more queries and more relevant documents and differentiated them from low-performance ones. Built upon RQ1, we developed classification models to identify high-performance sessions with user behavioral features to classify all sessions into two categories based on the cluster labels. Based on the preliminary results of the performance with different model settings, we chose feedforward neural networks as the model with the best performance. Figure 3 presents the prediction performance of neural network models at different query sequences in a session (e.g., initial query, 2nd query, 3rd query, etc.) for the four datasets. For the KDD19, SearchSuccess, and SIGIR16 datasets, the model performances gradually increased as search sessions proceeded with the increasing query order shown in Figures 3(a), 3(b), and 3(c). The elbow of the prediction point was observed at the third or fourth query, and the performance became relatively stable when the query number reached seven. This trend reflected the positive correlation between the query number and model performance for the whole session. However, during the initial few queries, the model’s ability to accurately identify the performance group that a session belonged to was limited, as the variations in user behaviors were insufficient. As the session progressed, the fluctuations in user behavior became more consistent with the average values of the previous three queries.

Figure 3. Model performance at different query orders.

Other than the similar trend for the three datasets, the model’s overall performance for the SearchSuccess dataset is higher than the models for the other two datasets, especially comparing the precision score. Noted that the SearchSuccess dataset contains tasks in different domain knowledge and participants from relevant domains. The higher performance indicates that user behaviors might have larger variances in the task of a specific domain than in the tasks of general topics. The TREC14 dataset showed more fluctuations with nonlinear variations and non-monotonic changes in the model’s performance. These fluctuations may be caused by the different characteristics of the dataset and less consistent variance in the fewer behavioral features. There were some false-positive predictions among models, indicating that some low-performance sessions were misclassified.

In general, the developed classification models can effectively identify high-performance search sessions based on user behavioral features. The results showed that the model performance gradually increased along with the query order for most datasets, except for the TREC14 dataset. However, false-positive predictions were common among the models, highlighting the need for further evaluation of the model’s performance. Therefore, we need to investigate if the sessions of predicted high performance are actually better than others with lower estimated performance for the same task. This part is explained in the next subsection.

**RQ3: Simulated search recommendation**

In the final stage of our research, we aimed to apply the knowledge gained from RQ1 and RQ2 to support users by employing early prediction models to simulate and evaluate search path recommendations. Our evaluation metrics included relevance-based and usefulness-based DCG, nDCG, and mRR. We compared the performance of the original query segments (Original) with that of two query recommendation methods: switching the query segments for the entire search path (Entire) and adapting each query segment based on the query intention (Adaptive). Furthermore, we compared the results based on the high-performance target labels without prediction (the Actual performance labels) with those based on early prediction results (Pred@k: with the labels predicted at the k-th query). Table 7 presents the query segment recommendation results for each dataset. The values are average scores of recommended or original query segments. Higher values for DCG or nDCG and lower values for mRR indicate better performance. In general, the results show that the recommended query segments demonstrated significant improvements over the original query segments in almost all relevance-based and usefulness-based scores with actual labels and predicted labels across four datasets. With the actual performance label, one or both recommendation methods can perform better than the original query segments. With the predicted label, some
metric scores showed greater improvements than those with actual labels. Additionally, in contrast to the increasing performance of the prediction model with more queries in RQ2, the query recommendation performance of the prediction point at the first query is similar to that of the prediction point at the second or third query. This finding highlights the potential of early prediction in supporting users.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Pred@1</th>
<th>Pred@2</th>
<th>Pred@3</th>
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<td></td>
<td>Actual</td>
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Table 7. Results of query recommendation simulation.

Additionally, we compared the usefulness-based and relevance-based scores of the recommended query segments and found that while the usefulness-based scores showed improvements, the relevance-based scores did not always do, as measured by nDCG and mRR in the SIGIR16 dataset. This discrepancy may be due to differences in the assessment processes used for the two types of scores. Users assess the usefulness of the documents they click on, and those with more clicks tend to have more usefulness assessments, resulting in higher usefulness-based scores and groups of high-performance sessions. Furthermore, in the SearchSuccess dataset, the relevance assessments were only for clicked documents, and this assessment may lead to bias in evaluating the query performance (e.g., users in high-performance groups might find more documents at lower ranks), affecting the improvements in relevance-based scores, particularly mRR, of recommended query segments.

**DISCUSSION AND CONCLUSION**

**Research Findings**

With the theoretical foundations of user online search performance, online search behaviors, and proactive information retrieval, we proposed a framework for evaluating users’ search performance, early predicting their performance with behavioral features, and assisting low-performance users with query segment recommendations. For the three RQs, we have the following answers:

**RQ1: Characterizing multidimensional search performance.** We combined users’ online behaviors with relevance- and usefulness-based offline metrics to measure users’ search behaviors by gain and cost. Previous research usually focused on one aspect of performance in search tasks, such as effective results, efficient interactions, knowledge increment, and increases in search skills and domain knowledge (Moraveji et al., 2011; Savenkov & Agichtein, 2014; Wildemuth, 2004). Our approach is unique in that we use various features and assessments to measure the total gain and effort to complete the task, providing a more comprehensive understanding of user performance. When analyzing the clustering results, we found that users in the high-gain group had high levels of relevance and usefulness assessments with more interactions in the session, including more queries and clicks for more relevant or useful documents. It indicates that their performance requires high effort, search skills, and experience. However, we also found that most measures negatively impact users’ satisfaction. This finding suggests that search systems
should focus on both search success and user satisfaction by considering multiple performance measures and optimizing the search results with minimum search effort (M. Liu, Liu, Mao, Luo, Zhang, et al., 2018).

On the other hand, we observed that some low-cost users in the medium gain group, especially the low-cost outliers, might also be considered high-performance users. These users submitted only one query in the session but clicked on relevant or useful documents with few cost interactions. They might be familiar with the task topic and can quickly find the information they need and leave the session, demonstrating high efficiency in completing the task (Kelly & Cool, 2002; Odijk et al., 2015; Shiri & Revie, 2003). However, we caution that their search strategies might not be appropriate for other users with less knowledge of the task topics.

**RQ2: Model performances at different query orders.** We evaluated models built with varying methods in early predicting search performance. The results indicate that the query order influences model performance in the KDD19, SearchSuccess, and SIGIR16 datasets. Based on the performance trend, it suggests predicting the third or fourth query might be the optimal prediction point. The results indicate it is feasible to predict user performance as an implicit search state and it is possible to early predict and intervene to assist low-performance users in search sessions (J. Liu et al., 2020; J. Liu & Shah, 2022; Sarkar et al., 2020). Besides, the fluctuation of model performance after the fourth query indicates that users might leave the session before the fourth query in a real search scenario and different user behavior patterns between short and long sessions. It suggests investigating the behavioral features and applying the early prediction in the short and long sessions separately (Hassan et al., 2014).

**RQ3: Simulation of query segment recommendation.** We simulated the collaborative query recommendation by first predicting the session group at an early point and then recommending queries from high-performance sessions for the same task. As we expected the queries from users in the high-performance sessions could help users in other sessions, and the results show consistent improvements with the actual performance labels. In addition, we chose two methods of query segment recommendation and compared varying approaches to proactive information retrieval. Our proposed method might better satisfy users’ needs by recommending query segments related to their query intentions instead of recommending the entire search path as the recommender expected in previous research (Bhatia et al., 2016; Hendahewa & Shah, 2017; Sarkar et al., 2020). Overall, the improvements in the query recommendation simulation show the validity of the previous two steps in this research. The performance evaluation step can divide sessions with high performance, and the prediction step is able to predict those sessions with only behavioral features at an early point in sessions. With the last step of query recommendation, our research completes the framework of evaluating and predicting users’ search performance and assisting low-performance users.

**Limitations and Future Research**

The study has certain limitations that suggest the need for further research. Firstly, the user search performance needs to be defined across multiple dimensions beyond the sum value of each measure. The study can modify and add new factors to discuss different aspects of search performance, such as time-based gain or cost, gain/cost ratio, and increment values. The actual user performance can be set at the tradeoff point between clearance and one hundred percent completion by adjusting the weights of measures based on a better balancing of gain and cost. Secondly, the study is based on simulated research and requires further investigation of user characteristics in different performance groups to develop new performance measures and extract useful features. Future work can involve more user performance labels as evaluation baselines, direct explicit feedback on recommended search paths, and behavioral features in ablation studies to analyze feature importance. Thirdly, the study used effective but simple query segment recommendation methods, and future research can consider more advanced methods, such as AI-enabled information retrieval. User studies can be conducted to investigate how users perform given recommended query segments in real search scenarios, and the activity path in recommended query segments can also be investigated to improve re-ranking performance. Furthermore, query recommendation needs to consider users’ preferences on topically diversified results at different moments of search (J. Liu & Han, 2022).

In conclusion, this research proposed a cost-gain-based framework for evaluating users’ search performance, early predicting their performance with search behavioral signals, and supporting low-performance users by query segment recommendation. The results show the feasibility of early predicting and improving user performance in search sessions. Despite the limitations, this research contributes to understanding and characterizing multiple aspects of user performance in complex search tasks. It suggests further research to improve the multidimensional evaluation of search performance, user characteristics, and proactive information retrieval methods.

**ACKNOWLEDGMENTS**

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Finding the Aha! Moment of Search: A Preliminary Examination of Insight Learning During Search

Wang, Xinyue  
Department of Information Management, Peking University, China | xinyuewangle@stu.pku.edu.cn

Liu, Chang  
Department of Information Management, Peking University, China | imliuc@pku.edu.cn

ABSTRACT
Research in information behavior has examined search difficulties and how people learn during searches but has not fully examined how searchers solve the difficulties on their own and gain new knowledge during this process. This study introduced the concept of insight learning during search to provide a new perspective for the studies in Search as Learning (SAL) and to optimize searchers’ experiences in a more efficient, innovative, and joyful way to combine search and learning. As a preliminary study, we conducted self-reported interviews with 30 participants to collect cases of insight learning during the search process. Based on thematic analysis of the data, we summarized the benefits of insight learning during search, described the process of how aha! occurred after impasse, and identified the antecedent, key, and consequence of insight during the search process. We aimed to help generate more insights by providing three dimensions of key factors to think about. A preliminary understanding of the insights formed in this study could contribute to further discussion about learning during the search and could help design new search tools that support effective learning.

KEYWORDS
Insight; Information Search; Information Search Process; Search Difficulty; Search as Learning

INTRODUCTION
Online search is prominent and widely used for acquiring information. From users’ perspectives, the search process typically involves expressing an information need using queries, receiving a ranked list of information items, and selecting information within the list. Besides such traditional search interaction modes, there appears to be a trend towards providing fast and organized information for searchers so as to respond to searchers’ information needs as quickly and effectively as possible, e.g., through question-answering systems, conversational systems, or artificial intelligence-generated content (such as ChatGPT). However, we may ask, is this the best way for users to acquire information? What is the most important goal for a search system nowadays? Recent research on Search as Learning (SAL) has also argued that searchers can learn through various search activities rather than just using the information system as a tool to simply find, retrieve, and collect information (Rieh et al., 2015). From this perspective, search is not just an aid to learning but learning itself. Learning is not the simple acceptance of external information but involves the active selection, understanding, and utilization of information, which is a complex information processing activity. Therefore, it is not profound enough for users to take the simple accumulation of facts as learning, and search systems need to be reconfigured to support more diverse types of learning beyond knowledge acquisition (Rieh et al., 2016). We should draw on what we have learned from learning science and other related disciplines to consider how to design search systems to support users in learning new knowledge, increasing their information literacy, and making sense of information rather than simply getting a piece of relevant information.

In this paper, we introduce the concept of insight learning into the search process to inspire the design of future learning-driven search systems and provide another perspective for SAL discussions. Imagine a child who is learning about the world for the first time and is amazed by each discovery, and another child who is typically taught by pieces of information. Both are important in understanding the way the learning process functions, but one of the biggest advantages of insight learning is its efficiency. Insight often refers to the sudden realization of the solution that pops into the mind unexpectedly, evoking an aha! moment (Durso et al., 1994; Sandkühler & Bhattacharya, 2008; Kounios & Beeman, 2014). Just like Newton and that apple and Archimedes in the bathtub, one common pattern of insight was shared: a person encountering impasse after an endeavor temporarily removes themselves from the task and then finds themselves surprised by the sudden resolution (Osuna-Mascaró & Auersperg, 2021). Other similar concepts to insights include inspiration and the aha! moment. Insight may emphasize more on the overall response, while inspiration refers to the idea itself; insight can occur without inspiration (Oleynick et al., 2014). Moreover, insight is frequently linked to a number of features, such as impasse and Aha!, that set it apart from conventional learning (Osuna-Mascaró & Auersperg, 2021). Aha! (also known as Aha! moment or Aha! experience) is the subjective experience of feeling joy and accomplishment when the solution emerged while insight or insight learning consisted of the overall process.

Nowadays, conventional information accumulation-based learning through search systems is readily available. However, it is not clear whether and how search systems could provide insights for learning or insights that facilitate increased efficiency and transfer of learning. Exploring insight in the field of information search may have several
benefits. First, insights could help searchers further deepen their thinking, broaden their minds, and even foster creativity. Second, the joy of learning new insights during the search process, as a positive emotion, could increase searchers’ perceptions of their search experience and knowledge gain dramatically. Furthermore, the impressive solutions could benefit searchers in dealing with similar difficult situations in the subsequent search process, so as to improve their learning performance and information literacy. The idea of insight learning in information science is not brand new and has been explored in several scenarios, including creating a library creative environment to better trigger insight moments (Anderson, 2011), insight during the serendipity process (Makri, 2014), and observing the eureka effect in patent prior art finding (Yang, Luo, & Wing, 2015). However, not much exploration has been done to examine insight learning during the search process yet.

This study aims to examine the benefits and process of the insight learning process during information search. Specifically, we explored the following four research questions (RQs) in this paper:

RQ1: What benefits could searchers gain through insight learning during the information search?
RQ2: When does the aha! moment usually occur during the search?
RQ3: What stages have searchers experienced during the insight learning process?
RQ4: What are the key factors that could trigger insight learning during the search?

**LITERATURE REVIEW**

Before conducting our own research, we reviewed recent studies on Search as Learning, insight learning in learning science research, and some empirical studies on search difficulties and solutions.

**Research in Search as Learning**

Insight learning is related to the field of Search as Learning in that they both stress learning during search. Research in the SAL field has investigated the learning process during search as well as the learning performance after search. Searching is often considered a learning process, and it is critical for searchers to learn both domain knowledge and search skills, e.g., how to critically seek, evaluate, and use information for various search tasks (Rieh et al., 2016).

With respect to the evaluation of learning performance, research has mainly focused on the evaluation of searchers’ learning gains in domain knowledge. For example, the learning in Moraveji and his colleagues (2011) was realized in the form of tactical search feature tips that expand user awareness of task-relevant tools and features of the search application and demonstrate search efficiency. Wilson and Wilson (2013) proposed analyzing handwritten summaries as indicators of measuring open-ended learning based on Bloom's taxonomy and evaluating the learning performance from different perspectives. Recently, Urgo and Arguello (2022) summarized methods and measures to evaluate learning performance in search-as-learning based on prior work. However, not much research has examined whether searchers gain any new search skills after they complete a search task, whether they have gained any deep understanding of domain knowledge, or whether they have found solutions to any problems.

Although Search as Learning can be challenging, various tools and features were designed to facilitate or support learning from different perspectives during search. For example, Huurdeman, Wilson, and Kamps (2016) pointed out that, without cluttering simple searches, features less commonly found in web search interfaces, when presented at the right moment, could provide value for users. Roy et al. (2021) proposed that highlighting and note-taking tools built into the search interface in a SAL environment could help learners cover more facts and subtopics. Ward & Capra (2021) proposed OrgBox as a knowledge representation tool to support complex search tasks by creating “boxes” to organize information. SearchIdea, which enabled searchers to actively interact with search results by comparison, prioritization, and rearrangement and was currently introduced by Chavula, Choi, and Rieh (2023), could also be a valuable tool to support learning during search. However, there has not been much investigation into how to provide searchers with insight during their searches. We hope our preliminary exploration of this topic can shed light on this direction.

**Insight Learning in Learning Science Research**

Insight learning has been widely discussed and implemented in learning-related science. The theory of insight learning was first proposed by one of the founders of Gestalt psychology, Wolfgang Köhler. Gestalt theory emphasizes the holistic nature of experience and behavior, and insight learning emphasizes problem solving in context, the essence of which is to engage in a completely new way (Köhler, 1969). Research in many fields has shown that insight learning has significant advantages in enhancing learning and memory (Danek et al., 2013; Danek & Wiley, 2020), which could be related to the enhancement of learning abilities, the promotion of memory migration, and the development of higher mental faculties and result in the most effective learning. It could be concluded that, different from conventional ways of learning, insight places more emphasis on the suddenness and efficiency of the solution and encourages one to be involved in the task in a brand new and creative way, hence leaving a deep impression and bringing out joyful feelings.
There are several features that make insight learning unique, such as impasse and aha! (Osuna-Mascaró & Auersperg, 2021). Insights learning described in our study refers to a process. When no further progress can be made and an impasse is met (Knoblich et al., 1999), a sudden solution may come up, resulting in representation restructuring (Stuyck, Cleeremans, & Bussche, 2021), which leads to a deeper understanding of the problem and is followed by the aha! moment, a unique experience represented by positive emotions that results from uncovering the solution to the problem (Danek et al., 2014). The word impasse is most commonly used instead of difficulty to describe the struggling situation that individuals experience before the aha! moments occur. Therefore, in the current study, we will also use the word “impasse” to describe the situation when searchers experience intractable difficulties and frustrations that lead to search stagnation. Researchers have also explored several influential factors, such as different levels of mental preparation (Tian et al., 2011) and interactivity conditions (Henok, Vallée-Tourangeau, & Vallée-Tourangeau, 2020), that trigger insight learning. The release of restrictions allowed the brain to be freed from its solidified framework and was an important factor in facilitating the “pop-up” of insights (Knoblich et al., 1999).

**Search Difficulties and Solutions**

Before aha! appears during insight learning, there will generally be an impasse stage. It could be inferred naturally that search difficulties could also be experienced before aha! during information searches. Therefore, we reviewed empirical studies on search difficulty in the research field of information search. We reviewed the difficulties in complex searches as a reference for the impasse before the aha! moment appeared.

Research on task difficulty sought to unveil the reasons that create a sense of difficulty for searchers. For example, Liu, Kim, and Creel (2015) categorized frequent causes of difficulty into three dimensions: complexity, uncertain information needs, and domain-specific knowledge. It was found that common reasons leading to task difficulty were specific requirements and too much (unrelated) information based on the data collected in a controlled lab experiment. Various difficulty reasons could be linked with the different task types and different levels of topic knowledge among searchers (Liu et al., 2011).

More research efforts have been devoted to generating predictive models of task difficulty using behavioral evidence. It was found that the perceived difficulty of tasks was often closely related to more complex queries, more advanced operators, the dwell time of content pages, the dwell time of Search Engine Results Pages (SERPs), the number of content pages visited, etc. (Aula, Khan, & Guan, 2010; Liu et al., 2011). Average query interval duration, average document dwell time, and SERPs dwell time can effectively predict task difficulty (Liu, Liu, & Belkin, 2014). It was also found that using only a limited number of important behavioral variables could obtain high prediction accuracy (Liu et al., 2012). Furthermore, research that took query intervals as timestamps to generate predictive models of task difficulty demonstrated that the predictive models were effective for first-round prediction, meaning that it was possible to predict task difficulty at the very beginning of the searching process (Liu, Liu, & Belkin, 2014; Arguello, 2014).

It can be seen that when searchers encounter search difficulties, they will adjust and change their search behaviors. However, there are still unanswered questions: What are the search difficulties that users solved themselves? What are the search difficulties that users eventually give up or compromise on? What kind of experience have users had in the process of solving difficulties? In order to analyze, discover, and understand insight learning during search, we will focus on those cases where participants have tried multiple times to solve the impasse and finally accomplished and obtained insight learning.

**METHODOLOGY**

We adopted qualitative research methods to carry out this exploratory research since we had limited understanding of insight during the information search. In this section, we reported on participants, data collection, and data analysis processes.

**Participants**

Online questionnaires were distributed to recruit participants for the interview and collect cases of insight learning during the search. The questionnaires were designed by both authors and then distributed mainly to students at Peking University through Wechat (a popular social platform), the university BBS, and online recruitment group chats using an online survey platform (wjx.cn). The main target group was university students because we believed that they had more experience searching for information and were more likely to generate insight. In the questionnaire, we first explained the definition of insight learning and then encouraged participants to recall their specific experiences that contained insight learning during search recently, fill in the description of the search task, impasse, and insight, and explain how insight occurred. They were also asked to score the impasse feelings before insight, the sudden degree when insight appears, and the degree of surprise and joy after insight. Participants were also asked whether they would like to participate in the follow-up interviews. 257 questionnaires were collected. We gave preference to the participants whose cases did not overlap with others and who reported cases with stronger
feelings during the search process, as relevant feelings could be regarded as indicators of insight. Finally, a total of 30 participants engaged in the interview based on the consideration of data and theoretical saturation, reporting a total of 33 cases (P1, P6, and P7, reported 2 cases). Participants were balanced in gender (15 males and 15 females each), aged between 18 and 32. Their education level included undergraduate (13 participants), master's (12 participants), and Ph.D. (5 participants), and their disciplines included humanities, social sciences, science, engineering, arts, sports, etc. Their cases could be largely divided into four types of topics: learning (e.g., looking for research methods, P17), work (e.g., helping with the publicity work, P29), entertainment (e.g., looking for horror movies to watch, P28), and life (e.g., aiming to buy similar pants, P16), etc. The source of the task may be endogenous (e.g., preparing for the interview, P7, T7-1), assigned (e.g., assigned by the instructor, P23), or cooperative (e.g., helping a friend find information for an exam, P20).

Self-report Interview
The related research pointed out that self-report data collection methods should be included in the research on investigating the insight process (Danek et al., 2014). Therefore, the self-report interview was adopted in our study to collect data. The outline of the interviews was primarily based on the research questions of this study. Further, we conducted four pilot interviews to test the understanding of insights gained from our initial explanations and the feasibility of interview outlines. After receiving the feedback, we made minor adjustments and began the official interview. Before the interview, we first sought the informed consent of the participants. By giving appropriate guidance with illustrations of the search process and the initial concept of insights, we checked with the participants that they understood the purpose of the interview. Then the interviews began according to the interview outline. The interview outline consisted of five fixed questions: What was the search that you were searching for? What impasses did you encounter during your search? What solutions did you come up with? How did you come up with the final solution? What helped you generate insight? During the interviews, the participants were allowed to express themselves fully without interruptions, while follow-up questions (such as: Did you solve this task as you regularly do? What did insight mean to you during your search? When did insight occur during the information search? What would the procedure be like when insights occurred during the search?) were used to ensure that the interviews did not deviate from the research purpose and enrich details. The interview was conducted from January 18th to March 17th, 2022. Each interview lasted as long as the participants needed (from 45 minutes to 90 minutes). All the interviews were conducted using Tencent Meeting to record the audio. As compensation for their time and efforts, participants will receive RMB 30 for each case reported. The first author conducted the interviews and wrote down observational notes.

Thematic Analysis
The research goal of this study was to develop an initial understanding of the insights learned during the search process. Toward this end, we adopted a primarily inductive thematic analysis approach (Braun & Clarke, 2021) to identify, analyze, and report the themes emerging from participants’ narratives directly instead of trying to put them into a pre-existing coding framework. After anonymization, the interviews were transcribed verbatim. During the data analysis procedure, following the thematic analysis procedure, the collected data in the interview were summarized and transformed into coded sentences to generate themes by QSR Nvivo 12.0. The coding of themes was discussed repeatedly by both authors to better extract themes and categorize the codes. We regularly checked subjective intercoder agreement during the coding process, as past researchers have done (Magee & Simpson, 2019).

FINDINGS
This section presented our preliminary findings with respect to each of the RQs.

RQ1: What benefits do searchers gain through insight learning during the information search?
In order to identify and analyze the benefits of insight for the search, we asked searchers to compare the search process with and without insight. In summary, participants have shared three aspects of the significant gains during the search, as follows:

In terms of the search process, insights made searchers feel much happier and could improve their confidence in their own judgment, thus avoiding delays and completing the task as soon as possible, such as "with this method (the method triggered by insight), it might be more efficient. (P23)"

In terms of task completion, the appearance of insight helped searchers gain a deep impression of the search process and created a sense of satisfaction and a long-lasting memory for completing the task, thus facilitating searchers' ability to accumulate lessons learned and migrate and disseminate them to other search task solution paths. For example, P22 mentioned, "If it (a similar situation) comes up again in the future, it will definitely be very easy to solve it".
In terms of the feelings of searchers, the insight made searchers feel a sense of accomplishment and satisfaction, enhanced familiarity with the task topic, and could even satisfy their need for social interaction, as P6 addressed: "I would definitely introduce Quark (the search engine she had used to solve the task) to others about this function".

**RQ2: When does the aha! moment occur during the search?**

In order to address RQ2, we analyzed participants’ answers to the question of when aha! (the joyful feeling after breaking impasses) occurred during the information search. It is found that before the aha! occurs, searchers often experience impasses. Therefore, in this part, we first described impasses at different stages and how aha! occurred to overcome that impasse. In order to better analyze how the impasse was eventually broken, we adopted the four subprocesses summarized by Liu et al. (2021), which summarized four main stages based on the Information Seeking Model (Marchionini, 1995), namely: Understanding and Planning (including Recognize & Accept and Define Problem), Searching and Execution (including Select Source, Formulate Query, and Execute Query), Examination (corresponding to Examine Results), and Use (including Extract Information, Reflect, Iterate & Stop).

It was found that searchers have experienced different impasses at different stages, and they would identify different strategies that finally helped them solve these impasses; these strategies include clarifying, reviewing, switching, and reformulating. Before describing how they adopted different strategies, we first explain each of these four strategies in the current study. Clarifying is to redefine, understand, and possibly decompose the current task. Reviewing means reviewing the searchers’ previous experience in memory or the summarized patterns during this particular search process. By reviewing the search history, summarizing the search experience, and connecting with existing knowledge and experience, searchers can break the limits of their thinking patterns or rediscover the possible ideas that lead to new breakthroughs. Switching (which mostly represents the switching of information sources) could also be used (e.g., from a database to a search engine and vice versa) to trigger aha!. Reformulating, including generalization, specialization, word substitution, repetition, and a new query (Liu et al., 2010), refers to the reformulation of search queries and also serves as an important information search strategy. The four strategies could be used in combination.

The main impasse and the main strategies searchers came up with were described in the following subsections.

**Understanding and Planning Stage**

The main impasse reported by four participants in this stage was the inability to understand the goal of the task and express it properly to the search systems. In this stage, searchers who experienced impasse and insights were not clear about the information they needed to complete the task at the beginning of their search because they perceived the task to be complicated or exploratory. For example, two participants described their impasses as below: "If you know exactly what research method you want to use, you can do it straightforwardly, but I did not know what method I could use at that time, so I did not know what to search for at the beginning. (P3)" "Something went wrong right at the beginning: it (referring to a word) was mentioned in the recording, but I did not know what this was exactly. (P23)"

Rather than just trying different random solutions, insight learning required more comprehension. Learners aimed to understand the relationships among the pieces of the puzzle. In the Understanding and Planning stage, the impasses were mainly solved by clarifying and reviewing strategies; an example of clarifying strategy was from P3: "I later found out that I didn't really need to know what method to use, but rather I needed to identify a research question. And this website, when I clicked on it, already offered the research question. (P3)" When receiving a task and preparing to search, searchers could be frustrated due to a lack of clear ideas and plans for task completion. The search systems, especially those that present well-structured information, covered a large amount of relevant information that could create the possibility of providing new ideas or helping the searchers accumulate knowledge. Reviewing the pattern of this search process could help locate the intersection between existing knowledge and what the information system can offer, such as: "After this word appeared repeatedly, I was able to realize that this word starting with the letter B could be a personal name. Because the oral history went like this based on my past experience and the name had a specific pattern of pronunciation. (P23)"

**Searching and Execution Stage**

The main difficulty in the Search and Execution stage was formulating a proper query when lacking background knowledge and task information, as reported by four participants. For example: "I intended to describe the flower, but there was really no particularly good description. (P6, T6-1)". We found that if a searcher did not find satisfactory results in the current information source by using queries constructed on existing information, switching was found to be an effective strategy. Also, the searcher could be guided toward reviewing existing knowledge to help expand their ideas. In other words, helping the searcher review and associate the current task with existing knowledge or experience would be necessary at this stage. Switching and reviewing were combined to solve P6’s task: "My idol endorsed this search engine (referring
I later found that there was no way to find the relevant information through various channels, and then I remembered that I had joined some group chats before and found answers there, then suddenly I thought, why not try this way to see if I could find people for advice? (P20)

Evaluation impasses occur when the quality and quantity of the information are unsatisfactory. As for the evaluation impasses, if there was a problem with the quality of the information, the searcher could be guided to switching and reformulating strategies. The dilemma went like this: searchers could sometimes solve their tasks by switching strategies. However, due to the fact that searchers' task solving was strongly influenced by their preconceptions and habits, they would always choose the regular search strategy they used most. In general, relying on previous paths to solve tasks helped searchers deal with familiar tasks efficiently, but it also prevented searchers from seeing better solutions in different or unfamiliar environments. If it was a problem of information quantity, the searcher could be guided in reviewing and reformulating strategies. Search query reformulation on the searchers' own could be demanding; hence, search suggestions based on their past search history, such as reference queries or search paths when solving similar problems, could also be helpful. By offering alternative query choices like this, it could trigger searchers to continue solving the problem. When the searcher taped into and further expressed his or her new, real needs in a form that was more in line with the implicit needs, new queries could be formed and the tasks subsequently solved. Specifically, if the system presented too much information, then it could inspire the searcher to decompose the task, narrow the target, and specify. For example, P16 saw "someone on the street wearing a pair of good-looking pants". But relying only on image recognition, there was "too much" content to be recognized. After several attempts, he tried to add the "key feature" of the pants, the text "chain", to the query.

Use Stage
A total of seven searchers reported impasses during the use stage. At this stage, the searcher may not be able to extract information from the system’s feedback. Or the searcher has collected a certain amount of information, but the information is not convenient for the searcher to carry out subsequent operations. For example, "at that time, I was helping my senior apprentice analyze data using time series analysis, but we found that the data could not pass the stability test. So we were looking for ways to pass the test. But no matter how hard we looked for it, all kinds of methods could not fit in (P13)." Confronted with this during the use stage, searchers like P13 tended to rely on a clarifying strategy: "Later, I felt that I had trapped myself. So we started from the most primitive task purpose, that is, what method we can use to analyze this data instead of focusing on solving the stability problem, and then the new method came up." We could assume that the search engine itself provides a large amount of information, which may invariably enter the searcher's subconscious and facilitate the search for useful information if it were presented in a structured, organized form that was consistent with the search engine's mental model, it would be easier for the searcher to utilize the information.

RQ3: What stages have searchers experienced during the insight learning process?
This study considered insight learning during search from the perspective of the process. We identified three stages that existed during the insight learning process: impasse, incubation, and reconstruction. We have discussed impasse in the previous section and mainly discussed incubation and reconstruction in this section. Further, we located their roles during the search, namely, impasse as the antecedent, incubation as the key, and reconstruction as the consequence. Insight learning during the information search process went like this: during the search process, information accumulation and comprehension were completed, which laid the foundation for breaking impasses. There would be impasses at different stages of the information search, especially in the Examination stage. However, impasses may be broken by incubation. Finally, reconstruction was made to complete the task.

Impasse as the Antecedents
Impasse has long been recognized as an inherent aspect and hallmark of insight, and in our study, it meant when a seeker was stuck; he or she could have tried many unsuccessful trials and did not know how to move forward. The findings of RQ2 have described what impasses seekers often encounter at different stages, which will not be
elaborated again in this section, but we would like to emphasize that impasses should be regarded as the antecedent to insight learning.

**Incubation as the Key**

Why can some impasses be resolved while others are abandoned in the end? It was found that the core was in the critical stage of incubation. Incubation benefited from information accumulation and comprehension during the information search process. When the searcher interacted with the system, the information provided by the system continued to pour into the searcher's mind, some of which was understood and some of which was accumulated. The understood and accumulated information fused with the structured knowledge in the searcher's mind to trigger an insight. During the interview, when asked to reflect on their insight, P2 suggested that the main reason for the insight was "the accumulation of literature over a long period of time".

However, if searchers focused too much on the task itself, they could get stuck and, therefore, enter the incubation stage by taking a break or trying to do something else. For P2, the incubation was formed by escaping from the task and taking a meal instead: "The break helped me a lot. I felt like I had been exploring but with no results, and that was exhausting. I just thought I'd have a quick meal and then come back and continue searching, as a new beginning."

As the key to insight, incubation made searchers jump out of the box and form new angles to scrutinize, such as "After the break, I began to wonder if I was going in the wrong direction. I deeply believed that I should switch my thoughts, like maybe I should start from the collections of monographs on archaeological sites... (P2)."

**Reconstruction as the Consequence**

The emergence of aha! was certainly gratifying, but it was not the last stage of the insight learning process. Reconstruction, as a result, may occur afterwards as a following action, as P4 says, "I had to go through that previous search process again, although I was finally clear on the keywords I was searching for." Restructuring meant changing the initial solution idea to form a new one, reconstructing the previous behavior, and putting it into task resolution in a new way, thus hitting the final solution of the task. We also found that searchers immediately engaged in the process of completing the task after the insight occurred: "just bought it straight away (P16)" and "immediately followed the actions in the video (P22)", probably because searchers often experienced an extremely strong sense of meaning and achievement from the insight, and this positive emotional experience helped them to further invest their energy.

**RQ4: What are the key factors that could trigger insight learning during the search?**

This research question aimed to address why some of the participants experienced aha! during the search while others did not. During the interview, we asked the participants to recall what helped them trigger insight learning. Specifically, three key factors that trigger insight learning from the emerging codes were identified: metacognition, emotion, and information systems.

**Metacognition**

Metacognition, often discussed in the field of information search behavior nowadays, could help identify key information, make connections, and be critical for task solving. At present, there is no uniformity in metacognition strategies. When exploring insight cases, we found the following six metacognition strategies: prediction, planning, monitoring, selective focus, adjustment, and evaluation. Prediction means that the searchers who believe they have a greater possibility of completing the tasks would help them break the impasse, such as "I think this task was easy to find the solution because I think my search ability in the entertainment field was relatively good (P1,T1-2)". Planning refers to setting goals (Ward & Capra, 2021), and if the searchers have a clear understanding of the solution process from a macro and general perspective or are able to make a general plan for their own completion, it will help to trigger insights. As P4 illustrated, "I am actually a person who has a fixed plan every day; my task that day was to find relevant literature. I felt like I had to get this job done no matter what". Monitoring the feasibility of the searcher's ideas and the progress of obtaining information would also help (Ward & Capra, 2021; Crescenzi, 2016), such as "I have been exploring for such a long time and I believed I should take a break (P2)". Through monitoring, searchers may be able to rationalize their rest and thus enter the incubation period. Selective focus refers to narrowing down to the key point while leaving all other elements in the frame out of focus, such as "My search range was too large; I want to narrow it down, so I decided to recall the specific details of the pants (P16)". Adjustment represents the cognitive behavior of adjusting ideas or thinking patterns, such as "selecting the research method according to the research purpose only (P13)". Evaluation refers to the searcher's evaluation of the current achievement relative to the prospected final results during the search process (Ward & Capra, 2021), such as "Toward this end, I first analyzed why I had this problem and felt that I didn't think about this topic very clearly (P17)". By assessing the difference between the ideal goal and the current state, searchers may be able to clarify goals for the next phase.
**Emotion**

Among many variables that have been shown to predict the emergency of aha!, emotion was one of the most widely studied predictors (Orita & Hattori, 2019). Both positive and negative emotions could promote the occurrence of insights. Positive emotions could promote the efficient allocation of attentional resources (Orita & Hattori, 2019), promote the identification of cues, and broaden participants’ searches of the problem space. An example of being calm and relaxed would be: "I calmed myself down and asked myself to breathe deeply. And I decided to think about what the teacher said and tried to extract possible keywords, and it occurred to me (P25)." An example of being confident would be: "I was confident that the task would be solved successfully. Because I felt that there must be an answer, it could just be hidden, so I just had this confidence from nowhere (P29)." While negative emotions may force searchers to be more focused on the current tasks (Orita & Hattori, 2019), an example of being doubtful would be: "I thought the biggest point was that because of my doubt, I was also forced to rush. I probably based it on this skepticism, and then I started looking through the previous ones, and I found it in it (P14)." It seemed that it was the intensity of the emotional feelings that triggered the insight learning rather than whether the emotion was positive or negative.

**Information System**

It was recommended that the search systems not only simply solve searchers’ tasks or directly offer answers but also be able to trigger insights for searchers. According to the self-reported data, if the system could provide more aggregated and fine-grained search results and help visualize the searcher’s search path, it would help searchers process information faster and contribute to insight learning. First, the system should provide well-organized information that is easily absorbed by searchers, such as a collection of relevant topics. An example would be: "(This system) provided a collection of monographs, which was absolutely more convenient (P2)". Provide more fine-grained information, which could save searchers time from finding detailed information and reduce the chance of information disorientation, such as "I entered aesthetics, but the system fed me the book. The key words and title of this book had nothing to do with aesthetics, but there was a highlighted paragraph in it that mentions aesthetics, which gave me a lot of inspiration (P24)". As P1 said, when she visualized the searcher's search path, she "actually summarized experiences based on multiple times on the search and then made a summary of all the valid paths on my own, which was very energy-consuming." Therefore, if the search engine "could provide a complete path of how to search and directly summarize what these effective paths have in common", then it may largely contribute to the insight.

**DISCUSSION**

This paper explored the benefits of insight learning during search, which resulted in joyful, impressive, and meaningful learning, as well as when and how insight learning occurred, and finally summarized factors that might contribute to the generation of insight learning. In this section, we first discussed how insight learning was related to search difficulties and solutions, and then further elaborated on the power of incubation and connected insight learning during search with serendipity during information browsing. Finally, design implications and future work were proposed.

**Search Difficulties and Solutions**

People may need to seek help from search systems for difficult and complex tasks. One possible solution was to keep searchers from encountering difficulties or help them avoid them in advance. For example, Information Fostering (Shah, 2018) aimed to predict potential problems searchers may encounter and provide help (such as a document or a strategy) to overcome those problems. Another possible solution was that when the searcher encountered difficulties, instead of helping the searcher avoid or solve them, the system could offer clues to solutions, allowing the searcher to solve the difficulties on their own. Impasse was a significant contributing factor to the insight revelation as it encouraged the appearance of errors to be fixed (Dubey et al., 2021). In this study, we investigated cases where searchers overcame the search difficulties (so-called "impasses") either by themselves or through suggestions by the search systems and had impressive search experiences, so as to infer indications for the design of the search system from the second perspective. In our preliminary study, we identified four strategies that searchers found effective: clarifying, reviewing, switching, and reformulating. The strategies identified in the current study may seem familiar to some of the search experts (Bates, 1979; Aula & Kellar, 2009; Buscher et al., 2012), but they were found to be very insightful and effective for searchers in our study. The reasons for this might be that these searchers were not very familiar with these strategies or that the current search systems did not fully support or explicitly suggest these strategies. Therefore, when they came up with these strategies and found them effective, they found them very impressive. Previous studies have identified search tactics and search strategies but have not explored how to teach or guide searchers to use different strategies for different tasks or difficulties. In this study, we found that the key for searchers to experience insight learning during search was to help them jump out of their existing or limited thinking framework and try new and creative strategies when trying to solve difficulties during search or learning.
The Power of Incubation During the Information Search

Incubation is a typical phenomenon of creativity that occurs in insight learning. The power of incubation in learning-related fields may be explained by the British educator Wallas (1926), who suggested that the key step to insight was the incubation period. The incubation period was characterized by being repeatedly thought about at first (refer to the information accumulation and comprehension in our study), taking a break or releasing the focus, and then allowing previous information to enter the mind unconsciously. A final solution via restructuring old and new information could thereby be achieved.

As the key to insight learning, incubation also played a vital role during the search for information. After trying repeatedly but unsuccessfully to reach an impasse, the searcher could move on to the incubation stage. At this point, the inherent limitations were lifted, the knowledge accumulated during the search process formed an interconnected system, and individuals rearranged disorganized or useless resources in a meaningful way, but only if the searchers were able to think outside the box, using strategies such as clarifying, reviewing, switching, or reformulating.

Insight learning could not be achieved in any single attempt but was gradually acquired through various cognitive and behavioral thinking processes. Although incubation seemed to refer to relaxation and the release of constraints in its literal meaning, it also meant information accumulation and comprehension and involved efforts to think outside the box. Traditional information-seeking models have described users’ search processes. For example, the Berry Picking Model described the searching process as bit by bit based on the information gathered along the way (Bates, 1989), and Information Foraging Theory (Pirolli & Card, 1999) argued that the users’ search behaviors would adapt with the change of search context and the searchers’ cognition, and the integration of external information into existing cognitive structures may lead to the creation of new cognitive structures, or reconstructions. We also like to argue that even though insight learning seems like a sudden increase of information, the incubation stage, as a stage to step back, relax, and reorganize their acquired information, may also be important for searchers to solve problems or gain new knowledge.

Incubation has been identified as one of the creation strategies in a recent study that examined users’ information seeking behaviors and creation processes during independent topic selection as a type of creative learning task (Li, Liu, & Hansen, 2023). The definition of incubation was adopted from Hadamard (1954), which emphasized continuous work on the creative task rather than rest and relaxation. Selection and exploration in Kuhlthau’s ISP model were matched with the incubation stage. People belonging to the incubation type spent the longest time in this stage when completing creative tasks. They selected appropriate information and explored the domain to understand and analyze the task in preparation for the final creation. Nevertheless, the incubation processes in this study emphasized taking a break from pre-existing constraints through rest and relaxation. The differences may be caused by the different types of tasks investigated in the two studies. Li, Liu, and Hansen (2023) focused only on creative learning tasks, and the incubation stage might last relatively long, at least for a couple of days. While the current study only focused on one search session and problem solving, the incubation in our study emphasized the relaxation from struggling and then jumping out of the thinking frame. Particularly, it was found that the insight learning cases that stressed the incubation stage reported by our participants mainly belonged to learning or work-related tasks or were assigned by others. This could indicate that the more restrictive the tasks, the more relaxation may be needed for searchers to jump out of the current status quo. The common part of the incubation concept in both our study and that of Li, Liu, and Hansen (2023) stressed knowledge accumulation and reservation before the generation of some creative or insightful knowledge.

Connections of Insight Learning During the Search with Serendipity During the Browsing

This paper examined insight learning during the searching process, and insight has also been mentioned in serendipity-related work. For example, Makri (2014) proposed that insight learning often occurs when information is unintentionally discovered. He proposed that connection-making was established during browsing between seemingly unrelated information, leading to insights. Insight learning was achieved through the establishment of links between knowledge by extracting structural relationships for knowledge acquisition and application so that searchers had new ideas, behavioral or cognitive changes (which refers to reconstruction in our study), and felt the emotions of surprise and joy (which refers to aha! in our study) (Makri, Ravem, & Mckay, 2017). If serendipity was defined by Fine and Deegan (1996) as the unique and contingent mix of insight coupled with chance, then similarly, we could define the insight in the search process as insight coupled with purpose. In the process of serendipity, searchers’ surprising and delightful information from serendipity pushed them to places they had not been before. For insight, the surprise and joy afterwards came not only from the feeling of luck but also from the recognition and satisfaction within oneself that the solution emerged with effort.

Furthermore, with more emphasis on goal-directed or task-driven learning, insight learning during search may depend more on incubation to overcome the restriction and proactive problem solving by trying to jump out of the current mindset. How serendipity happened during browsing could also help explain how insight learning happened.
during search. It may be the case that searchers turn to aimless browsing when they encounter an impasse in completing the tasks, and then the relaxation allows searchers to enter the incubation period so that they may have a better chance of getting useful information for their tasks. The current study also indicated that in the future, the boundary between information search and information browsing may blur, and information systems should allow users to smoothly switch between searching and browsing. Such a mode may also lead to better learning performance.

**Design Implications**
This study examined the benefits of insight learning during search and investigated the reason and process of its occurrence, which could shed light on the design of future search systems to support insight learning for users. For example, the findings of RQ2 reveal that reviewing is essential to breaking the impasse. Providing retrospective functions during the search may be helpful. Based on the findings of RQ3, impasse as the antecedent is a stage at which searchers have tried multiple times but failed, so it is very important for the system to be able to detect such impasse during search and provide timely assistance to trigger insight, such as providing new search strategies or new queries to help describe the information they need. Understanding and the accumulation of information are the basis for insight. However, too much information may make searchers feel disoriented or overloaded. Hence, it is important to provide knowledge graphs or search trails for users and adjust the amount of information supplied according to searchers’ stages. Since incubation is the key to insight, search systems could facilitate relaxation or help searchers jump out of their original thinking frame by providing heterogeneous information or reducing the amount of information provided. As addressed in the RQ4, information systems could offer meta-cognition tools to help users monitor and evaluate, provide more aggregated and fine-grained search results, provide a visualized search path, and boost users’ confidence to trigger insight.

**Limitations and Future Work**
We acknowledged that this study was preliminary in its exploration of insight learning during information searches. The benefits of insight learning during search were analyzed based on the cases reported by our participants, and they could vary from individual to individual, which meant the insight for one person may not be salient or impressive for another person. However, consistent with the existing research, we regarded searchers' opinions as an important criterion for judging whether insight occurs; that is, we considered them the authorities of their own experiences (Makri, Ravem, & Mckay, 2017). It would also be useful to know how the search tasks and demographic backgrounds were related to their experiences of insight in future work. And it should be further examined to determine the effects of the dimensions of key factors that trigger insight during the search process, using user experiments to validate whether and how these factors could actually promote insights. In this study, insight learning is a process that triggers the aha! moment during the search. However, we should acknowledge that insight could also be considered an outcome and might be associated with different levels or nuances. Future work is needed to measure insight during search in detail and determine whether it could be inferred from the observation of users’ interactions or neuro-physiological signals, as well as apply it to the design of search systems or other learning systems. In the future, researchers in the field of SAL should expand the orientation of learning beyond mere knowledge accumulation to assist in the generation of more insights, creativity, etc. Search will not only be a tool to assist in the accumulation of knowledge but will also be an important choice for insight learning. How will solving difficulties in search contribute to learning? How could critical, impactful, and creative learning emerge? How do different conditions lead to different types of learning? These questions were examined briefly in our research, but they merit further investigation.

**CONCLUSION**
This preliminary study aimed to introduce the concept of insight learning during search and provide a new perspective on studies on Search as Learning. Through self-reported interviews, this study revealed the benefits of insights in terms of acquiring deep impressions, facilitating the search processes, and enhancing familiarity with the topics. Three key stages of the insight learning process were identified: impasse, incubation, and reconstruction. In addition, the study showed how impasses in different stages were resolved by clarifying, reviewing, switching, and reformulating and were guided to reconstructions. Finally, we summarized meta-cognition, emotion, and the information system as the main factors that could trigger insight learning. By profiling the source of searcher-generated solutions, i.e., exploring where the searchers’ insights come from, we meant to make a difference toward learning and help revitalize the future work of task-based information search by proposing the concept of insight and presenting a framing of insight during the search process. More discussion is bound to be needed for insight learning, but in any case, may aha! be with us!

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The Trans Metadata Collective

Watson, B. M.  
University of British Columbia iSchool, Canada | brimwats@ubc.ca

Murphy, Devon  
University of Texas at Austin, USA | devon.murphy@austin.utexas.edu

Schaefer, Beck  
Osgoode Hall Law School Library (York University), Canada | bschaefer@osgoode.yorku.ca

Huang, Jackson  
The University of Michigan, USA | huangjq@umich.edu

ABSTRACT
This paper presents the history, internal processes, and finalized report of the Trans Metadata Collective (TMDC), founded to address the lack of attention paid to trans and gender diverse issues in galleries, archives, libraries, museums, and special collections (GLAMS). The TMDC, an ad-hoc group of nearly a hundred information professionals, developed best practices for the description and classification of trans and gender diverse information resources. These guidelines prioritize transparency, cultural sensitivity, correct identification, explicit descriptions of transphobia, and regular assessment of trans-related content. It examines the effects of commonly used standards and controlled vocabularies such as Resource Description and Access (RDA) and Library of Congress Subject Headings (LCSH) on trans and gender diverse people and critiques the inadequacy of these standards’ representation of those communities. The TMDC provides guidance for using existing LCSHs, recommends alternative subject vocabularies, and proposes revisions to improve representation. The paper advocates individual agency in naming and gender identification, with recommendations on contacting creators and documenting their preferences. The TMDC emphasizes the importance of minimizing potential harm and protecting privacy in metadata creation. Overall, the report aims to enhance the representation and inclusion of trans and gender diverse communities in GLAMS institutions.

KEYWORDS
Knowledge Organization, Cataloging and Classification, Remediative Cataloging, Reparative Description, Metadata, Information Ethics/Information Privacy

INTRODUCTION
Trans and gender diverse people (here used as an umbrella phrase for people who identify as transgender, transsexual, nonbinary, genderfluid, and/or have non-Western gender identities) face unique challenges and dangers in information contexts. As a group, they often do not receive the same legal protections against discrimination as cisgender people and they are subject to significant risk of harassment, discrimination, and even violence. Within academic, informational, and professional contexts, many experience a form of personal trauma connected to their pre-transition identities that makes them especially vulnerable (Tanenbaum et al., 2021). Trans and gender diverse people can also be misnamed or misgendered in metadata, which runs the risk of outing them and putting them at risk of harm or violence. For example, Resource Description and Access (RDA)’s requirement for recording creator gender (Billey, 2019, 2022; Billey et al., 2014, 2016; Billey & Drabinski, 2019) and the Getty Vocabularies’ collection of gender information for artist records (Harpring, 2023) represent two of many methods by which sensitive information about trans and gender diverse people can be improperly shared.

While there are many publications in Library and Information Science concerning issues faced by trans and gender diverse patrons, staff, and users of Galleries, Libraries, Archives, Museums, and Special Collections (GLAMS) (D.C. et al., 2017; Jennings, 2017; Lyttan & Laloo, 2020; Naidoo, 2018; Smith-Borne, 2019; Taylor, 2002; Wilson, 2018), little attention has been paid to issues faced in the description, cataloging, and classification of information resources related to these individuals, communities and/or their works, and even fewer have consulted members of those communities. The harm caused by information systems can be especially pernicious in cultural heritage institutions, where metadata records may persist for decades and be aggregated across multiple platforms. As metadata is often created about trans and gender diverse communities by professionals unfamiliar with these issues, work practices that appear to be neutral continue to enact harm. In order to counteract these problems, metadata best practices should be developed by those who will be affected by them, as seen in efforts like the Archives for Black Lives in Philadelphia, Protocols for Native American Archival Materials and the Chicano Studies Collection Thesaurus (Antracoli et al., 2019; Antracoli & Rawdon, 2019; CARFAC, 2021; Castillo-Speed, 1992; First Archivists Circle, 2007). To meet these challenges, the Trans Metadata Collective (TMDC) was created in 2021, with the goal of developing a series of best practices that addressed the sizable gap in information resources for trans and gender diverse materials and the communities that data is derived from. The group was formed organically over virtual, informal communication channels, eventually comprising over one hundred cataloguers, librarians, archivists, scholars, and information professionals. The variety of individuals served as a way to ensure the best practices could be instrumental for various kinds of cultural heritage institutions. This long paper discusses the

LITERATURE REVIEW

Critical Cataloging

According to Watson (2023), summarizing nearly a century of literature, critical cataloging refers to practices “deeply rooted in the history of technical work in cultural heritage institutions, librarianship, archivy, and museology—whether those practices are called alternative, radical, reformative, or critical.” (Watson, 2023) Critical cataloging literature recommends:

1. the use of multiple or alternative vocabularies or classifications, where available
2. the practice of “cultural competency” when considering historic identities, items, or groups the use of“ethical outreach” when dealing with still-living identities, items, or groups
3. “trickster” practices of “alteration,” “subversion,” or “extension” of dominant metadata principles or systems, and/or the replacement of dominant classification or cataloging on a local level
4. consultation with described subjects
5. and finally: the realization that changing words and hierarchies alone will not fix the problems or harms caused by description, cataloging, or classification (Watson, 2021).

Discussions around and about the ethical labeling of marginalized subjects in knowledge organization systems (KOS) are nearly a century old, since the publication of Dorothy Porter’s 1933 review of Oberlin’s Anti-Slavery Propaganda catalog (Porter, 1933) and the development of her Moorland-Spingarn Research Center classification system (Bledsoe, 2018; Helton, 2019; Nunes, 2018). Other approaches, like Sanford Berman’s “Prejudices and Antipathies” (Berman, 1993), Brian Deer’s classification system (Bosum & Dunne, 2017; Cherry & Mukunda, 2015; MacDonell et al., 2003; Swanson, 2015), and formation and work of the GLBT Round Table within ALA (Adler, 2012; Poole, 2020) demonstrate the wide variety of initiatives and individuals engaged in the representation of marginalized identities in LIS. They have also laid the groundwork for the breadth and depth of research and development of actionable tools used by information/cultural heritage professionals today. These items range from thesauri and terminology lists to broad policy recommendations (for comprehensive lists of current efforts, see Watson, 2023 at critcat.org, and Fox, 2023, at cataloginglab.org). Two of these resources, Archives for Black Lives and BlackLivesMatter, have pointed out that despite its flaws, LCSH may remain essential for users and researchers (Gross et al., 2015).

Concerns about trans and gender diverse metadata in GLAMS

While there are many publications in Library and Information Science concerning issues faced by trans and gender diverse patrons, staff, and users of Galleries, Libraries, Archives, Museums, and Special Collections (GLAMS) (D.C. et al., 2017; Jennings, 2017; Lyttan & Laloo, 2020; Naidoo, 2018; Smith-Borne, 2019; Taylor, 2002; Wilson, 2018), very little of it is aimed at and addresses the concerns of metadata workers at GLAMS. Scholars such as Adler (2012, 2015), Poole (2020), and others (Floegel et al., 2021) have demonstrated, queerness and queer bodies (including trans and gender diverse ones) destabilized the rules and historical understandings between catalogers and the catalogued. Resultingly, information professionals, activists and researchers have struggled with controlled vocabularies, especially ones as pervasive as the internationally-used Library of Congress Subject Headings (LCSH). While terms from controlled vocabularies broadly and LCSH specifically contain terms describing marginalized groups that are often criticized as inappropriate, misleading, or outrightly offensive (Adler & Tennis, 2013; Berman, 1993; Drabinski, 2013; Long et al., 2017; Olson, 2002; Satija & Martinez-Avila, 2017) researchers have pointed out that despite its flaws, LCSH may remain essential for users and researchers (Gross et al., 2015).

The use of authorial or creator names in metadata records is one of the fundamental principles of library and information science. Traditionally, metadata workers within GLAMS have been instructed by LIS research to include all iterations of author’s name, and authors have been directed to self-cite earlier publications. For example, Melvil Dewey spent more time and ink on the proper naming of authors in the first edition of “Classification and Subject Index for Cataloguing and Arranging the Books and Pamphlets of a Library” (Dewey, 1876) than on the subject cataloging of resources. For institutions that use MARC, creator names take precedence as the first field (1XX), and for institutions using RDA will find that a significant portion of RDA’s instructions “RDA: Resource Description and Access” (Joint Steering Committee for Development of RDA et al., 2015, Chapters 9–11) is dedicated to explaining the use of names (chapters 9-11). Finally, the two major cataloging and classification...
texts by Joudrey et. al. (2015) and Chan and Salaba (2016) each dedicate nearly a hundred pages to the processes around naming. In recent years, a number of authors—including academics, activists, and classically trained catalogers—have raised concerns around the use of names as identifiers and access points (Seeman, 2012; Shiraishi, 2019; Whittaker, 2019). Identified issues include: include the use of women’s family or married names (Kazmer, 2019; Martin, 2019), the use of colonial and anthropological nomenclature (Elzi & Crowe, 2019; Fernandez, 2018; Gilman, 2006; Kam, 1992; Rigby & Gallant, 2019), misspelled or miscopied non-Western names (including improper use of Indigenous names) (Arastoopoor & Ahmadinasab, 2019; Diao, 2015), and racist terminology (Antracoli et al., 2019; Antracoli & Rawdon, 2019).

Trans and gender diverse creators are uniquely vulnerable to discrimination and violence directly related to the disclosure of their gender identities through the names assigned to them by systems. Authors applying queer theory to cataloging have also focused on other ways information in authority records out transgender individuals. To illustrate via example, Thompson’s (2016) excellent and relevant article examines the authority records for 60 authors who self-identify as trans to ascertain if their authority records ‘out’ them as trans. By examining fields for recording name and gender, Thompson was able to identify that nearly two thirds (39/60) of the records effectively outing the authors. Only 21 of those 39 records cited the author as the source for the information about their gender identity. Thirty-four of the 39 provided more than one name for the author, either as a name set (alternate versions of a name used simultaneously) or name sequence (names that the author has used in the past but does not currently use). That so many authority records contained sensitive information that did not come from the authors themselves verified Thompson’s concern that authority records may unwittingly — and unacceptably — expose the authors in ways the authors never intended. This issue has been also explored by others who demonstrate that including gender identity in authority records is not necessary for bibliographic purposes (Billey, 2019; Billey et al., 2014, 2016; Billey & Drabinski, 2019).

ORIGINS OF THE TRANS METADATA COLLECTIVE
The initial idea for the Trans Metadata Collective project began as a conversation after a panel at the University of Victoria’s Moving Trans History Forward conference in March 2021. Within a few weeks, planning for what would become the Trans Metadata Collective began in earnest by when K.J. Rawson, Brian Watson, Beck Schaefer, Laura Horak, Magnus Berg, Clair Kronk, and Dijaz Zulida met in the summer of 2021. Recognizing the limitations of their perspectives, this planning group launched a broad call for participation on Twitter, GLAMS-relevant listservs, and elsewhere. The response to this call was overwhelming, and over a hundred GLAMS professionals expressed interest in participation. Special effort was made to recruit from the mailing lists of communities traditionally underrepresented in GLAMS.

Two large-scale meetings (called the Convening Committee) were held to discuss action plans and organize several working groups that would cover narrower themes and allow individuals to contribute based on their own expertise. These initial working groups were called Descriptive Practices, Subject Headings & Authorities, Name Authorities & Access, and Ethical Recommendations. A Slack workspace was created, and the working groups began meeting to develop individual documents. These documents took a variety of forms, including lists, bibliographies, and formal reports. On a semi-monthly basis, a representative from each working group met in a so-called Coordinating Committee in order to ensure that work was progressing and not being duplicated. As working groups finished preliminary drafts of their self-assigned work, their documents were merged into a larger document, which was edited by one or more representatives from each group. During this year-long process, individuals participated as they were able to and committees remained productive despite the challenges of COVID.

TMDC’s use of “Trans and Gender Diverse”
From the beginning, the TMDC was deliberate in its use of language (perhaps unsurprising, given that it was made up of metadata professionals). The document was meant to be a practical resource for metadata professionals, not a introductory-style ‘Trans 101.’ Members recognized that gender is a complex subject, and chose to explain their rationale behind certain decisions. This is particularly noticeable in the use of “trans and gender diverse” throughout the best practices document. Gender is not just about presentation/identity; it can also include social role and cosmological place, making conceptualizations of gender culturally specific. Translation is one way this fraughtness can be illustrated. While communication, understanding, and overlap exist between communities of people that speak different languages, gender systems may also require translation rather than direct equivalence when a specific metadata term is used. In the United States and the Western world more broadly, there is a culturally dominant understanding of gender as both binary (man vs. woman) and static (gender is based on sex assigned at birth). Other nations and peoples—both historically and in the present—have their own cosmological conceptualizations of the world and of gender where the assumptions of “binary” and “static” may not apply or may be understood very differently. Likewise, trans is a culturally and historically specific framework, which may not map exactly onto other cultural understandings of gender. Therefore the TMDC uses “gender diverse” as a stand-in umbrella term for conceptualizations of gender that fall outside of that static binary; non-Western people and
languages have had and still have their own culturally-specific gender terms, which they may use instead of or alongside the term “trans.”

This is doubly important in the context of GLAMS because of the ways that settler colonialism and colonialism abroad have influenced collecting policies and practices at Western GLAMS. Cultural heritage institutions in the West often hold at least some materials from or about Indigenous peoples; many influential white men from history were also hobbyist ethnographers. What is often called “ethnographic material” is hidden within larger collections, and the TMDC wanted to encourage professionals to consider how these guidelines apply beyond a narrow conventional understanding of “trans archives,” and to understand the ways in which trans and gender diverse resources may appear in other spaces, e.g. material on gender diversity included in an anthropological or “natural” history archive. Current society’s gender terms and/or conceptions do not necessarily map to other cultures or ways of being specific people or communities do not always view themselves as “trans” (Indigenous Two-Spirit identities, for example). While trans and gender diverse are not equivalent, there are many overlapping issues and gender diverse resources from other cultural contexts may also already be labelled with trans-specific subject terms.

**Authorship & Review**

While the TMDC’s aim was better (or even explicitly articulated) guidelines and best practices for metadata and description of trans and gender diverse resources, it aimed to be intentional in how it gave participants credit for their contributions. As the goal was to create high quality guidelines, but the collective was independently organized and did not have the funding to pay people for their expertise or labor, participation was voluntary and often occurred on top of other existing professional and personal responsibilities. While a top-down and hierarchal structure may be more efficient or clear, the TMDC attempted to create a space where people could choose to participate to the degree that they could and wanted to.

However, goals of timeliness and quality were still of importance and the work of the collective was deeply personal for the vast majority of contributors, so the group aimed to be “intentional not only about what we were making but how we were making it – in how we communicated with one another, shared labor, and made decisions” to quote from one participant. In presenting their work, the Collective aimed to represent the “how” of this process in the clearest way possible, by giving credit for in a way that fairly and accurately reflected the varying labor of contributors and the deeply collaborative and communal process of working collectively, which was often times quite different from how work occurs in other parts of member’s professional lives, in institutions that are generally more hierarchical in decision-making, division of labor, and attribution of credit. Therefore, the individuals listed in the "Authors" section of the final document were primary authors (those who wrote sections), listed alphabetically, and all other authors and reviewers ("contributors") were listed at the end of the document in whatever order they chose (mostly by peer review order). The TMDC also felt that providing a section with self-description of authors and reviewers at the end of the document also provides additional transparency on who was involved and demonstrated both our expertise and our limitations. The inclusion of reviewers was also seen as important because of the extensive dialogues that occurred during the month-long comment period that allowed the reviewers to shape the final document. This review process was seen by the collective as not style editing, but rather a formative collaborative stage in the overall guideline creation process.

Finally, according to the notes accompanying the authorship section, there were many individuals that elected or opted out of inclusion in either section due to concerns of harassment, local/national political environment, outing, and/or personal danger.

**GENERAL GUIDELINES & PRINCIPLES**

In their recommendations, the TMDC aimed for recommendations that were both concrete and actionable, not just critical or theoretical. While the collective agreed that critique is good and that theoretical frameworks are useful, its the greater goal was encouraging the adoption of consistent best practices easier by GLAMS. Furthermore, over the course of 2021 it became increasingly apparent that there was a need for a document of this type.

After discussing the possible formats of the final document, members envisioned something that would be usable across institution types and experience levels; something that could be applied in both public and academic libraries, archives, museums, and special collections at R1 institutions, independent institutions, or even local historical societies. The collective also aimed for guidelines that basic enough that they could be understood by volunteers, or new professionals, but also desired the inclusion of more detailed recommendations for readers with extensive experience and expertise in technical services, metadata, or other fields. Consequently the collective agreed on a two-part structure for its final document. The first part, entitled “General Guidelines & Principles” was high-level and conceptual, an articulation of principles or achievable goals. The second part, entitled “Domain-Specific & Technical Details” would contain granular technical guidelines to support implementation across a variety of systems. This balance was important to the Collective as their goal was not to hand down instructions from above but instead to provide support to institutions and individuals exercise their professional expertise and discretion in an
informed way. The final high-level guidelines the TMDC settled in their final document (The Trans Metadata Collective et al., 2022, p. 4):

1. making the process of metadata creation transparent, which may include making descriptive standards, rationale, and context publicly available, providing methods for user feedback, and collaborating with community members (with consent and compensation).

2. using culturally and contextually appropriate labels for trans and gender diverse communities and subjects: different cultures and communities may have terms for genders that may not translate into the typical descriptive tone or primary descriptive language. This may include Indigenous vocabulary or community terminology uncontrolled by vocabularies. Collaborate with specific communities and prioritize their terms and protocols alongside controlled vocabularies or otherwise authoritative terms.

3. correctly naming and identifying trans individuals, meaning that trans and gender diverse individuals may use different names in different points or contexts in their life and that metadata should rely on self-identification and self-description where possible, including direct consultation with individuals or communities. It is not necessary and not recommended to record information about someone’s gender identity or previous names when resources have nothing to do with gender identity.

4. being explicit about transphobia in collections, items, and metadata, meaning that metadata should identify perpetrators and victims and use active voice and subject headings to “embed responsibility.” Metadata workers and policies should aim to correct, update and remediate offensive or inaccurate language provided by other metadata creators.

5. identifying trans-related content and metadata through regular assessment and prioritizing it for remediation, meaning that institutions should plan proactively for periodic assessment and remediation, including the identification of materials related to trans and gender diverse communities and individuals, especially when they are parts of larger collections where they are not the focus. We also recommend avoiding using automation for batch replacement and caution when using externally supplied records.

**DOMAIN-SPECIFIC & TECHNICAL DETAILS**

The second major section of the document was aimed at workers with extensive experience and expertise in technical services and metadata. The collective recognized that these readers, especially those in libraries with outdated infrastructure, may face additional challenges in implementing the second and third recommendation as their work relies heavily on standards and controlled vocabularies. The most commonly used of these are RDA and the LCSH. RDA gives instructions for identifying and recording bibliographic information. LCSH provides standardized terminology for describing the subject matter of a resource.

Though limited, there are a few critiques of bibliographic descriptive systems and their impacts on trans and gender diverse people. Billey, Drabinski, and Roberto (2014) criticize the RDA instruction to record a person’s gender as reinforcing a fixed and binary conception of gender and disregarding gender self-identification. They also note that gender information is generally irrelevant to the user tasks of finding and selecting library resources. Thompson (2016) further identifies areas where gender may be recorded indirectly and points out potential problems with using former names in metadata. Thompson advocates that creators be given agency in how they are represented in library metadata. Adler (2009), Johnson (2010), Jardine (2013) and Roberto (2011) demonstrate various ways that LCSH under- and misrepresents trans people. Johnson sees a potential solution in the use of alternative vocabularies and social tagging while Adler suggests the use of folksonomies. While valuable, the recommendations in the literature are of a general nature and do not provide the granular level of instruction in reference to RDA and LCSH that catalogers need. Therefore, TMDC members drew from their own personal cataloging practices and observations, an examination of RDA and LCSH, and their associated documentation. The collective also incorporated feedback from reviewers familiar with these systems.

**Library of Congress Subject Headings (LCSH)**

At the time of TMDC’s founding, there were only four broad categories of trans identities: “Transgender people”, “Gender nonconforming people”, “Transsexuals”, and “Two-spirit people”, the latter of which is only appropriate for Indigenous resources. In turn, there were only three concepts for gender diversity: “Gender identity”, “Gender nonconformity”, and “Gender expression”. A few headings did exist centered on lived experience, including: “Gender transition”; “Transphobia”; “Gender-neutral toilet facility”; and “Social work with gender-nonconforming youth”. Though it may be obvious, the authors would like point out that eleven headings are hardly enough to encapsulate the entirety of trans life, culture, history, and more; not to mention the complete inadequacy of one heading for all of Indigenous gender identity, including those of Indigenous nations that do not have or use the concept of Two-Spirit.
While LCSH does not adequately represent trans people, the TMDC recognized that it is so entrenched in cataloging practice that it would have been impractical to recommend entirely against its use. Therefore, the report provides an overview and assessment of existing LCSHs that are relevant to transness and gender diversity. The collective identifies a significant list of harmful LCSH to avoid, aiding catalogers in avoiding harmful language. A few other subject headings require care in use since they are formulated in a way that erases trans experience, such as: “Coming out (Sexual orientation)” and “Outing (Sexual orientation).” While trans and gender-diverse people come out and are outed in ways similar to lesbian, gay, or bisexual people, unfortunately, LCSH uses headings specifically referring to sexual orientation. There is a distinction between coming out (telling people one’s true gender) and disclosing (telling people one’s trans status). To describe the latter concept, the collective recommends the use of the headings “Self-disclosure” and “Gender identity” (The Trans Metadata Collective et al., 2022, p. 12). The document details nuanced implementation for these headings and others. Following these terminology lists, the report then presents strategies to address the inadequacy of LCSH in subjects relating to gender. These recommendations include the use of alternative subject vocabularies, such as Homosaurus, which can provide more specific, nuanced, or rich terminology than what is currently available in LCSH. Utilizing terms of self-identification elsewhere in the bibliographic record are also encouraged to ensure that the record is included in search results for that term. The collective advocates proposing new LCSHs and revisions to existing LCSHs, with the document providing resources for this process.

**Resource Description and Access (RDA)**

RDA includes instructions on recording names and personal attributes, including gender. These instructions apply to bibliographic records (a record containing information about a resource, such as title, author, etc.) and name authority records (NARs). NARs are brief records that include various forms of a person’s name (including the standardized form), distinguishing biographical information, and a citation for at least one work written.

**Names**

RDA instructs that the name of an author (or other creator) appears in a bibliographic record in two forms: the form that appears on the resource and the standardized form used in the NAR. This practice can lead to not only a former name displaying publicly but a former and current name displaying together. This can out trans people, potentially putting them in danger.

The TMDC’s primary recommendation is to give authors and other creators agency over how they should be named in library metadata. To this end, the document illustrates how to contact individuals to inquire about former names and document their preferences. Acknowledging that consultation is not always possible, the collective recommends using the author or creator’s most recent name and avoiding former names if their preference is not known. While this is not necessarily the preference of all trans and gender diverse people, this approach was designed to minimize any potential harm and protect privacy. In some cases, it may be necessary to use a former name in a non-public way to link all works by a single person together. The report also provides coding instructions for this.

**Gender**

RDA provides the option to directly record gender in NARs. Gender and gender identity may also be recorded indirectly (e.g. gendered occupations). The collective recommends that gendered information should not be recorded either directly or indirectly. While working on the document (April 2022), the Program for Cooperative Cataloging (PCC) Ad Hoc Task Group on Recording Gender in Personal Name Authority Records released their revised report recommending that gender not be directly recorded in NARs, stating that NARs are not meant to primarily contain biographical information, but instead only meant to disambiguate between names (Billey et al., 2016). This recommendation has been adopted as official policy. The PCC Task Group on Gender (a successor to the initial ad hoc task group) is currently formulating guidance on indirect recording of gender amongst other issues, including gender-related name changes and gendered terminology in LCSH. Their final report is scheduled to be released in August 2024.

**CONCLUSION**

The Trans Metadata Collective’s document, Metadata Best Practices for Trans and Gender Diverse Resources was initially released in June of 2022. Since its release the report has circulated widely, reaching past 10,000 downloads and has been partially or locally implemented in various GLAMS institutions. After publication, the collective’s focus lies in continuing dissemination of its recommendations to broader professional audiences, encouraging further local implementation, and updating the report when needed.

To achieve in creating accurate metadata for trans and gender diverse communities and their works, metadata workers must take a reflective approach, centering trans and gender diverse information protocols and reciprocally building relationships with those being described when appropriate. The recommendations outlined in this paper consciously steer professionals away from harmful terminology and workflows used in libraries and archives.
Further work is needed to expand these best practices into other institutional and professional spaces, including both cultural heritage and broader information science contexts.

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Curating for Contrarian Communities: Data Practices of Anthropogenic Climate Change Skeptics

Wofford, Morgan F. University of Michigan, USA | mwofford@umich.edu
Thomer, Andrea K. University of Arizona, USA | athomer@arizona.edu

ABSTRACT
The open data movement is often touted as a sweeping strategy to democratize science, promote diverse data reuse, facilitate reproducibility, accelerate innovation, and much more. However, the potential perils of open data are seldom examined and discussed in equal measure to these promises. As we continue to invest in open data, we need to study the full spectrum of what open data facilitates in practice, which can then inform future policy and design decisions. This paper aims to address this gap by presenting an investigative digital ethnography of one contrarian community, anthropogenic climate change (ACC) skeptics, to describe how they process, analyze, preserve, and share data. Skeptics often engage in data reuse similar to conventional data reusers, albeit for unconventional purposes and with varying degrees of trust and expertise. The data practices of ACC skeptics challenge the assumption that open data is universally beneficial. These findings carry implications for data repositories and how they might curate data and design databases with this type of reuse in mind.

KEYWORDS
data practices, data repositories, data curation, data reuse, anthropogenic climate change skeptics

INTRODUCTION
One of the purported promises of the open data movement is its democratizing potential, affording people outside of scholarly communities the ability to access and analyze data (Baack, 2015; Cavalier & Kennedy, 2016; Espinosa et al., 2014; Nielsen, 2011; Ricker et al., 2020; Zuiderwijk & Janssen, 2014). Open data activists typically envision a “democratization of information” (Baack, 2015) as a largely positive development. There are numerous examples of these prosocial outcomes, such as citizen groups like the Anti-Eviction Mapping Project and the Mapping Police Violence Database utilizing open government data to support the needs of marginalized communities (Anti-Eviction Mapping Project, 2021; Mapping Police Violence, 2021).

However, open data can also be susceptible to misuse or misinterpretation by various communities. For instance, local governments and private companies often misuse climate data when determining financial climate-related risks, resulting in inaccurate projections (Fiedler et al., 2021). Additionally, during the COVID-19 pandemic, anti-mask proponents employed ‘orthodox visualization methods’ on open government data to bolster their ‘unorthodox arguments’ against mask mandates (Lee et al., 2021). In another example, DNA samples and 3D facial images were utilized to train machine-learning algorithms used by law enforcement agencies to reconstruct suspects’ faces from DNA samples, leading to biased outcomes (Pasquetto, 2018).

Understanding the different ways open data are used and misused is crucial for infrastructural development and supporting appropriate data reuse by scholars and non-scholars alike. These tasks often fall to data repositories managing the discoverability, accessibility, usability, and preservation of datasets housed in their collections. Understanding the diverse data practices of a full range of repository users – even those that may misuse data – is essential in informing design decisions and curatorial activities.

In this paper, we conduct an investigative digital ethnography on a contrarian community (that is, a community that defines itself in opposition to the mainstream and employs misinformation (Ribeiro et al., 2020)) of data reusers -- anthropogenic climate change (ACC) skeptics -- examining their data practices, specifically how they acquire, process, analyze, preserve, and publish/share open climate data. We analyze how ACC skeptics’ data practices compare to traditional academic data practices by comparing them to the primary elements of the USGS’s data lifecycle model (DLM) (Faundeen et al., 2014). We ask: What are ACC skeptics’ data practices and goals? How do these differ from those of academic or traditional data reusers? We find that skeptics’ data reuse is similar to that of traditional data reusers, albeit with different research goals, levels of trust, and expertise. We end with a discussion of the implications of these findings for data repositories, including the need for data misuse policies and designing for diverse user groups.

LITERATURE REVIEW
Open Data and Data Re- and Mis-use
Open data refers to datasets that can be accessed and “freely used, modified, and shared by anyone for any purpose” (Open Knowledge Foundation, n.d.). The promises of open data have been espoused for years, with groups touting its potential to facilitate reproducibility (AlQuraishi & Sorger, 2016; Martens & Vizcaíno, 2017; Stodden et al., 2014), accelerate innovation (Knoppers, 2014; Knoppers et al., 2014), democratize science (Cavalier & Kennedy,
promote collaboration (Pasquetto et al., 2019), and derive new insights from old research (Pasquetto et al., 2019; Rung & Brazma, 2013; Zimmerman, 2003, 2008). Sabina Leonelli suggests that the very allure of open data “lies precisely in the impossibility to predict and quantify their potential as evidence in advance,” reflecting the reality that it is impossible to thoroughly foresee how data will be reused (2013, p. 9). In the United States, the federal government has issued memorandums (Holdren, 2013), executive orders (Obama, 2013), and more binding legislation (Ryan, 2019) that require all federally-funded research to publish non-sensitive data publicly. In response to these potential benefits and governmental mandates, stakeholders have invested in making the promises of open data a reality via initiatives such as the FAIR guiding principles for scientific data management and stewardship (Wilkinson et al., 2016).

The perils of open data are less frequently explored but not disregarded. Philip Mirowski argues that open data may be more readily utilized by those with greater resources, such as corporate data scientists, which could exacerbate existing power imbalances and fail to truly democratize and diversify science (2014, 2018). There is also a well-established literature on indigenous data sovereignty, which addresses the historical harms caused by data collected about indigenous communities and emphasizes community control and ethics rather than maximum openness (CARE Principles, 2022; OCAP, 2022; Radin, 2017; Tsosie et al., 2021). Making data public means that contrarian communities, those that oppose mainstream views or attitudes and often create and spread misinformation, such as ACC skeptics, vaccine skeptics, flat earthers, and eugenicists, can also use the data (Ribeiro et al., 2020). Data creators also have concerns about sharing their data due to the potential for misuse or misinterpretation (Cragin et al., 2010; Sayogo & Pardo, 2013; Tenopir et al., 2015, 2018), as evidenced by instances of misuse as defined by subject matter experts in climate science (Fiedler et al., 2021; Hardy & Jamieson, 2017), genomics (Pasquetto, 2018), ecology (Clavero et al., 2022), and medicine (Jourdain, 2021). Furthermore, the very concept of open data can be weaponized in politicized debates (Levy & Johns, 2016), with partisans in legislative bodies using the perceived non-partisan value of scientific transparency and open data to advance their political agendas. At the same time, the open data requirements are worded, perhaps purposefully, to be impossible to satisfy due to technical infeasibility, lack of resources, or missing privacy, security, and confidentiality exceptions.

Open data facilitate data reuse, defined as the “usage of a dataset by someone other than the data creator” (Pasquetto et al., 2017). Various studies examine who searches for open data, why they do so, and how they reuse data. Most studies focus on academic data reuse practices using data access requests (Coady et al., 2017; Federer, 2019), surveys (Curty et al., 2017; Faniel et al., 2016; Gregory et al., 2020; Tenopir et al., 2011; Yoon & Kim, 2017), and published data citation metrics (Fan et al., 2022; Huang et al., 2015; Khan et al., 2019; Laﬁa et al., 2023; Park et al., 2018; Peters et al., 2017; Piwowar & Vision, 2013; Robinson-Garcia et al., 2017). Several types of data reuse have been identified, including:

- Comparative data reuse: Data are reused for ground-truthing, calibration, comparison, and conﬁrmation (Pasquetto et al., 2019).
- Integrative data reuse: Data are reused to answer new questions, identify patterns, perform meta-analyses, or develop new statistical methods (Pasquetto et al., 2019; Thomer, 2022).
- Reproducibility data reuse: Researchers reuse the same data and analysis methods to verify a study’s findings (Borgman, 2015; Federer, 2019; Pasquetto et al., 2017).
- Infrastructural data reuse: Data are reused to populate a database or repository (Federer, 2019).
- Educational data reuse: Data are reused for educational or instructional purposes (Thomer et al., 2023).

Overwhelmingly, studies that measure the impact and outcome of open data are done by advocates of that infrastructure, leading to a potential for positive biases (Mayernik et al., 2017). Additionally, by focusing on academic impact, they often fail to consider reuses in educational or policy settings (Mayernik et al., 2017).

Another group of studies examines the data practices within different disciplines (Borgman et al., 2015; Faniel et al., 2013, 2020; Faniel & Yakel, 2017; Weber et al., 2013). The goal is to support repositories as they make design decisions to support these intended users (Faniel et al., 2020; Faniel & Yakel, 2017; Kansa, 2012). Repositories intending to serve broader communities have even greater user requirements to consider. The design choices and material forms of data schemas in repositories profoundly impact how “these systems play in the social settings in which they are used” (Thomer & Wickett, 2020).

Climate Science and the Persistent Presence of Skeptics
Climate science is one of many disciplines embracing open data; the Registry of Research Data Repositories lists 131 repositories associated with the keywords “climate” or “climate change” (Re3data, 2014). The majority of climate research focuses on the drivers and effects of ACC, “a statistically significant variation in either the mean
state of the climate or in its variability, persisting for an extended period,” caused by human activity
(VijayaVenkataRaman et al., 2012). Climate scientists use global climate models (GCMs) and simulations to make
projections about the future climate (Edwards, 1999, 2010). As a scientific concept, ACC has reached a level of
scientific consensus that most theories will never attain, with 99.99% of publishing scientists validating its existence
(Powell, 2015). However, despite this relative certainty, ACC skepticism still permeates politics and popular culture,
principally in white, conservative, male-dominated circles (McCright & Dunlap, 2011; Sharman, 2014). This
skepticism could have disastrous consequences if it delays climate change mitigation and adaptation.

At their most extreme, ACC skeptics use climate science’s reliance on models to dismiss the discipline and its
findings as imaginary and politically motivated. In less extreme circumstances, they discover and report errors in
climate data to spark debate and introduce additional uncertainty (Gramling, 2007), or they use and manipulate open
climate data in direct service of their positions and beliefs (Lewandowsky et al., 2016). ACC skeptics use techniques
such as data-dredging or p-hacking, both forms of data analysis misuse, to support their claims (Nissen et al., 2016).
Lewandowsky et al. performed a blind expert test on multiple contrarian claims about climate data and found them
all to be misleading (Lewandowsky et al., 2016). Skeptics present their findings as having the same legitimacy as the
research of thousands of climate scientists. Frank Fischer studied how climate science skeptics interpret scientific
studies, noting that fact-checking and scientific literacy is insufficient in changing their minds; instead, researchers
need to look deeper at how climate skepticism is culturally and historically situated (Fischer, 2019).

METHODS
To gain insights into the data practices of ACC skeptics, we conducted an investigative digital ethnography that
combines methods from digital ethnography (Boellstorff, 2012; Coleman, 2010, 2012; Hine, 2000; Krafft &
Donovan, 2020; Panofsky & Donovan, 2019; Pink et al., 2015) and investigative journalism (Silverman, 2020). The
overall process for conducting an investigative digital ethnography involves identifying relevant topics and artifacts,
ascertaining the media ecosystem and influencers, creating a monitoring environment and strategy, auditing
assumptions, and analyzing findings (Friedberg, 2020). Following conventional digital ethnography methods, we
account for the infrastructures that afford these data practices (Pink et al., 2015). We contextualize these as
knowledge infrastructures that are “robust networks of people, artifacts, and institutions that generate, share, and
maintain specific knowledge about the human and natural worlds” (Edwards, 2010).

Initially, we created social media accounts on Reddit, Twitter, and YouTube and seeded these accounts by following
popular ACC organizations and influencers identified from the DeSmog Disinformation Database (Lay, 2022). We
then engaged with platform affordances, such as viewing, liking, and re-posting content, to influence
recommendation algorithms and expand the monitoring environment. The recommendation algorithms suggested
new accounts to follow through algorithmic-assisted snowball sampling. The final monitoring environment included
40 Twitter accounts, four Facebook groups, two subreddits, and five YouTube channels.

The data collection period lasted from September 2021 through November 2021, totaling 75 hours. When open data
were discussed or reused, we archived the webpage. If posts linked to blogs or organizations that mentioned open
data, those websites and subsequent comments were archived. YouTube videos were transcribed. Daily memos were
written during the data collection and analysis periods. In total, 189 articles and posts were archived, 17 screenshots
were taken, and 19 pages of memos were written.

All the data artifacts were uploaded into NVivo for qualitative coding in January 2022. We synthesized themes
across the data using grounded theory (Glaser & Strauss, 1967) adapted for social media analysis (Postill & Pink,
2012), inductively coding the data for emergent themes. While doing this, we compiled lists of data reusers,
instances of dataset reuse, analytical tools mentioned by reusers and so on. These themes were then coded into
higher-level concepts, constructing theories grounded in the data (Charmaz, 2014). We then organized our findings
about ACC skeptics’ data practices according to the USGS DLM primary model elements to compare these
contrarian practices to normative data practices (Faundeen et al., 2014). We chose this model because it highlights
the relationship between data management activities and research project workflows, allowing us to focus on how
ACC skeptics interact with data repositories and manage their data. Moreover, the model is designed for types of
data that ACC skeptics are likely to reuse (e.g., from the earth and environmental sciences). The primary data life
cycle stages include plan, acquire, process, analyze, preserve, and publish/share. Within the analyze concept, we
additionally coded for the way in which data was reused for analysis, for instance, comparative or integrative as
appropriate (Pasquetto et al., 2019; Thomer, 2022). If instances of data reuse did not fit within these categories, new
codes were created.

FINDINGS
The ACC Skeptic Community
Across platforms, we observed 77 data reusers posting on their social media accounts, authoring blog posts, and
creating websites. Notably, the majority of identifiable influencers in this contrarian community are conservative,
Influencers are predominantly located in the United States, Canada, Australia, and England. Some of them have direct ties to the oil, gas, and coal industries as well as the tobacco industry. Three of the individuals were part of the Trump Administration, working in various agencies such as the Environmental Protection Agency (EPA), National Security Council (NSC), National Oceanic and Atmospheric Administration (NOAA), and White House Office of Science and Technology Policy (OSTP).

Generally, reusers are highly educated, many stating they have PhDs. They claim expertise in a wide range of disciplines, including aerospace engineering, atmospheric science, chemistry, climatology, economics, forestry, geography, geophysical science, hydrology, meteorology, modern history, philosophy, physics, and political science. We observed an overlap between ACC skeptics and anti-vaxxers, anti-maskers, and skeptics of the 2020 U.S. presidential election results. Though here we focus on their analysis of climate data, we also found that they apply their data literacy to other public datasets, including 2020 U.S. presidential election data, as well as COVID-19 data.

Plan & Acquire
While the USGS DLM’s lifecycle begins with planning work, we did not find that our users’ planned their projects publicly online. Instead, the majority of early lifecycle discussions focused on the acquisition and evaluation of public data and data repositories.

What Data do ACC Skeptics Reuse?
We observed ACC skeptics reuse 61 datasets (Figure 1) from 45 data repositories; of these, ACC skeptics most frequently reuse observational datasets about temperature because the core assumption of ACC rests on the idea that global temperatures are increasing. As a result, skeptics often rely on observational temperature datasets to challenge this assertion and attempt to undermine it in various ways. The top five most reused datasets are as follows:

- **HadCRUT** from the Met Office Hadley Centre and the Climatic Research Unit (CRU) (found in 24 documents) (Brohan et al., 2006; Morice et al., 2012, 2021). HadCRUT combines a sea surface temperature (SST) dataset and a land surface air temperature dataset. Often, skeptics state that these data are less trustworthy because of CRU’s involvement with Climategate, a controversy where an ACC skeptic published hacked emails from CRU and cited them as evidence that climate scientists had manipulated data to make global warming appear worse (Leiserowitz et al., 2013).

- **Global Temperature Report** from The University of Alabama in Huntsville Earth System Science Center (found in 13 documents) (Christy & Spencer, 2022). Two ACC skeptics, John R. Christy, and Roy W. Spencer, created this dataset. This global temperature dataset is derived from NOAA’s TIROS-N satellite microwave data and shows less extreme increases in temperature than similar datasets.

- **Goddard Institute for Space Studies Surface Temperature (GISTEMP) Analysis Dataset** from NASA (found in nine documents) (GISTEMP Team, 2022). GISTEMP is comparable to the HadCRUT dataset in combining a land-surface air temperature dataset and an SST dataset to create a global temperature dataset, and the two are often compared.

- **Global Historical Climatology Network monthly (GHCNm) Dataset** from NOAA’s National Center for Environmental Information (NCEI) (found in eight documents) (Menne et al., 2018). This dataset provides monthly climate summaries from stations around the world. Climate skeptics critique this dataset saying data are skewed due to urbanization and homogenization.

An additional 15 temperature datasets are found in the sample (see the supplementary material at https://hdl.handle.net/2027.42/176905 for the complete list).

Two datasets are reused in six documents, tying each other for the fifth most reused dataset. Unlike the previous four datasets, neither are temperature datasets. They include:

- **NOAA’s Global Monitoring Laboratory (GML) Earth - System Research Laboratories Monthly Average Mauna Loa CO2** (Tans & Keeling, 2022). This dataset shows monthly mean measurements of atmospheric CO2 at the Mauna Loa Observatory in Hawaii. Skeptics use this dataset to examine trends in CO2 and test for correlation with other variables. There is one other CO2 dataset in the sample.

- **National Snow & Ice Data Center’s Multisensor Analyzed Sea Ice Extent – Northern Hemisphere (MASIE-NH)** (U.S. National Ice Center & NSIDC, 2010). MASIE-NH provides a graphical view of sea ice extent. Skeptics use this dataset to explore trends in sea ice over time, suggesting the cause of changes are exaggerated or seasonal. Three other sea ice datasets are in the sample.

A related research topic to sea ice is the exploration of sea level trends, mainly arguing that the rate of sea level rise is not increasing. The sample included four sea-level datasets.
Another popular research topic is natural disaster rates, including fires, hurricanes, droughts, diseases, and associated climate-related death data. In this area of research, ten different datasets were reused. Skeptics commonly try to show that natural disaster rates are not increasing or attribute the observed disaster rate increase to changes in disaster categorization and reporting rates.

Skeptics also suggest alternative causes of climate change. These potential climate change drivers include the sun, the ocean’s oscillations, and atmospheric water vapor. The sample contains five solar datasets examining sunspot numbers, total solar irradiance, and outgoing longwave radiation. Six datasets look at the ocean’s oscillations. Only one dataset records atmospheric water vapor.

The last common research topic is investigations into the capabilities of fossil fuels and renewable energies. The sample contains seven energy datasets representing energy grid conditions, electricity production data, crude oil production, and fossil-fuel CO2 emissions. Quality of life data, like world development indicators or food production, are often used alongside fossil fuel usage to insinuate that quality of life has increased because of fossil fuels.

Figure 1: Dataset reuse frequency in collected documents. Due to space constraints, we only list the top 5 most reused datasets; see the supplementary material at https://hdl.handle.net/2027.42/176905 for the complete list. Frequency is calculated as the number of documents the dataset appears in.

**How do ACC Skeptics Evaluate Data and Data Repositories?**

In this contrarian community, not all data are created equal; unadjusted or “raw” data are considered superior to all other forms of knowledge because they are the least affected by human subjectivity. By “raw,” skeptics refer to data directly collected from instruments with no additional processing, adjustments, homogenization, or manipulation. Overwhelmingly, ACC skeptics favored reusing observational data over other types of data. Climate science, as a discipline, relies on GCMs rather than observational data, which ACC skeptics prefer. Most of the observed ACC skeptics did not engage sophisticatedly with GCMs enough to demonstrate mainstream climate science literacy. Instead, they reject these models outright, considering them inferior to observational data. Observational data are thus often used to critique proxy data and climate model projections.

Consequently, when acquiring data, some ACC skeptics closely examine data repositories, documentation, curatorial decisions, and scholarly products to find processing that has “contaminated” the raw data. For instance, in a Reddit post, a skeptic critiques the GHCN-M dataset by directly quoting the dataset’s documentation (Menne et al., 2018).

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...in the introduction to the data (CDRP-ATBD-0859 Rev 1 GHCN-M Mean Temperature-v4.pdf) it states: 'Data are collected from NOAA in situ networks as well as other national and international providers. They are subjected to a series of processes that combine data from various sources, perform quality control, homogeneity corrections, and output the data for customer access and permanent archive.'

And their readme.txt from their ftp site says in the Introduction: '...The greatest difference from previous version is a greatly expanded set of stations based on the large data holdings in GHCN-Daily as well as data collected as part of the International Surface Temperature Initiative databank (ISTI; Rennie et al. 2014).'
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ACC skeptics also note when different versions of datasets will be removed or no longer supported actively by repositories and accuse repository staff of changing or removing data to support the theory of ACC. If available, they compare different versions of datasets to note changes using the Wayback Machine.

In the most extreme cases of curatorial oversight, skeptics contact the data repository to question a dataset’s limitations and intended uses. For instance, one ACC skeptic discusses repository employees by name from the Centre for Research on Epidemiology of Disasters EM-DATA International Disaster Database, accusing them of endorsing a publication that contradicts the data’s recommended use. Within the blog post, the author includes correspondence with repository employees.

Even when ACC skeptics are not accusing repositories of intentionally altering data for political purposes, they often analyze curatorial decisions and documentation for their own reuse. For example, the website Climate4You compares differences in sea surface temperature (SST) using two different datasets, HadSST3 and UAHv6 and notes how changes in curatorial activities in both datasets affect their analysis. However, not all ACC skeptics adhere to appropriate data usage and documentation provided by data repositories in their analyses. For instance, the NSIDC recommends against using the MASIE-NH dataset to compare sea ice trends over time, suggesting instead using the NSIDC Sea Ice Index on a monthly, not daily, basis. Nevertheless, despite the repository’s recommendations, Ron Clutz compares MASIE-NH data on specific days in different years in a Science Matters blog post.

**Process**

In the USGS DLM, the next lifecycle phase is processing: this includes data cleaning, data element definition, dataset integration, and calibration to prepare data for analysis. We found limited descriptions of data processing by ACC skeptics for perhaps two compounding reasons. Firstly, many data reusers did not publicly publish or write about their data processing activities. Secondly, as shown in the acquire step, skeptics often disparage any data processing that researchers or repositories carry out on the data, valorizing “raw” data. When ACC skeptics’ data processing activities are made public, they often are not extensive, perhaps because of these beliefs.

That said, one common act of processing is converting data files to make them more accessible and computable in spreadsheets. Zoe Phin typically uses more accessible files in her published data reuse blog posts, but does not always convert data files for her own work. For instance, when examining albedo data she uses the netCDF file provided by NASA Earth Data. However, when sharing data with others in her comments, she converts the original netCDF file to a plain text file for ease of access by less technical users. Nowadays, data repositories often provide various file formats, including CSV and TXT files, making the need to convert file formats unnecessary. For example, in a CO2Science blog post, the author uses the HADCRUT CSV version of the dataset over the netCDF version, along with the TXT file of CO2 data from NASA.

**Analyze**

In the USGS DLM, analyze encompasses the activities undertaken by ACC skeptics as they explore and interpret the data they have selected, ultimately drawing their conclusions.

We separate analytical activities into the data reuse typology discussed in the literature review and methods section, which includes comparative or integrative data reuse. We found instances of comparative and integrative reuse (Pasquetto et al., 2019; Thomer, 2022). We additionally observed a new kind of data reuse which we call quality assessment reuse. We describe each of these below.

Integrative data reuse entails reusing data for new analyses to “identify patterns, correlations, or causal relationships” (Pasquetto et al., 2019). Integrative data reuse can include meta-analyses or novel statistical analyses. Within the ACC skepticism community, integrative data reuse is widespread and includes identifying patterns in observational data and testing for correlation between variables. ACC skeptics use observational data to identify trends in temperature, CO2 levels, sea ice area, sea-level rise, and natural disasters. Many of their findings directly contradict the scientific consensus: global temperature is cooling, sea ice size is increasing, or natural disaster rates are decreasing. Others assert that there are no identifiable trends in these variables. Others admit to identifiable and even statistically significant trends that support the scientific consensus but assert that they cannot be attributed to anthropogenic CO2 emissions. Finally, some evaluate the dataset and conclude that the data are flawed and unreliable due to changes in measurement practices or other perceived errors. These options lead to the almost inevitable contradiction of the scientific consensus regardless of the data used.

Comparative data reuse consists of reusing data “to assess similarities and differences for purposes such as ground-truthing, calibration, and experimental controls” (Pasquetto et al., 2019). Comparative data reuse within the ACC
skepticism community includes using observational data to evaluate model projections and proxy data. It also encompasses the comparison of similar datasets from different organizations or different versions of the same dataset. For instance, observational data are often used to test other types of what ACC skeptics perceive as inferior data, like climate model outputs and proxy measurements for temperature and CO2. One skeptic described observational data as “ground truth data” or “information provided by direct observation as opposed to information provided by inference.”

Finally, ACC skeptics reuse data in a way that does not straightforwardly fit into existing typologies, which we call **quality assessment data reuse.** While similar to reuse for reproducibility, it is distinct because they are not trying to reproduce the findings of a publication; rather, they solely analyze the quality of a dataset. For instance, one contrarian site, surfacstations.org, run by Anthony Watts, organized volunteers to survey temperature stations to document “biases and errors through faulty siting, encroachments, or maintenance issues.” Even though Watts showed these biases and errors to be statistically insignificant, he continues to critique the GHCN dataset publicly. The ACC skeptic website Climate4You contains perhaps the best example of quality assessment reuse in our sample. The website contains a global temperature page, which analyzes five global temperature datasets in a multitude of ways, including linear and polynomial regression for different periods of time. Here we focus on one example of analysis, which the site calls testing for temporal stability or each dataset’s internal degree of stability over time. The site does this by “plotting the net change in their global temperature record” between the May 2008 version of a dataset and the October 2021 version of the same dataset. By comparing the temporal stability of datasets, Climate4You asserts that,

> “….it is not possible to conclude which of the above five databases represents the best estimate on global temperature variations. The answer to this question remains elusive. All five databases are the result of much painstaking work, and they all represent admirable attempts towards establishing an estimate of recent global temperature changes. At the same time it should however be noted, that a temperature record which keeps on changing the past hardly can qualify as being correct.”

**Tools for Analysis**

Most skeptics rely on their own software, like Excel or R, to analyze data and create visualizations. Andy May, who analyzes data using R and Excel, states that “R makes it easy to do the calculation, but it is unsatisfying since we don’t get much understanding from running it or from the output.” This duplication of data analysis aligns with the skeptical values of teaching others how to reuse data and questioning assumptions behind analysis.

Skeptics also take advantage of interactive data analysis tools provided by data repositories, ACC skeptics’ organizations, and agnostic groups (Figure 2). This means that skeptics are not solely reliant on official data analysis tools but have other options that provide additional flexibility and interoperability with various datasets. Wood for Trees is the most popular tool created by an ACC agnostic software engineer, hosting “C++ software tools for analysis and graphing of [historical climate] time series data, and an interactive graph generator where users can play with different ways of analyzing data.” The home page asserts that,

> “It’s not the place of this Web site (or anyone else) to tell you the answers, even if I could! This is just a tool to help you dig into the data to help you form your own opinions. Whatever you decide the most important thing is that you learned what the issues in analysis are and how to test your ideas against real data.”

This statement reflects a mindset common in ACC skeptics that devalues expertise and emphasizes trusting one’s own data analysis. However, Clark follows this assertion with the following warning “with sharp tools comes great responsibility…beware of short, cherry-picked trends.” This is more guidance than skeptical tools offer.

The main C++ program for Wood for Trees is the analysis tool that performs a variety of processes on time-series data formats before outputting the data to a format suitable for plotting with Gnuplot. The program can read a variety of datasets, including the major global temperature datasets, Mauna Loa CO2 monthly average, PDO index, AMO index, and NSIDC Sea Ice Index. Recently, Wood for Trees added the ability for linear least-squares regression. Still, Clark notes “that it can be fairly dangerous…depending on your preconceptions, by picking your start and end times carefully, you can now ‘prove’ whatever you want with temperature trends.” This affordance, perhaps, contributes to its popularity with ACC skeptics.

RimFrost.no and Sealevel.info are two other tools that provide interactive database visualization tools incorporating numerous open datasets. RimFrost.no, “a unique collection of essential climate info,” provides a tool to graphically represent thousands of datasets, including temperature data, ice data “CO2 emissions, CO2-in-the-air measurements, river discharge data, precipitation intensity data, glacier mass balances, ocean energy and ocean water levels, sunspot numbers, and skiing conditions.” Sealevel.info is a website created by an ACC skeptic to provide a similar
tool as Wood for Trees but for sea-level data. The “spreadsheets...consolidate data from NOAA, PSMSL, and other sources to simplify examination of tide-gauge data for long term sea-level trend analysis.”

The seven other data analysis tools are associated with specific data repositories or governmental agencies. Generally, these have more limitations than the tools above, only including data from their own repository. The most used of these is NSIDC’s Chartic Interactive Sea Ice Graph, which visualizes the Arctic and Antarctic yearly seasonal cycles of sea ice extent beginning in 1979, which is the start of the satellite record.

![Figure 2: Frequency of interactive database visualization tool use in collected documents. Frequency is calculated as the number of documents the tool is used in.](image)

**Preserve**

The preserve stage of the USGS DLM involves activities related to storing data for long-term use and accessibility. This includes creating documentation and metadata, using accessible storage file formats, and creating supplementary products for preservation.

Many skeptical organizations utilize data to populate their websites and databases, providing convenient access to data in one location. When datasets are shared, application-neutral storage formats such as CSV files are commonly used. For example, Wood for Trees provides “raw” data in tabular plain-text files accompanied by metadata. The metadata in the file includes information on who processed the data (e.g., www.woodfortrees.org), the original source of the data (e.g., NASA Goddard Institute for Space Studies), a link to the original data (e.g., data.giss.nasa.gov/gistemp), the file name (e.g., GLB.Ts.txt), and a brief description of the data (e.g., Time series (gistemp) from 1880 to 2023.08). Other websites’ file formats are more diverse. For instance, SeaLevel.info provides JSON files with extensive metadata, copies of NOAA’s data in CSV files, spreadsheets of tabulated data in Microsoft Excel HTML format, and documentation for metadata in plain-text files.

Other websites and groups, such as Climate4You and Going Green Canada, rely on data repositories only providing links to publicly-available datasets without creating their own databases. They often choose to provide links to the documentation of these datasets to promote further understanding of the data. However, relying on these data repositories for data preservation means that any changes made by the official organization can affect the availability of data. Data and documentation may be moved to different sites, such as when many NOAA datasets were moved from NCDC to NCEI. In other cases, data repositories may remove certain datasets due to errors, newer versions, or administrative changes. As a result, links to datasets and documentation on these sites may occasionally be dead as site managers fail to update the links.

**Publish/Share**

In the USGS DLM, activities in the publish/share phase conventionally include the publication of findings in peer-reviewed journals as well as the distribution of data online. However, within the sample, ACC skeptics, with one exception, never published in peer-reviewed journals. Instead, they post their findings in blog posts, skeptical conferences, and on social media.

Frequently blog posts with data reuse cases have extremely long comment sections, reaching up to hundreds of pages. Commenters include ACC skeptics and some non-skeptics, although their specific stance on the issue is often difficult to determine. When errors are pointed out that the data reuser agrees with, the work is frequently changed. For instance, one skeptic responds to an error in his figure by stating, “Thank you very much for finding my labeling
error in Figure 10 that inadvertently switched the labels for land and deep ocean, ending up disagreeing with my own calculations. I updated the PDF above to correct this error.” In a way, the comments section functions as peer review. Commenters provide constructive critique, and reusers revise their work accordingly.

When discussing data sharing or publishing efforts, ACC skeptics emphasize the importance of involving more people in reusing climate data. If a commenter wants to reproduce work, the reuser will provide data, instructions, guidance, and in some cases, the code used. Very occasionally, data reusers refuse to provide data and code when asked for by commenters. One data reuser, Willis Eschenbach, states that the size of the data, along with their unwieldiness and lack of documentation, make them difficult to reuse. Instead, he would “MUCH rather do new and interesting research than spend time beating my code into usable shape.” While Eschenbach’s refusal may be due to flawed code or deliberate misuse, it seems just as likely that it results from the time commitment needed to make code understandable and reusable. However, he does provide the commenter with a folder with the basic functions he used. As another data reuser mentions in the comments of her blog post, “making small mistakes gets people involved. I think I’ll do it more often. I just made 2 more experts.”

**DISCUSSION**

**ACC Skeptics’ Data Practices in Existing Lifecycle Models and Reuse Typologies**

ACC skeptics’ data practices align with those described by the USGS DLM in the sense that skeptics acquire, process, analyze, preserve, and publish/share data, often in that order. However, skeptics diverge from traditional researchers in their data evaluation, research goals, criteria for publishable findings, and publication outlets. First, very rarely do ACC skeptics collect their own data and thus are entirely reliant on data they find in open access repositories. Second, the end research goal of many ACC skeptics is to discredit data by finding alleged errors. Additionally, skeptics do not process their data to the extent that traditional researchers would, perhaps, in part because they view mainstream processing activities as contaminating “raw” data, potentially leading to biases. Furthermore, ACC skeptics rarely publish in peer-reviewed journals; instead, they often post or present their findings in blog posts, skeptical conferences, and on social media.

Several studies have identified and categorized different types of scientific data reuse (Coady et al., 2017; Federer, 2019; Gregory et al., 2020; Pasquetto et al., 2019). These typologies are based on the data reuse practices of typical data reusers, such as academic researchers. Do the data reuse types found in the ACC skepticism community fit within these typologies? Largely, the answer is yes, with some caveats. Within the ACC skepticism community, data reuse types can be broadly classified into integrative data reuse (Pasquetto et al., 2019), comparative data reuse (Pasquetto et al., 2019), quality assessment data reuse, and infrastructural data reuse (Federer, 2019).

Integrative data reuse, as defined by Pasquetto et al. (2019), refers to the use of datasets for new analyses with the aim of identifying patterns, correlations, or causal relationships. Integrative reuse is widely observed within the ACC skepticism community, often involving the identification of patterns in observational data and testing for correlations between variables. However, it is a less common practice in the academic communities studied in the Pasquetto et al. paper. Pasquetto et al. argued that significant amounts of tacit knowledge are needed to facilitate effective integrative reuse; we speculate that because ACC skeptics are not performing integrative data reuse in the normative epistemological context of climate science, they do not share mainstream scientists’ qualms about integrating other people’s data. They do not consider tacit knowledge valid and do not require it for integrative reuse. Thus, integrative reuse is more common in ACC skeptic communities than in mainstream.

Comparative data reuse entails the practice of utilizing data to assess similarities and differences for various purposes, such as ground-truthing, calibration, and experimental controls (Pasquetto et al., 2019). Pasquetto et al. found comparative reuse to be common in the academic communities they studied; we similarly found that comparative data reuse is a prevalent and routine practice within the ACC skepticism community. Skeptics use observational data to evaluate model projections and proxy data, as well as to compare similar datasets from different organizations or different versions of the same dataset.

We observed on type of data reuse not found in existing typologies. In **quality assessment data reuse**, skeptics analyze the quality of a dataset to identify flaws or weaknesses, as shown in tests for temporal stability or surfacestations.org surveys. This differs from quality assessment done by the mainstream climate science community, where the quality of their selected data is assessed prior to reuse. For mainstream climate scientists, this assessment is rarely the final public output of the reuse. Additionally, ACC skeptics often conduct these quality assessments solely to discredit the data and climate science in its entirety.

Finally, we additionally observed instances of infrastructural data reuse, which involves reusing one or more datasets to populate a database or repository (Federer, 2019). ACC skeptics reuse datasets to populate databases on multiple sites, including Climate4You, SeaLevel.info, and CO2Science. They bring together datasets from various agencies and universities that are often siloed from one another into one accessible database. This serves a larger
goal of creating an alternative knowledge infrastructure that mimics and takes advantage of climate science’s mainstream knowledge infrastructure in an attempt to weaken it. We term this infrastructure a **parasitic knowledge infrastructure** that builds on the back of the mainstream climate science knowledge infrastructure (Wofford, 2022). A parasitic knowledge infrastructure generates, shares, and maintains its knowledge using components of another knowledge infrastructure while simultaneously weakening that infrastructure it relies upon. The “hypertransparency [of] open data, open code, commodity software tools, and alternative publication venues” allows skeptics to selectively use these artifacts (Edwards, 2019, p. 21).

**Implications for Data Repositories**

Our findings show that ACC skeptics frequently evaluate and interact with data repositories. Data will inevitably be reused in ways repositories do not anticipate and, perhaps, do not agree with. This will be difficult, if not impossible, to avoid through any act of design or curation. Nonetheless, our study has implications for repositories in dealing with contrarian reusers. While these implications primarily apply to scientific data repositories, they may also hold relevance for other contexts, disciplines, or data types. Future research is needed to investigate the interactions between contrarian communities and different types of data repositories.

First, repositories must consider how they might handle the misuse of data and develop policies accordingly. Throughout our work, we have struggled with how to characterize ACC skeptics’ use of data. The reusers we observed would not consider their work misuse of data, but certainly, many (if not all) mainstream scientists and data curators see ACC skeptic’s practices as inappropriate or flawed. Data repositories and curators are likely not in a position to act as arbiters for truth, but it is essential to recognize that repositories, like all technologies, are not neutral. Curatorial policies have the power to shape not just data reuse but public perceptions of scholarship.

Second, it is crucial to recognize that trust in a repository, its curators, and its data are not guaranteed. In fact, certain communities of reusers will come to a repository with high degrees of distrust. This distrust is not limited to contrarian communities. It may also be seen in other contexts, such as communities in cities expressing distrust in data collection and representation (Yoon & Copeland, 2020) or environmental justice groups distrusting federal data repositories due to perceived ties with polluting companies. Previous studies have linked more traditional data reusers’ trust in repositories with “organizational attributes, user communities (recommendations and frequent use), past experiences, repository processes (documentation, data cleaning, and quality checking), and users’ perception of the repository roles” (Yoon, 2014, p. 17). ACC skeptics bring up these factors when discussing their level of trust in repositories. Often data reusers lose trust in repositories due to validity errors or missing variables. Thorough and transparent documentation thus enhances trust and helps avoid violations in the first place (Yoon, 2017). However, even with increased documentation and decreased errors, it is unlikely that ACC skeptics would stop questioning and critiquing repositories. At the same time, these steps would give ACC skeptics less fodder for skepticism.

Furthermore, data repositories should be designed with various potential user groups in mind, even if all reuse cases cannot be predicted. Different user groups will come to the repository with various levels of expertise and goals; subsequently, they will interact with the repository and data differently. Data and tools, even if not publicized, will be found by non-experts. Because of this, repositories should design tools that do not easily afford misuse, even, in some cases, at the expense of flexibility. Yoon et al. suggest using data intermediaries to empower prosocial communities with limited resources to build data literacy and capacity (2018). Data intermediaries are agents positioned between two other agents in a data supply-demand chain that facilitate the reuse of data (Schalkwyk et al., 2015; Yoon et al., 2018). In this case, however, data intermediaries could be used to understand how data are being reused and, with contrarian communities, to decrease the likelihood of data misuse.

**CONCLUSION AND FUTURE WORK**

This paper examines the data practices of one contrarian community of data reusers, ACC skeptics. These practices are made possible through the parasitic relationship that exists between the skeptics’ knowledge infrastructure and the mainstream climate science knowledge infrastructure and its increased openness. In future work, we will further develop the concept of parasitic knowledge infrastructures and how contrarian knowledge infrastructures can simultaneously rely on and weaken consensus-based knowledge infrastructures through this case study. Other research, soon to be published by our team, looks at how three different contrarian communities, pro-life activists, Young Earth Creations, and ACC skeptics, engage with scientific values and norms (e.g., objectivity), standards (e.g., uncertainty), validation processes (e.g., consensus), and artifacts (Pasquetto et al., 2023). Finally, we hope to see whether this parasitic relationship distinguishes skeptics’ knowledge practices from other forms of public-led epistemic practices, such as those seen in environmental justice groups.

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Hyper-Local Fear of Crime: Identifying Linguistic Cues of Fear in Crime Talk on Reddit

Wu, Qunfang
University of North Carolina at Chapel Hill, USA | qunfang.wu@unc.edu
Hemsley, Jeff
Syracuse University, USA | jjhemsle@syr.edu

ABSTRACT
The fear of crime is an emotional response individuals have toward crime or the anticipation related to being the victim of crime. The increasing exposure to crime information presents considerable risks to people’s psychological health and well-being. Nevertheless, the fear of crime in online discourses is under-researched despite abundant conversations about crime. This work presents a mixed-methods study to comprehend how people disclose the fear of crime and what linguistic content or cues are associated with the fear. We gathered conversations about crime in the Baltimore subreddit. The content analysis revealed a necessity to differentiate between “experienced” and “expressive” fear of crime. The regression modeling identified strong factors related to the fear of crime, such as negative sentiment, objective expression, and first-person pronouns. This work extends the conceptualization of the fear of crime in online discourses and suggests potential ways to detect the fear automatically.

KEYWORDS
Fear of crime; logistic regression; emotion detection; Reddit; online discourse

INTRODUCTION
Hyperlocal social media, such as Nextdoor, Amazon Neighbors, Reddit, and Facebook groups, facilitate users to be exposed to, or actively participate in, conversations about crime. Studies have demonstrated that people collectively engage in conversations about crime through such platforms. For instance, people shared crime information with their neighbors (Masden, Grevet, Grinter, Gilbert, & Edwards, 2014; S. L. Erete, 2013), discussed crime prevention matters in community governance organizations (S. Erete & Burrell, 2017; S. L. Erete, 2015), and conversed with local municipal police departments (Williams et al., 2018; Wu & Huang, 2020). Nevertheless, the increasing exposure to crime-related information can lead to people to feel greater fear of crime and, thus, pose a risk to their well-being (Moore, 2019). This signals a need to more accurately conceptualize the fear of crime and mitigate its negative effects. This would benefit people’s well-being and support their ability to maintain routine activities (Ghandeharioun, McDuff, Czerwinski, & Rowan, 2019).

Generally speaking, the fear of crime is an emotional reaction people have toward crime or the anticipation related to being the victim of crime (Ferraro, 1995). To a lesser degree, studies have begun to explore how Information and Communication Technologies (ICTs) can assist in mediating fear of crime (Sachdeva & Kumaraguru, 2015; Blom et al., 2010; Karusala & Kumar, 2017). Nevertheless, the disclosure of the fear of crime in online discourses is under-researched despite the public’s extensive crime-related conversations.

To address this gap, we sought to unpack the fear of crime in online discourses. Specifically, we employed a linguistic approach to comprehend the types of fear of crime disclosed in people’s online conversations about crime and the linguistic features associated with such disclosures. We chose the local subreddit r/baltimore (www.reddit.com/r/baltimore/) as the research site where crime is a prevalent topic. Using crime-related conversation threads collected from r/baltimore, we initially conducted manual coding on 2,000 comments and generated a two-tier code schema for fear of crime disclosure. Subsequently, we selected linguistic features in comments that might be linked to the fear of crime and constructed logistic regression models to examine their relationships. We discovered that users disclosed two types of fear: “experienced” and “expressive”; the regression models revealed that the most pertinent variables to the fear of crime were negative sentiment, objective expression, and i personal pronouns. Finally, we propose future directions to investigate the fear of crime online, such as further exploring the cognitive dimension of fear of crime in social media settings.

RELATED WORK
What is the fear of crime?
Earlier survey studies have found that the fear of crime is a common experience among individuals (Hough, 1995; Kershaw et al., 2000; Koffman, 1996). Studies have conceptualized the fear of crime as diffuse anxiety toward crime or the anticipated risk of being the victim of crime (Gray, Jackson, & Farrall, 2008; Ferraro, 1995). The anticipated risk is a cognitive judgment, where people assess crime rates and the probability of being a target. These studies measured the fear of crime by inquiring respondents questions such as how secure they feel being alone in their neighborhood at night.

To differentiate the perceived risk of victimization and the emotional experience of fearfulness, researchers employed the concept of “awareness of crime” to describe three dimensions involved in fear of crime, namely
“cognitive,” “affective,” and “behavioral” (Fattah & Sacco, 2012; Jarrett-Luck, 2015). Moreover, Innes (Innes, 2004) proposed a “signal crimes” perspective to analyze the disclosure of fear of crime in people’s narratives, including interpreting crime incidents (“expression”), assessing actual or potential threats (“content”), and modifying behaviors (“effect”) (Innes, 2004).

However, Jackson criticized prior studies that had defined fear of crime as a diffuse anxiety toward crime and measured the perceived probability of risks rather than actual experiences in individual lives (Jackson, 2015). To address the criticized issue, Farrall proposed another measurement, which focused on “instances of worry” (Farrall & Gadd, 2004). This included everyday experiences of worrying about crime (Farrall & Gadd, 2004), and asked about both the frequency and the intensity of the fear of crime.

Gouseti summarized different definitions into two types of fear of crime: “expressive” fear and “experienced” fear (Gouseti, 2016). Expressive fear is mediated by and through diffuse anxiety towards vague risks, such as those arising from the social, political, cultural, and financial transformations of late modernity. Experienced fear is associated with the tangible experiences people have with particular criminal incidents or having been victims of crime in the past (Gouseti, 2016).

Scholars have various definitions and methods of measuring the fear of crime, yet they all concur that it encompasses both emotional and cognitive aspects. Previous studies have largely relied on survey questionnaires to understand the fear of crime. To gain insight into the disclosure of the fear of crime in online discourses, this study draws upon (Ferraro, 1995)’s definition, which encompasses both emotional and cognitive components.

The fear of crime disclosure in online conversations
With the proliferation of public discourses about crime on ICTs (e.g., Nextdoor and Facebook Neighborhood groups), it has been observed to have negative effects on people (Lane & Meeker, 2003; Weitzer & Kubrin, 2004). Articles have reported that crime-related information on ICTs can induce fear and reinforce stereotypes across various dimensions, such as race, geographic location, and more (Molla, 2019; Lustbader, 2019). Powell found that the extensive discussion of a crime incident (the disappearance of Gillian “Jill” Meagher) on Twitter created a misconception among the public that random violence can occur anywhere, and anyone can be a victim (Powell, Overington, & Hamilton, 2018). Therefore, it is essential to comprehend people’s fear of crime in the context of crime-related discourses in online spaces and to mitigate the adverse effects on people.

Previous studies have employed survey instruments to identify various factors associated with fear of crime, including but not limited to gender, age, race, socioeconomic status, crime rate, police presence, physical cues, information sources, social support networks, neighborhood satisfaction, and collective efficacy (e.g., Adams & Serpe, 2000; Visser, Scholte, & Scheepers, 2013; Yuan & McNeeley, 2017; Weitzer & Kubrin, 2004). These findings were primarily based on self-reported data in offline contexts.

To the best of our knowledge, there is a dearth of scholarship conceptualizing the fear of crime in online discourses. A pertinent study conducted by Sachdeva et al. (Sachdeva & Kumaraguru, 2015) identified the lexicons in Indian residents’ posts and comments on the Facebook page of Bangalore City Police. The results suggested that frequent keywords, such as fear, concern, worried, trouble, notice of, and issue, indicated residents’ fear or concerns toward crime and could be applied to monitor public voices and build community policing. However, the proposed keywords did not capture the fear of crime adequately, based on scholars’ definitions. Our work builds on prior work that defined and measured the fear of crime offline and online but focuses on the online discourses about crime. Our first research question is: What kinds of fear of crime are disclosed in online conversations?

The Fear Emotion Detection
In the online environment, the presence of fear of crime can be identified through the analysis of linguistic patterns or cues present in online discourses. Below we review existing methods that detected the fear emotion in textual data.

According to Ekman (Ekman, 1992), fear is one of the six basic emotion categories, alongside happiness, sadness, anger, disgust, and surprise. A considerable body of research has investigated supervised and unsupervised methods for classifying the six emotion types in textual datasets (e.g., Bostan & Klinger, 2018; Islam, Mercer, & Xiao, 2019). However, prior work has demonstrated that detecting the fear emotion is more challenging than other emotions. This is due to two primary factors. Firstly, in some corpora, the fear emotion’s annotation results have exhibited lower inter-coder agreement than other emotion categories (Schuff, Barnes, Mohme, Pado, & Klinger, 2017; Torkildson, Starbird, & Aragon, 2014). Secondly, the disclosure of fear is normally scarce, unlike happiness and anger, which are frequently expressed in text (Bostan & Klinger, 2018; Ghazi, Inkpen, & Szpakowicz, 2015). Bostan’s study (Bostan & Klinger, 2018), which compared 14 pre-labeled corpora for emotion classification, showed that less frequent emotions, such as fear, achieved poorer classification performance.
There is an increasing body of research exploring situational expressions in public discourses, with the aim of better understanding human discourse patterns and monitoring emergencies and trends in large-scale data, such as self-disclosure (F.-Y. Wang, Carley, Zeng, & Mao, 2007), mental health discourses (De Choudhury, Sharma, Logar, Ekhout, & Nielsen, 2017), and crisis discourses (Wiebe & Riloff, 2005; Sen, Rudra, & Ghosh, 2015). Among these works, detecting situational awareness on social media during mass emergency events (Lamb, Paul, & Dredze, 2013; Verma et al., 2011; Sen et al., 2015) is most pertinent to this study as it attempts to differentiate informational messages from those expressing opinion or emotion (Verma et al., 2011). Situational awareness refers to people’s knowledge of the overall state of mass emergency events (Sarter & Woods, 1991). Situational awareness text contains more information to inform the state or decision-making during a mass emergency, whereas non-situational awareness text has more personal opinions, emotions, or status (Verma et al., 2011). For example, Lamb et al. applied a linguistic method to separate flu infection facts from emotional expression (mostly fear) for influenza surveillance on Twitter (Lamb et al., 2013). These studies explored what linguistic features could be used to identify situational awareness text and how well they could improve automatic detection (Lamb et al., 2013; Verma et al., 2011; Sen et al., 2015).

Given the existing scholarship, it appears difficult to apply emotion classification techniques to detect the presence of fear of crime in text. Moreover, the disclosure of the fear of crime involves human cognitive processes rather than pure emotion expression (Innes, 2004; Ferraro, 1995). Thus, it is essential to comprehend what linguistic traits can assist in detecting the presence of fear in online conversations about crime. Building upon related work that investigated human discourse patterns in the HCI community, we posed a second research question: What linguistic features are associated with the fear of crime in online conversations?

**DATA COLLECTION**

To gain insight into how individuals express their fear of crime in online discourses, we examined Reddit, a social media platform that enables users to join various communities, known as “subreddits,” based on shared interests or identities. Users can post and comment around particular subjects. One popular subject is crime.

Based on a quick search, users usually discuss crime in local subreddits (e.g., r/baltimore), crime-centric subreddits (e.g., r/crime), and support seeking & provision subreddits (e.g., r/Anxiety). Then, we browsed these conversations about crime. Crime-centric subreddits focus on the information on criminal investigations, which does not meet our research goal. Local subreddits and support seeking & provision subreddits focused on people’s experiences and opinions about crime in daily lives. However, the support seeking & provision subreddits contained limited conversations about crime. Thus, we chose local subreddits as the potential research site. Users in these local subreddits actively engage in discourses about local issues, including crime. We referred to a list that ranked the most popular city/local subreddits on Reddit by the number of subscribers and frequency of posts (Osiris32, 2016). Finally, we targeted the subreddit r/baltimore. The subreddit Baltimore was established in June 2008 and had approximately 47 thousand subscribers when we collected the dataset. Mass media and social media often portray Baltimore as an unsafe city with high levels of crime (Metzler, 2019). The image is echoed in r/baltimore, where users post numerous crime reports and engage in extensive conversations about crime.

To collect discourses about crime in r/baltimore, we consulted the FBI Uniform Crime Reporting (UCR) site (FBI, 2012), which delineates four violent crimes (i.e., murder and non-negligent manslaughter, rape, robbery, and aggravated assault) and four property crimes (i.e., burglary, larceny-theft, motor vehicle theft, and arson) in the United States. We meticulously examined the definitions of the eight types of crime and constructed a list of keywords. To acquire a comprehensive sample, we consulted a thesaurus (www.thesaurus.com/) and generated a wide range of synonyms for each initial keyword. We compared the synonyms’ meanings with the FBI UCR’s definitions. Then, we searched for the synonyms in r/baltimore and eliminated those that returned no search results. We added crime and criminal into the keyword list since users discussed crime without specifying the specific crime type. We also merged the crime types of larceny-theft and motor vehicle theft since they shared the same keywords (e.g., thief, theft, steal).

We developed a data crawler built upon the Python Reddit API Wrapper (PRAW) tool (praw.readthedocs.io/en/latest/index.html). PRAW enables researchers to access various back-end and often data-centric features on Reddit. The crawler collected all the posts and their comments that contained the keywords. After obtaining the initial dataset, we conducted a manual inspection for each keyword. The purpose was to ensure the posts and comments were related to violent or property crimes. For example, the keyword kill targeted posts that used kill for the meaning stop or fail, which had no connection to crime. Thus, we excluded these keywords from the list. The final list of keywords is presented in Table 1. We obtained 958 posts with 27,434 comments. The data collection was completed by October 2019. Among the 958 posts, there were 612 (64%) posts reposted from external websites, such as news or social media messages, and 346 (36%) original posts created by Reddit users. To
investigate the fear of crime in users’ discourses, we randomly sampled 2,000 comments from the entire dataset. Subsequently, our analyses were based on these 2,000 comments.

<table>
<thead>
<tr>
<th>Type</th>
<th>Sub-Type</th>
<th>Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crime in General</td>
<td></td>
<td>crime, criminal</td>
</tr>
<tr>
<td>Violent Crime</td>
<td>Aggravated Assault</td>
<td>assault</td>
</tr>
<tr>
<td></td>
<td>Robbery</td>
<td>robbery, robber, rob, mugging, mugger</td>
</tr>
<tr>
<td></td>
<td>Rape</td>
<td>rape, raper, rapist</td>
</tr>
<tr>
<td></td>
<td>Murder</td>
<td>murder, murderer</td>
</tr>
<tr>
<td>Property Crime</td>
<td>Larceny-Theft &amp; Motor Vehicle Theft</td>
<td>thief, theft, shoplifting, shoplifter, pocket-picking, steal</td>
</tr>
<tr>
<td></td>
<td>Burglary</td>
<td>burglary, break-in, burgle, burglar</td>
</tr>
<tr>
<td></td>
<td>Arson</td>
<td>arson, arsonist, pyromania, incendiarism</td>
</tr>
</tbody>
</table>

Table 1. Crime types, sub-types, and keywords for the data collection

CLASSIFYING THE DISCLOSED FEAR OF CRIME ONLINE (RQ1)

To answer the first research question, what types of fear of crime are disclosed in online conversations, we conducted an iterative manual coding process (Corbin & Strauss, 1990) to identify the comments that disclosed the fear of crime. The two authors served as coders, both of whom are Reddit users and proficient in English.

First, we discussed the definitions of the fear of crime and randomly selected 100 comments. We coded them independently based on the understanding of definitions. While coding, we immersed ourselves in the context by reading the original posts and the backgrounds of crime incidents. The comments were coded into either FEAR comments (comments that disclosed the fear of crime) or NONFEAR comments (comments that did not reveal the fear of crime). Then, we discussed the coding results together. We found two distinct types of fear presented in these comments. One type of fear was an expression of worry about specific crime incidents experienced by individuals; the other type was an expression of diffuse anxiety around crime. Since the patterns of the two types of fear were different, we decided to further code FEAR comments into two subcategories: experienced (EXPC) and expressive (EXPV). We found that the two subcategories, EXPC and EXPV, could cover all circumstances for the FEAR comments.

Second, with the initial two-tier code schema, we coded another 400 comments. We calculated Cohen’s Kappa (Viera, Garrett, et al., 2005) to evaluate the inter-coder agreement. The coding result showed good agreement (.89) for the first-tier codes (FEAR/NONFEAR) and the second-tier codes (EXPC/EXPV) (.95). We discussed the disagreements. They mainly fell onto the comments where users talked about crime in general—the EXPV fear. Users did not always disclose the fearful emotion directly but used words such as “unsafe” and “high crime rates” to indicate a high probability of victimization. We decided to code this kind of comments into FEAR and then EXPV. We present the definitions and examples for the EXPC and EXPV fear comments in Table 2.

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPC</td>
<td>An expression of worry about certain crime incidents that were or will be experienced by individuals.</td>
<td>One user shared a carjack incident happening to them and expressed a fearful emotion: I’m glad you at least got your car back. Well, I mean, it was completely totaled because the little shits decided that driving a 2009 Honda down a sidewalk was a good way to joyride, but hey. Geico paid me out! They also somehow didn’t hit any cars, just some trees, and curbs. The fun part was the kids didn’t know how to drive, so I was literally running down the sidewalk after them trying to flag someone else down. Was that a smart idea? Nah. <strong>But I was not in the best of mindsets after being jacked at 0430</strong> when I was walking to my car to go to work. One user was worried about being a carjack victim and took a precautious action: *I live in frigging <em>Columbia</em> and I wouldn’t leave the keys in my car.</td>
</tr>
</tbody>
</table>
One user expressed anxiety about more and more gun shoots in Baltimore; the user suggested the self-protection way: *Ops should be on every corner. Call in for federal support. The national guard should be here. It’s terrible to think about. The city is only getting worse. If u get caught with an illegal firearm, it should be attempted murder. Why else are u carrying a gun around? Protection? From who what have you done that you need a gun.*

One user presented a fear about a large number of homicide cases in different cities of the country: *Holy shit DC already has 13 homicides for the year. I don’t know Philly’s current count, but they had a record number of 351 last year. Maybe east coast cities are just going to keep getting more violent.*

Table 2. The definitions and examples of the experienced (EXPC) and the expressive (EXPV) fear comments

<table>
<thead>
<tr>
<th>EXPV</th>
<th>An expression of diffused anxiety about crime happening around neighborhoods, cities, or countries.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPV</td>
<td>One user expressed anxiety about more and more gun shoots in Baltimore; the user suggested the self-protection way: <em>Ops should be on every corner. Call in for federal support. The national guard should be here. It’s terrible to think about. The city is only getting worse. If u get caught with an illegal firearm, it should be attempted murder. Why else are u carrying a gun around? Protection? From who what have you done that you need a gun.</em></td>
</tr>
<tr>
<td>EXPV</td>
<td>One user presented a fear about a large number of homicide cases in different cities of the country: <em>Holy shit DC already has 13 homicides for the year. I don’t know Philly’s current count, but they had a record number of 351 last year. Maybe east coast cities are just going to keep getting more violent.</em></td>
</tr>
</tbody>
</table>

Third, using the coding schema, the first author coded the remaining dataset (1,500 comments). Of the 2,000 comments, 105 were FEAR comments, and 1,895 were NONFEAR comments. The FEAR and NONFEAR comments’ distribution was imbalanced. Among the 105 FEAR comments, 38 were EXPV fear, and 67 were EXPV fear.

REGRESSION MODELS: THE LINGUISTIC FEATURES RELATED TO THE FEAR OF CRIME DISCLOSURE (RQ2)

Given that the disclosure of fear of crime involves human cognitive processes rather than being solely driven by pure emotional expression, emotion detection techniques encounter challenges in accurately detecting the presence of fear of crime, making them less suitable for this specific context. Therefore, we conducted a regression analysis to test which linguistic traits significantly predicted the presence of fear in online conversations about crime. First, we selected linguistic features based on previous literature and generated corresponding variables. Then, we constructed two logistic regression models.

Linguistic variable selection and measurement

The detection of fear of crime is a novel undertaking. Drawing on prior research that identified emotional and cognitive information in social media corpora, we selected linguistic features such as sentiment, emotion, self pronouns, named entities, and objectivity. Additionally, we incorporated non-linguistic features such as crime types and post sources to provide contextual information regarding the fear of crime. We explain the selection and manipulation of variables below.

Negative sentiment. Fear is a negative emotion (Ekman, 1992) and is associated with a negative sentiment in narratives or speeches (Schuff et al., 2017; Hoffmann, 2018). Sentiment analysis is generally considered simpler than emotion analysis in text classification tasks. Therefore, it is reasonable to use the negative sentiment feature to understand the fear of crime in public discourses. We applied the Vader toolkit in Python (Hutto & Gilbert, 2014), a widely-used sentiment analysis tool for social media text, to measure the negative sentiment in comments. The precision and recall scores of Vader for social media text were reported to be 0.99 and 0.94, respectively (Hutto & Gilbert, 2014). Vader provides four sentiment scores (namely “positive,” “negative,” “neutral” and “compound”). We chose the negative score as the negative sentiment variable in our study.

Anger. Plutchik argued that anger and fear were two complimentary emotions (Plutchik, 1980, 2001). However, research has not consistently demonstrated a negative correlation between the two emotions (Hoffmann, 2018). In our analysis, we observed that anger was often expressed in comments related to crime. People expressed their anger towards criminals or police misconduct. For example, one user commented, *I actually grew up in the city and learned that they were definitely my enemy. I saw them do legitimately horrible shit. I am glad to have moved away.*

Self and others. “Self” refers to words such as *I, me, I’d, I’m, my, etc.* “Others” refers to words such as *you, it, her, wife, kid, everyone, people, etc.* According to Pennebaker, the self pronouns (e.g., *I*) were used more by people who were “insecure, anxious, or depressed” (Pennebaker, 2011). We assumed that the “self” disclosure would be presented more in FEAR comments than in NONFEAR comments. Users also expressed their fear of crime when talking about crime incidents associated with their family and friends. To measure “self,” we adopted the “1st pers singular” (e.g., *I, me, mine*) and the “1st pers plural” category (e.g., *we, us, our*) in LIWC; to measure “others,” we used the “2nd person” (e.g., *you, your, thou*), “3rd pers singular” (e.g., *she, her, him*), “3rd pers plural” (e.g., *they, their, they’d*), “family,” and “friends” categories in LIWC. The variables were referred to as *I, we, you, shehe, they, family, and friend* respectively in this work.
Named entities. Named entities are elements of events and have been utilized for event detection (Edouard, 2016; Inyaem, Meesad, & Haruechayyasak, 2009). We observed that users discussed named entities related to criminals, crime times and locations, municipal police departments, and crime statistics. However, it is unclear which types of named entities were mentioned more frequently when the fear of crime was disclosed. Named entities can be identified by Named Entity Recognizer (NER) tools. According to the comparison result in (Atdağ & Labatut, 2013), Stanford NER (Finkel, Grenager, & Manning, 2005) demonstrated superior performance compared to other NER tools. We applied the seven-class model in Stanford NER, which can recognize location, person, organization, money, percent, date, and time. The output for each class was the frequency of named entities detected from the text.

Cognition. According to the “signal crimes” perspective (Innes, 2004), the fear of crime was perceived and disclosed by describing crime incidents (the “expression” stage), perceiving an actual or potential threat to them (the “content” stage), and generating appropriate emotional, cognitive, or behavioral reactions (the “effect” stage). The fear of crime was usually disclosed during the second and the third stage, which involved more human cognitive activities, such as estimation or inference, than the first stage. LIWC provides a “cognitive processes” category. The “cognitive processes” category represents various human cognitive activities, such as insight, causation, discrepancy, tentative, certainty, differentiation. In this study, we included this category, called cognition for brevity, and compared the variable in FEAR comments and NONFEAR comments.

Informality. Verma and Sen discovered that tweets containing situational awareness were more formal than those without, exhibiting comprehensive narratives and proper grammar (Verma et al., 2011; Sen et al., 2015). We hypothesized that discourse in FEAR comments would be more informal than in NONFEAR comments. To measure the degree of informality, we employed the “informal language” category in LIWC.

Objectivity. Objective and subjective linguistic features were used to detect situational awareness (Riloff & Wiebe, 2003; Wiebe & Riloff, 2005). Subjectivity was defined as linguistic expressions of opinions, evaluations, emotions, and speculations in (Banfield, 2014). If a sentence contains any expression of opinions, evaluations, emotions, and speculations, it is subjective; otherwise, it is objective. We assumed that more subjective discourses were presented in FEAR comments than in NONFEAR comments. We applied OpinionFinder (Wilson et al., 2005) to determine the objectivity of the text. The OpinionFinder lexicons had been applied to sentiment analysis for social media data (Verma et al., 2011; Díaz, Johnson, Lazar, Piper, & Gergle, 2018). Each comment was assigned as “objective” or “subjective” based on its overall objectivity. The objectivity variable was a dummy variable with “objective” equal to one and “subjective” equal to zero.

Crime types. The types of crime discussed in posts might be related to the fear disclosed in comments. Each post could include one or multiple types of crime. Based on our observation, violent crimes elicited more fear of crime than property crimes. We included seven specific crime types (i.e., assault, robbery, rape, murder, theft, burglary, arson) and the general variable crime as eight dummy variables, with a value of one indicating the post discussed the type of crime, and zero indicating the post did not.

Post source. The source of posts might be associated with the fear disclosed in comments. The original posts typically recounted the first-hand experiences of the poster with crime, while the external posts were usually sourced from news reports or social media. We included the post source feature as a dummy variable, with original posts equating to one and external posts equating to zero.

Table 3 presents the descriptive statistics for all variables for the three datasets: the entire dataset, the FEAR dataset, and the NONFEAR dataset.

<table>
<thead>
<tr>
<th>Continuous variables</th>
<th>All (n = 2,000)</th>
<th>FEAR (n = 105)</th>
<th>NONFEAR (n = 1,895)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>sd</td>
<td>skew</td>
</tr>
<tr>
<td>negative</td>
<td>0.1</td>
<td>0.1</td>
<td>1.9</td>
</tr>
<tr>
<td>anger</td>
<td>1.7</td>
<td>5.5</td>
<td>10.8</td>
</tr>
<tr>
<td>i</td>
<td>3.0</td>
<td>4.9</td>
<td>2.9</td>
</tr>
<tr>
<td>we</td>
<td>0.6</td>
<td>1.9</td>
<td>5.4</td>
</tr>
<tr>
<td>you</td>
<td>2.0</td>
<td>3.8</td>
<td>2.9</td>
</tr>
<tr>
<td>shehe</td>
<td>0.8</td>
<td>2.6</td>
<td>5.3</td>
</tr>
<tr>
<td>they</td>
<td>1.3</td>
<td>2.8</td>
<td>3.6</td>
</tr>
</tbody>
</table>
Regression modeling results

In this section, we ran logistic regression models to examine which linguistic features in the FEAR dataset were distinct from those in the NONFEAR dataset and to interpret the results.

The dependent variable was coded as one for FEAR comments and zero for NONFEAR comments. Logistic regression was chosen due to the dichotomous nature of the dependent variable. While logistic regression does not have the same set of assumptions as a standard OLS regression (e.g., requires a normal distribution), it does assume that the independent variables are not excessively correlated, which we explain below.

As presented in Table 4, we included all the variables in Model 1; we excluded variables with p-values greater than 0.05 in Model 2. The Akaike Information Criterion (AIC) value for Model 2 (770) was lower than the AIC value for Model 1 (793), indicating that we obtained a more optimal model with fewer independent variables. If we continued to eliminate variables such as the insignificant variable *informality*, the AIC value would increase again. We conducted the likelihood ratio test to assess whether Model 2 significantly improved over Model 1 with fewer predictors. The result showed Model 2 was significantly better than Model 1 ($\chi^2 = 0.53$). We also checked multicollinearity for Model 2. All variance inflation factors were smaller than 2, indicating there was no multicollinearity issue.

<table>
<thead>
<tr>
<th>DV: FEAR/NONFEAR</th>
<th>Model 1 Coef</th>
<th>Model 1 S.E.</th>
<th>Model 1 Z</th>
<th>Model 2 Coef</th>
<th>Model 2 Model S.E.</th>
<th>Model 2 Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-3.179</td>
<td>0.546</td>
<td>-5.826***</td>
<td>-3.300</td>
<td>0.185</td>
<td>-17.824***</td>
</tr>
<tr>
<td>negative</td>
<td>2.184</td>
<td>0.793</td>
<td>2.755**</td>
<td>2.891</td>
<td>0.678</td>
<td>4.266***</td>
</tr>
<tr>
<td>anger</td>
<td>0.026</td>
<td>0.017</td>
<td>1.522</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: 606/1,394 means 606 objects were equal to one and 1,394 objects were equal to zero.

Table 3. Descriptive statistics for variables in the entire dataset, the FEAR and the NONFEAR dataset
Table 4. The logistic regression results for Model 1 and Model 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z</th>
<th>P-Value</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Z</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>3.260**</td>
<td>0.065</td>
<td>0.018</td>
<td>3.536***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>we</td>
<td>0.008</td>
<td>0.063</td>
<td>0.119</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>you</td>
<td>-0.071</td>
<td>0.041</td>
<td>-1.741</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>shehe</td>
<td>0.025</td>
<td>0.038</td>
<td>0.665</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>they</td>
<td>0.028</td>
<td>0.035</td>
<td>0.812</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>family</td>
<td>-0.021</td>
<td>0.111</td>
<td>-0.186</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>friend</td>
<td>0.030</td>
<td>0.063</td>
<td>0.478</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>location</td>
<td>0.223</td>
<td>0.072</td>
<td>3.119**</td>
<td>0.179</td>
<td>0.060</td>
<td>3.001***</td>
<td>0.060</td>
<td>3.001***</td>
</tr>
<tr>
<td>person</td>
<td>-0.268</td>
<td>0.218</td>
<td>-1.231</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>organization</td>
<td>-0.126</td>
<td>0.105</td>
<td>-1.190</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>money</td>
<td>-0.028</td>
<td>0.212</td>
<td>-0.132</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>percent</td>
<td>0.177</td>
<td>0.253</td>
<td>0.700</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>date</td>
<td>0.022</td>
<td>0.069</td>
<td>0.315</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>time</td>
<td>0.666</td>
<td>0.275</td>
<td>2.422*</td>
<td>0.663</td>
<td>0.266</td>
<td>2.495*</td>
<td>0.663</td>
<td>2.495*</td>
</tr>
<tr>
<td>cognition</td>
<td>-0.024</td>
<td>0.014</td>
<td>-1.715</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>informality</td>
<td>-0.066</td>
<td>0.028</td>
<td>-2.387*</td>
<td>0.050</td>
<td>0.027</td>
<td>-1.836</td>
<td>0.050</td>
<td>-1.836</td>
</tr>
<tr>
<td>objectivity</td>
<td>-1.522</td>
<td>0.362</td>
<td>-4.209***</td>
<td>1.384</td>
<td>0.346</td>
<td>-3.997***</td>
<td>1.384</td>
<td>-3.997***</td>
</tr>
<tr>
<td>crime</td>
<td>0.279</td>
<td>0.495</td>
<td>0.563</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>assault</td>
<td>-0.128</td>
<td>0.554</td>
<td>-0.231</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>robbery</td>
<td>0.414</td>
<td>0.421</td>
<td>0.980</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>rape</td>
<td>0.357</td>
<td>0.630</td>
<td>0.566</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>murder</td>
<td>0.304</td>
<td>0.477</td>
<td>0.637</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>theft</td>
<td>-0.112</td>
<td>0.441</td>
<td>-0.254</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>burglary</td>
<td>0.579</td>
<td>0.473</td>
<td>1.224</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>arson</td>
<td>-12.42</td>
<td>660.949</td>
<td>-0.019</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>post source</td>
<td>0.276</td>
<td>0.244</td>
<td>1.130</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>AIC</td>
<td>793</td>
<td>770</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Significant at: *0.05, **0.01 and ***0.001 levels, respectively.

In Model 2, the most significant variables were negative (Z = 4.266, p < 0.001), objectivity (Z = -3.997, p < 0.001), and i (Z = 3.536, p < 0.001). Results for the three variables were consistent with our hypotheses.

Negative sentiment was positively related to FEAR comments, which echoed previous studies. Intuitively, the disclosure of fear of crime was more likely to be a negative sentiment. Given the negative sentiment detection task is mature, negative sentiment is a reliable indicator of fear of crime.

Objectivity was negatively related to FEAR, suggesting that FEAR comments were more subjective than NONFEAR. This was a strong predictor for distinguishing between FEAR and NONFEAR comments. FEAR comments were more likely to contain more subjective content, such as emotions and speculations, than NONFEAR comments.

The i pronoun is positively related to the FEAR comments. Users said i more in FEAR comments than in NONFEAR. By checking FEAR comments, the i scores of which were high, we found most of them were relating self-experiences of being victims or witnesses or being experiencing fear of crime. For example, one user shared personal experiences of being flattered, where many i pronouns were used: Yes, this happens to me as well. I will generally just laugh it off or act as if I did not hear them, then hurry on my way as fast as possible. I will then avoid that particular shop/area on the days that I know the employee is there (this information is often volunteered to me). I generally do not do well with confrontation.
Location and time in named entities were significantly related to the disclosure of fear of crime, meaning there were more location and time information in FEAR comments than in NONFEAR comments. For example, one user wrote an open letter to the Mayor of Baltimore where they described several crime incidents with specific location and time information and expressed their fear and willingness to move out of Baltimore: ... And then last night at 2 AM, a lifelong resident of Locust Point got shot outside our Royal Farms store. He was simply on his way home from work, and he was shot and killed because he had money. My chief safety concern used to be people breaking into my car to steal things, but last night even before this happened, I was worried when my wife was walking a mile to and from Cross St to meet a friend for drinks. This could have been her! ... Overnight, some thugs helped make that decision clearer for me. I love Baltimore, I love my Orioles, and I love the small town in a big city feel that Baltimore has - but I don’t want to lose my life for it.

The informality variable was negatively related to FEAR comments. The comments that expressed the fear of crime were more formal, while those that did not contain such fear were more informal. However, in Model 2, this was not a significant predictor ($Z = -1.836, p = 0.07$).

Variables for anger, others, cognition, crime types, and post source were not found to be significant in the regression models. We discuss these results in more detail in the Discussion section.

**DISCUSSION**

The present study sought to conceptualize the fear of crime in online discourses about crime through mixed methods. We reflect on some missing perspectives in existing definitions and called for further investigation to better understand, detect and mediate the fear of crime.

Recapping the conceptualization of the fear of crime

The fear of crime might be expressed implicitly without containing fear-related lexicons. In our manual coding, we identified only 105 out of 2,000 comments that displayed the fear of crime (RQ1). Many comments did not explicitly show emotion content. This finding aligns with existing work, where most respondents reported being unworried about crime (Gray, Jackson, & Farrall, 2010). One possibility is that, in conversations about crime, users tend to debate or provide support to others, rather than revealing private and personal status. Implicit expressions have been proven to be prevalent in critical self-disclosures (Chen, Lee, Li, & Huang, 2010; Lee, Chen, & Huang, 2010; Lee, Chen, Li, & Huang, 2010). When a fearful emotion is not explicitly expressed with emotion lexicons, tools have difficulty to detect the emotion and its cause (Ghazi et al., 2015). It is thus necessary to further investigate how to detect implicit fear of crime. Another explanation is that users may consider Reddit as an inappropriate platform to discuss their fears. In the support seeking & provision subreddits, we rarely found explicit fear disclosure. People’s willingness to engage in self-disclosure is influenced by the platform’s affordances and other users’ interactions (Yang et al., 2019). For example, Reddit users opted to utilize throwaway accounts when engaging in emotional self-disclosure to safeguard their identities (Mann & Carter, 2021). Platform design should consider incorporating features that enhance privacy and allow users to control the visibility of their identities, potentially fostering a more comfortable environment for emotional self-disclosure.

In our manual coding, we categorized the fear of crime into two types: expressive fear and experienced fear, which aligns with Gouseti’s classification for fear of crime (Gouseti, 2016). The results indicated that people were more likely to express expressive fear than experienced fear (RQ1). Expressive fear refers to an emotional reflection that is more diffuse and intangible than any specific event. Its intangible and diffuse nature allows individuals to articulate and share subjective emotional experiences without the need for specific triggers. In contrast, experienced fear may stem from specific traumatic events or personal encounters with crime, causing individuals to be more cautious or hesitant in disclosing those experiences. Overall, the difference in expression between expressive fear and experienced fear underscores the multifaceted nature of the fear of crime, highlighting the need to explore the underlying psychological and sociocultural factors that influence individuals’ preference for one type of fear expression over the other.

The regression model results suggest that negative sentiment, objective expression, and first-person personal pronouns can serve as indicators for identifying FEAR comments. These variables were more frequently used to describe the context of crime incidents and people’s emotional reactions to crime. The regression model also revealed the difficulty of capturing the cognitive processes associated with the fear of crime (RQ2). Cognition was a negative predictor ($Z = -1.715, p = 0.09$), suggesting that FEAR comments contained less cognitive content than NONFEAR comments. However, the disclosure of fear was often accompanied by cognitive processes. For example, a user might estimate the risk level in a potentially dangerous situation and express fear, as shown in this example: And what happens if I lose control of the gun and it’s turned on me or someone I love? Because that is quite likely. Getting a punch in the face is not nearly as bad as potentially getting shot - not to mention the alarming prospect of actually taking a life, regardless of whether that person deserves it or not. In another example, a user might express their opinion on crime: It’s a long shot, but maybe Steam has some record or info about the laptops.
That, of course, would assume that the robber wouldn’t just format the drive. But maybe they can see if it logs in at any point. Quite frightening. Good luck! The examples demonstrate the intertwining of cognitive processes with the disclosure of fear, indicating the need for further exploration and understanding of cognitive processes from different perspectives in the fear of crime. The “awareness of crime” concept (Gabriel & Greve, 2003) and the “signal crimes” perspective (Innes, 2004) provide frameworks to comprehend the cognitive dimension of the fear in people’s narratives. Both frameworks break down the disclosure of the fear of crime into multiple components. For instance, the “signal crimes” perspective treats a crime incident as a signal with three stages: interpreting crime incidents (“expression”), assessing actual or potential threats (“content”), and modifying behaviors (“effect”).

Furthermore, we should not view the fear of crime as entirely negative. It can serve as a reminder for people to take precautions and avoid becoming victims. Ferraro argued that a person might perceive a high likelihood of being a victim of crime without necessarily feeling fearful about it (Ferraro, 1995). Gray et al. argued that, unlike dysfunctional fear, functional fear of crime does not diminish the quality of life if people take precautions and feel safer (Gray et al., 2010). Therefore, functional fear is the desired state. Previous research suggests that higher crime levels may increase the fear of crime but do not affect feelings of insecurity (Visser et al., 2013). Additionally, Ferguson and Mindel (2007) found that factors such as social support, neighborhood satisfaction, and collective efficacy play a positive role in managing the fear of crime, while social distrust and perceived ethnic threat contribute to the induction of fear of crime (Visser et al., 2013). Considering that many conversations about crime and victimization occur in online communities, it is essential to develop a comprehensive understanding of how fear is manifested and communicated in different online contexts. Understanding the factors that influence the disclosure of the fear of crime, such as social support and collective efficacy, opens avenues for targeted interventions. Design considerations may include interactive features that foster social connections, encourage positive interactions, and promote trust-building among users, ultimately helping to reduce social distrust and mitigate the dysfunctional fear of crime.

Limitations and Future Work
This work has several limitations. The manual coding was based on prior literature and the researchers’ subjective judgment. As such, we were unable to ascertain the users’ underlying intentions behind their narratives. Future work could explore the richer cognitive dimensions behind the narratives by conducting interviews or survey studies.

Furthermore, given the size of the ground truth dataset, we did not differentiate between experienced and expressive fear in the regression models. Additionally, the study did not include all possible linguistic features that might be related to the fear of crime, such as the fear disclosed in the posts and users’ profile information. In the future, it would be interesting to explore why expressive fear was more prevalent than experienced fear, whether expressive fear was over-represented, and what precipitated it. Additionally, the two types of fear possess quite distinct characteristics. It is worth studying how the two kinds of fear affect people differently, e.g., whether they are beneficial or detrimental to people’s daily routines and well-being, and how to design different detections or interventions for the two fears.

Finally, misdetection of the fear of crime may have ethical implications. For instance, underestimating users’ fear may lead to missing precautionary action reminders and thus victimization of crime; biased detection may reinforce the stereotypical images of certain populations that are related to crime. Researchers must be mindful when applying the findings to detection tools or interventions. Future work could investigate what factors could result in functional fear or positively influence managing the fear of crime and develop interventions (e.g., chatbots) in online conversations. Further, online platform should consider create a more comfortable space for users to disclose their fear of crime, not only anger or debates.

CONCLUSION
Online discourses about crime have increased the public’s awareness of crime and, at the same time, allow researchers to understand how the public discusses and reacts to crime in their daily lives. This study tried to conceptualize the fear of crime disclosed in online conversations about crime and explored ways to detect it. The manual coding revealed two types of fear expressed by users: “experienced” and “expressive.” By analyzing linguistic features in the comments, we constructed logistic regression models to explore their relationship with the fear of crime. The work contributes to our understanding by identifying negative sentiment, objective expression, and personal pronouns as the most relevant variables associated with the fear of crime. Overall, the results suggest that the fear of crime bears more meanings than emotional reactions. This study sheds light on future work to further model the implicit expressions of fear and the cognitive process involved in the expressions.

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Using Explainable AI to Understand Team Formation and Team Impact

Xu, Huimin
Saar-Tsechansky, Maytal
Song, Min
Ding, Ying

The University of Texas at Austin, USA | huimin.xu@utexas.edu
The University of Texas at Austin, USA | Maytal.Saar-Tsechansky@mccombs.utexas.edu
Yonsei University, South Korea | min.song@yonsei.ac.kr
The University of Texas at Austin, USA | ying.ding@ischool.utexas.edu

ABSTRACT

The citation of scientific papers is considered a simple and direct indicator of papers’ impact. This paper predicts papers’ citations through team-related variables, team composition, and team structure. Team composition includes team size, male/female dominance, academia/industry collaboration, unique race number, and unique country number. Team structures are made up of team power level and team power hierarchy. Team members’ previous citation number, H-index, previous collaborators, career age, and previous paper numbers are a proxy of team power. We calculated the mean value and Gini coefficient to represent team power level (the collective team capability) and team power hierarchy (the vertical difference of power distribution within a team). Taking 1,675,035 CS teams in the DBLP dataset, we trained the XGBoost model to predict high/low citation. Our model has reached 0.71 in AUC and 70.45% in accuracy rate. Utilizing Explainable AI method SHAP to evaluate features’ relative importance in predicting team citation categories, we found that team structure plays a more critical role than team composition in predicting team citation. High team power level, flat team power structure, diverse race background, large team, collaboration with industry, and male-dominated teams can bring higher team citations. Our project can provide insights into how to form the best scientific teams and maximize team impact from team composition and team structure.

KEYWORDS

Citation predication; Team composition; Team structure; XGBoost; Explainable AI; SHAP

INTRODUCTION

Citing behavior represents the credits to those scientific works with intellectual contributions (Merton, 1988). Yet some researchers argue that high citations do not mean disruptive innovation to the scientific community (Wu et al., 2019), and citations bring structural biases to minority groups, disparities across institutions and countries (Sugimoto, 2021). Despite these shortcomings, the citation count is still a crucial metric to evaluate the impact of scientific work, individual scientists, journals, and departments (Bornmann et al., 2008). For example, the low citation of papers will influence how people perceive their quality and thus reduce close reading (Teplitskiy et al., 2022). The citation of scientists’ work is closely related to their received awards number and appointed apartment ranking (Cole & Cole, 1967). The citation of a paper also quantifies the impact of a scientific team who collaborates to finish the publication. Given the citation of papers requires the accumulation of time, it is a valuable task to predict the long-term team impact shortly after the paper’s publication.

Scientific work is more team collaboration than individual endeavors (Wuchty et al., 2007). Division of labor requires everyone to specialize in specific areas to solve complex problems (Becker & Murphy, 1992). Previous research predicts paper citations from paper features, journal features, author features, early citation, and peer review (e.g., Li et al., 2019; Ruan et al., 2020). But, the literature shows poor research endeavors in predicting citation count regarding team-related features. The science of science research community mainly focuses on exploring and stressing individuals’ characteristics to influence team impact instead of taking all researchers in the team as a whole. Specifically, Li et al. (2019) measured the characteristics of first authors (e.g., the accumulated citations, H-index, publication number) in the author features but ignored the contributions of all other authors. Compared with the influence of an individual, the team structure of how members communicate (Woolley et al., 2010), share power (Xu et al., 2022a) and divide the work (Xu et al., 2022b) has a greater influence on team performance. Besides the characteristics of the first authors or corresponding authors, the team composition, such as team size (Wu et al., 2019), gender and race diversity (Hofsträ et al., 2020), country diversity (Wagner et al., 2019) of team members are also determinants of team success. In this project, we aim to predict team impact using team-related variables, team composition, and team structure. Teams in this project is represented by the list of authors of one published article because the authors of one publication have to work together as a team for one or two years to get this paper published. As to team composition, we consider team size, racial backgrounds, institutional backgrounds, academia/industry collaboration, and gender-dominated variables for all authors. Compared with team composition, team structure is widely applied in organizational behaviors (Greer et al., 2010) and sports (Halevy et al., 2012). Still, few are discussed in scientific teams (Xu et al., 2022). Team structure comprises team power level and team power hierarchy. Team power level means the collective ability of the whole team (Greer et al., 2011). Team power...
hierarchy implies the distribution of resources within the teams (Greer et al., 2018). It can be hierarchical (e.g., top-down management) or flat (all team members share similar power), influencing the communication, collaboration process, and performance. Team power can be measured using team members' previous citation number, H-index, previous collaborators, career age, and previous paper numbers. We can compute the average value and Gini coefficient to represent team power level and hierarchy.

Integrating prediction and explanation is essential when we study social problems to understand how and why the phenomenon happened (Hofman et al., 2021). The explanation can help us open the black box of machine learning models. Instead of pursuing high accuracy, we also need to know models' ethical implications and consequences (Wallach, 2018). For example, although a model has high accuracy, it might bring bias to disadvantaged people. However, the research on paper citation prediction lacks a combination of high prediction and robust explanation. There are two branches of study in predicting team citation. One branch focuses on achieving high prediction results but lacks a thorough analysis of how variables contribute to final results. The other branch highlights the interpretability of models but lacks high predictability of team performance. In this paper, we choose XGBoost (Chen & Guestrin, 2016) to help predict team impact measured by citations. By applying the Explainable AI method SHAP (Lundberg & Lee, 2017), we can quantify feature contribution to the citation count. Meanwhile, we can understand how team features influence each team locally and all teams globally through interpretability. Based on that, we can provide insights into team formation in the scientific context.

This paper uses explainable AI methods to understand team formation and team impact. This study addresses the above research gaps by taking Computer Science (CS) as a test field to predict team citation through team structure and composition variables. This paper is structured as the followings. Section 2 summarizes the related literature. Section 3 details the research methods. Section 4 describes the model comparisons and feature contribution. The last Section 5 concludes the study and points out future research directions.

RELATED WORK
Features in Citation Prediction
The literature mainly predicts paper citation based on five aspects of information: 1) paper content, 2) peer review, 3) journal, 4) early citation, and 5) authors. Firstly, the paper's content, such as title, abstract, keywords, topic, and references, is used to predict paper citation count (Fu & Aliferis, 2010; Hu et al., 2020; Jiang et al., 2021, Yan et al., 2011). For example, Hu et al. (2020) applied the LDA model to extract keywords from titles, abstracts, and author-defined keywords. They then measured these keywords popularity on google scholar, research gate, and google trend websites. They suggested that keywords popularity was an important indicator of citations. Also, when papers cite the most recent and relevant references in the subfield, they would attract more attention in the community (Roth et al., 2012). Secondly, peer review, as an evaluation of paper quality, Li et al. (2019) extracted the most similar peer review texts to abstracts and proposed a cross-review matching mechanism in order to get a comprehensive and relevant review representation. Thirdly, journal quality, like, the impact factor, is an important predictive feature for paper citation (Fu & Aliferis, 2010; Yan et al., 2011). Fourthly, early citations of papers can contribute to long-term citations (Newman, 2014). Researchers predict 5-year citations based on the first two years (Ruan et al., 2020). The final aspect of author information is the main element in predicting citation. Researchers select the first, most productive, and most influential authors to help predict the whole team's performance (Fu & Aliferis, 2010). Usually, researchers might use a mixture of this content-based and bibliographic information to predict paper impact jointly. This paper uses a unique perspective—team-related variables—to predict paper citation. We take all individuals in the paper as a team to predict team outcomes.

Team Composition and Structure
Team composition mainly highlights demographic-related variables influencing team performance, such as team size, gender, race, sector, and country. For example, by analyzing the team photo after finishing the game, Saveski et al. (2021) trained machines learning to judge whether the team escaped successfully from the maze. They found that large teams, gender diversity, race diversity, and older but fewer age differences can improve the chance of success. Team size plays an important role in team performance. Team size, as a parameter in a model for the self-assembly of creative teams, could determine team performance (Guimera et al., 2015). Large teams tend to receive more citations (Wuchty et al., 2007; Larivière et al., 2014). However, Wu et al. (2019) showed that innovation does not scale up with large teams. As to gender composition, researchers designed games to illustrate how the proportion of different gender influences the process of cooperation in lab experiments. They concluded that female-dominated teams are positively related to equal conversations (Woolley et al., 2008). This is because women have more social sensitivity compared with men in teams, which means they can sense how others think through nonverbal signals. This result is consistent with an experiment that requires students to finish a project paper in class (Berdahl & Anderson, 2005). They found that majority-female and balanced teams prefer equal communication and shared leadership over time, which could encourage everyone to participate in activities and contribute to teams. Freeman & Huang (2015) studied how race diversity influences team performance in the WOS dataset. They divided race into
eight categories and found that although scientists prefer to work with those who are similar to them in race, homophily can lead to lower citations and low-impact journals. Thus, they confirmed an assumption race diversity has positive effects on teams. Compared with the industry, universities dominate in paper publishing (Larivière et al., 2018). The collaboration between these two different sectors can bring more benefits for teams. For example, by analyzing the paper published by Canadian institutions from 1980 to 2005, Lebeau et al. (2008) confirmed that university-industry teams have more citations than pure university or industry teams. When authors from different countries are involved in teams, it can cause an additive citation effect (Hsiehchen & Hsieh, 2015). Wagner & Leydesdorff (2005) also proved that international collaboration could receive more citations for papers. Overall, the diversity of demography in teams can increase team citation.

The team structure is made up of team power level and team power hierarchy. The concept of team power level and team power hierarchy has been discussed in different contexts. In the organizational behavior field, Greer et al. (2010) regarded the positions in organizations as power and computed the average positions as team power level and standard deviation as team power hierarchy. In sports, Halevy et al. (2012) measured team power with NBA players' salaries. They all found that team structure is crucial to team conflicts, team coordination, and team ultimate performance. When people have brainstorming, negotiating, and puzzle games in experiments, a flat structure measured by equal speaking-turn distribution among team members can maximize collective intelligence (Woolley et al., 2010). In the scientific context, as long as more than one person works on a common project, team power dynamics will influence every step of collaboration, including defining topics, distributing labor of division, choosing methods, deciding journal targets, etc. A researcher's career age, previous citation, H-index, previous collaborators, productivity, function, and role can also be taken as the proxy of power since they represent prestige, resources, knowledge, and experience (Merton, 1973). Xu et al. (2022a) took the career age as the basis of power, where senior researchers have more rights in decision-making than junior researchers. By analyzing teams in Computer Science, Physics, Sociology, Library & Information Science, and Arts & Humanities, Xu et al. (2022a) calculated the mean value and Gini coefficient of team members' career age to represent the team power level and team power hierarchy. Finally, they found that a flat structure at different team power levels can have higher team citations. Similarly, Xu et al. (2022b) identified the leaders who conceived, designed, supervised, and wrote in publications through paper contributions and suggested that a flat structure with multiple leaders was better for team novelty and long-term impact than sole leadership. Although these team-related features have been proved important to performance, few science of science research considers them when predicting citation.

Methods in Citation Prediction
Predicting paper citations uses either traditional statistics models or advanced deep learning models. Yu et al. (2014) applied multiple linear stepwise regression models to analyze the correlation between paper features and citations in around 1,000 papers in the field of Information Science & Library Science. Similarly, Fu & Aliferis (2010) used SVMs and logistic regression models to predict whether medical papers exceeded a threshold value within ten years. These simple models are easily interpretable by understanding the coefficient of related variables. Ma et al. (2021) utilized deep learning models Bi-directional Long Short Term Memory (Bi-LSTM) to predict AI paper citations in the long term. Even though they found deep learning models outperform other baseline models and achieve higher accuracy, they did not interpret the outputs from the black box model. In the library, information and document field, Ruan et al. (2020) predicted papers' citations within five years through the BP neural network. To explain the relative importance of features, they trained different models when they dropped one feature but kept all other features (leave-one-out model) and then compared model differences. The drawback is authors do not consider the correlation between variables, and the model computation has low efficiency. Integrating prediction and explanation in modeling is a future direction since explanatory power can quantify how much we explain and reveal the limitation of our understanding of the social phenomenon (Hofman et al., 2021).

The combination of XGBoost and SHAP has been used in various contexts, such as marketing, health care, and traffic safety. By analyzing the product reviews on Amazon with XGboost and SHAP, Meng et al. (2020) found that the length of reviews contributes most to the headset review helpfulness while the frequency of product attributes is most helpful to the facial cleanser consumers. Yang (2020) trained the XGboost model to predict patients' recovery and modality. Compared with gender, time in the hospital, and the presence of chronic disease, Yang (2020) concluded that age is the most important factor in COVID-19 mortality prediction through SHAP and LIME value contributions. In accident safety, when inputting traffic, network, demographic, land use, and weather features into the XGBoost model, the speed difference before and after accidents is the key to traffic occurrence (Parša et al., 2020). The accuracy can achieve 99% in the Chicago metropolitan highway dataset. Ma et al. (2022) predicted the visibility of papers that are broadly mentioned and long-term disseminated on social media through literature-related features (authors, journal, paper) and social media-related features (user, tweets). They found that XGBoost algorithms performed best in predicting paper visibility and explained the contributions of each feature in disseminating through the SHAP method. Overall, the methods can achieve a balance between a high prediction rate
and high interpretability. But the explanation AI method has not been widely applied in predicting and understanding team citation.

**METHODOLOGY**

**Data**

We use the DBLP dataset (https://dblp.org/), including 4,894,081 papers in the Computer Science (CS) field. We choose 3,658,127 papers that have more than one author from 1980 to 2020 since we assume a team must have at least two authors. We take authors in each paper as an independent team who collaborate together to finish a research project and publish the outcomes. For example, if a paper has five authors, then these five authors are considered to be a team. When we identify the gender and academia/company information of each author, there are unknown categories. Unknown gender-dominated teams occupy 27% (984,912) and unknown race teams occupy 36% (1,316,527). We exclude these unknown teams, and 1,675,035 teams are left with complete information.

**Measures**

**Team impact:** We use the 5-year citation to evaluate the impact of a paper, which is also the impact of a team who published this paper. This is a binary variable, high team impact (above or equal to mean value) and low team impact (below mean value). The mean 5-year citation is 5. 1,263,162 teams are below the mean value, whereas 411,873 teams are above the mean value. Above-mean value is labeled as 1, and the below-mean value is labeled as 0. Here, we do not use the median value of a 5-year citation as a threshold. The median value of a 5-year citation is 2 since most of the papers (63%) do not have more than two citations. Using the median value cannot show the distinct difference between high-impact papers and low-impact papers.

**Team size:** We count the number of authors in a team as the size of this team. The median team size value is 3.

**Gender:** Teams are assigned to male-dominated, female-dominated, and equal. For instance, male-dominated means the identified male author number is larger than the identified female author number. We use the Bert-based model trained by Acuna & Liang (2021) to predict authors' gender information. After excluding unknown categories, there are 1,316,193 (79%) male-dominated teams, 184,608 (11%) equal teams and 174,234 (10%) female-dominated teams.

**Race:** We calculate the team's unique number of authors' race. Acuna & Liang (2021) distinguished four kinds of race: Black, Hispanic, White, and Asian. The median value of unique race in teams is 1, suggesting that most of the teams are homogenous in race.

**Sector:** Teams are divided into pure academia, pure company, and combined. Pure academia (company) means teams are made up of all researchers from academia (industry) institutions, whereas combined teams have both academia and industry researchers. Manjunath et al. (2021) methods have been applied to match authors' institutions with eight categories in the Global Research Identifier Database (GRID), including government, education, company, facility, healthcare, nonprofit, archive, and others. We merge the health care (mainly universities) and education into academia and keep the company as the industry category. After excluding unknown categories, there are 1,501,131 (90%) academia teams, 63,399 (4%) industry teams, and 110,505 (7%) combined teams. Academia teams are dominating in paper publishing.

**Country:** We calculate the unique number of authors' countries based on authors' affiliations in a team. The mean value of a unique country in teams is 1, indicating that most teams come from the same country.

**Career Age:** We calculate the mean career age and Gini index of career age among all team members. The median value of mean career age is 8, and the Gini career age is 0.34.

**Citation:** We calculate the mean citation and Gini index of citation among all team members before collaborating on the paper. The median value of mean citation is 63, and the Gini career age is 0.50.

**H-index:** We calculate the mean H-index and Gini index of the H-index among all team members. H-index can comprehensively reflect a researcher's productivity and impact (Hirsch, 2005). The median value of the mean H-index is 3, and the Gini H-index is 0.50.

**Collaborators:** We calculate the mean collaborators and Gini index of collaborators among all team members before collaborating on the focal paper. The median value of the mean collaborator is 19.5, and the Gini coefficient of collaborators is 0.39.

**Productivity:** We calculate the mean papers and Gini index of papers among all team members before collaborating on the focal paper. The median value of mean career age is 15.25, and the Gini career age is 0.50.
Methods
An XGBoost model is trained for binary classification of high/low team impact. XGBoost applies a gradient tree boosting algorithm and has state-of-the-art classification performance (Chen & Guestrin, 2016). Firstly, we plan to use Python xgboost package. 80% dataset was taken as training, and the remaining 20% dataset was taken as testing. For the predicted value, the result is not balanced. Below-mean values have a more significant proportion. Thus, we take the up-sampling methods to ensure the trained dataset is balanced. We randomly choose from the positive values multiple times to make the positive instances number the same as the negative ones. Secondly, we evaluate the model's performance in comparison with baselines. Thirdly, SHAP is an explainable AI method used for model interpretation through Shapley value (Lundberg & Lee, 2017). By comparing the difference with the variable and without the variable in the model, the importance of each variable can be inferred. SHAP interprets the contribution values of each feature in each instance to the particular prediction. We can draw the relative feature importance of explanatory variables on the model results using the mean SHAP value of variables and the distribution of the SHAP value of variables for each individual. Finally, we draw interactive plots to show the relationship between variables and SHAP values.

Evaluation Metrics
The results of the predicted model can be divided into four categories: True Positive (TP), False Positive (FP), True Negative (TN), and False Negative (FN). Here 0.5 is used to be a threshold in the 2-binary classification where the instance with value larger than 0.5 is a positive one, and the instance with a value lower than 0.5 is a negative one. We calculate the accuracy (ACC) as the evaluation metrics: \( \text{ACC} = \frac{(TP+TN)}{(TP+FP+TN+FN)} \). F1 measure combines the consideration of Precision, \( \text{Precision} = \frac{TP}{(TP+FP)} \), and Recall rate, \( \text{Recall} = \frac{TP}{(TP+FN)} \), \( \text{F1} = \frac{(\text{Recall}*\text{Precision}*2)}{\text{Recall}+\text{Precision}} \). Difference from using 0.5 as threshold values, AUC considers the performance of different thresholds. AUC considers the variables of Recall, and False Positive Rate, \( \text{FPR} = \frac{FP}{(FP+TN)} \). The larger the AUC, the better the model’s performance is. The range of AUC is 0-1.

Hyper-Parameter Tuning
In the XGBoost model, we set the learning rate is 0.01, the subsample ratio of the training instances is 0.8, the maximum depth of a tree is 20, the minimum sum of instance weight in a child is 5, the minimum loss reduction required to make a further partition on a leaf node of the tree is 3. Fig 1 shows the results of Train and Test within 100 epochs. Our objective of the model is to maximize the AUC and Error (1-ACC) value. It suggests that the changes in error and AUC values in the test dataset have been stable. Thus, we choose the last epoch as the best performance of our model.

RESULT
Comparison of Model Performance
We choose logistic regression and decision tree as our baseline models. We can conclude that the XGBoost model outperforms these traditional models in all three evaluation metrics: ACC, F1, and AUC. Although the XGBoost model only has a 4% higher accuracy rate than the logistic model, we need to consider that our sample is large, so the 4% improvement means a large sample.
<table>
<thead>
<tr>
<th>Model</th>
<th>ACC(%)</th>
<th>F1(%)</th>
<th>AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>XGBoost</td>
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<td>46.84%</td>
<td>0.71</td>
</tr>
<tr>
<td>Logistic Regression</td>
<td>66.38%</td>
<td>45.76%</td>
<td>0.68</td>
</tr>
<tr>
<td>Decision Tree</td>
<td>62.72%</td>
<td>44.72%</td>
<td>0.66</td>
</tr>
</tbody>
</table>

Table 1. Model comparison results on DBLP dataset

Results of Feature Contribution
When we choose to predict models, we can feed more features into the model to increase the prediction performance. When we explain how variables contribute to prediction performance, we need to consider the interdependency between features, especially the team structure variables, such as career age, H-index, productivity, citation, and collaborator. These team structure variables are highly related (Table 2-3). We can find that the H-index is highly related to career age, productivity, citation, and collaborator, in the combination of mean value and Gini coefficient. Thus, when we try to explain the feature contribution, we only consider H-index in the team structure.

<table>
<thead>
<tr>
<th></th>
<th>Mean Career Age</th>
<th>Mean H-index</th>
<th>Mean Productivity</th>
<th>Mean Citation</th>
<th>Mean Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>Mean Citation</td>
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<td>0.82</td>
<td>0.71</td>
<td>1.00</td>
<td>0.64</td>
</tr>
<tr>
<td>Mean Collaborator</td>
<td>0.54</td>
<td>0.77</td>
<td>0.87</td>
<td>0.64</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 2. Pearson correlations between mean team structure variables

<table>
<thead>
<tr>
<th></th>
<th>Gini Career Age</th>
<th>Gini H-index</th>
<th>Gini Productivity</th>
<th>Gini Citation</th>
<th>Gini Collaborator</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Gini Productivity</td>
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<td>1.00</td>
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<tr>
<td>Gini Citation</td>
<td>0.66</td>
<td>0.87</td>
<td>0.84</td>
<td>1.00</td>
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<tr>
<td>Gini Collaborator</td>
<td>0.68</td>
<td>0.51</td>
<td>0.63</td>
<td>0.54</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Table 3. Pearson correlations between gini team structure variables

Cases
We visualize two cases (Fig 2) to show how features contribute to each team locally. Comparing the first team with the second one, we can find that lower Gini H-index, higher Mean H-index, and larger team size positively contribute to team citation.
We apply the SHAP method (Lundberg & Lee, 2017) to better interpret the XGBoost model's results. This method measures the contribution of each feature to each team in the DBLP dataset and then aggregates the results of all samples. The aggregated mean (SHAP value) are ranked from high to low. In Fig 3, team power level (Mean H-index) and team power hierarchy (Gini H-index) are the critical factors, followed by Race Number, Team Size, Academia/Industry, Male/Female, and Country Number. The mean H-index of the whole team members stands out in the first position, and meanwhile, the distribution of the H-index within the whole team is important. We can conclude that team structure variables are more important than team composition variables.

In Fig 4, each point represents the specific contribution value of each feature in each individual. The x-axis means the impact of each feature on the team's performance in citations, positive or negative. The color of each point implies the scale of the feature value (red is highest, blue is lowest). Firstly, as to the Mean H-index, the higher the mean H-index is, the more positive impact it has on team citation. When the Gini coefficient is low in H-index, which suggests that everyone shares a similar H-index, the team has a higher probability of having above-mean citations. When teams are more diverse in race, they have more citations. When the team size is larger, teams have more influence. Most of the combined teams (mixed color) and industry teams (pure red) are on the left side, whereas academia teams (pure blue) are on the right side. It shows that combined teams and industry teams outperform pure academia teams. Female-dominated teams (pure red), and equal teams (mixed color), which are mainly on the left, indicate that female-dominated teams and equal teams have fewer citations than male-dominated teams (pure blue). Finally, when teams are diverse in the country, they might have more citations or fewer citations. It suggests that country diversity can bring innovation but also bring cultural barriers.
Interactive Feature Contribution

We draw the dependence plots between any two variable pairs and found an interactive effect between team power hierarchy (Gini H-index) and team power level (Mean H-index) in Fig 5. Each dot is a team. The x-axis is the value of Gini H-index, whereas the y-axis is the SHAP value for the feature, which represents how much the feature's value changes the output of the model in prediction. The color bar represents a second feature Mean H-index. The blue points (low Mean H-index) are higher than red points (high Mean H-index) when the Gini H-index increases (Fig 5). When teams have a high hierarchy, teams with low team power levels are more likely to have a higher impact than teams with high team power levels (Fig 5). It suggests that teams with low team power level benefits more from a hierarchical structure than teams with high team power level.

CONCLUSION

This paper calculates different team composition and team structure variables to predict high/low team citation impact with the XGBoost model. Our model outperforms traditional models, such as the logistic model and random tree, in terms of ACC, F1, and AUC metrics. Then, we apply the Explainable AI SHAP method to interpret each feature contribution to each team's citation prediction. After aggregating all individual values, we found that team structure is more important than team composition. The team power level and hierarchy rank first and second in the overall contribution, followed by unique race number, team size, male/female dominance, academia/industry collaboration, and unique country number. High team power level is positively related to team citation, whereas high team power hierarchy is negatively related to team citation. There is an interactive effect between team power level and hierarchy. When team members are more diverse in race, are more in team scale, and have academia/industry interaction, they can receive more citations. But including female collaborators can reduce citations. It might be caused by the specific CS discipline where female researchers are underrepresented. The diversity in institutional countries cannot guarantee an increase in citations.

Our project makes important contributions to team citation prediction from team composition and structure. We enrich team-related variables rather than emphasize individual superstars to predict citation impact. The ranking of feature prediction through SHAP values can offer suggestions to scientific teams about the priority lists when they try to form new teams and build connections to maximize team performance. However, we need to admit that the
team-related variables we choose have limitations. On the one hand, variables about mean career age, mean productivity, mean citation and mean collaborations and mean H-index have an overlap to some extent. On the other hand, the variables we choose are not complete. We could still consider the team composition from the department dimension. Or we could consider whether teams belong to high-rank institutions. Secondly, our model is trained to predict whether team citation is above the mean value or not. The best model, XGBoost, can only reach 70% accuracy. The prediction results still have gaps with previous literature. Finally, we only test our results in the CS field. For the future work, there are interesting areas of extending this research to different disciplines including science, social science, and humanities. It is great to use two Explainable AI methods to cross validate the feature importance.

ACKNOWLEDGMENTS
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Social VR: A Promising Platform for Enhancing Mental Wellness among College Students

You, Xinyue (Sally)  The University of Texas at Austin, USA | xinyueyou23@utexas.edu

ABSTRACT
In recent decades, there has been an alarming increase in the number of university and college students struggling with intensifying psychological distress, which has become a mental health crisis on campuses. To address this issue, this study proposes social VR as a potential platform to promote social interaction and improve mental well-being for college students. In this study, 68 students explored a variety of social VR applications in a classroom setting. Results showed that a) virtual space, audio, avatar, communication types, and activities were key contributing features that facilitated social interaction among college students in social VR and have the potential to enhance mental wellness, and b) the anonymous nature, communicative cues, and designated private areas provided by social VR platforms were effective in facilitating self-disclosure, indicating social VR’s potential in delivering mental health services such as individual and group counseling and therapy. This study provides evidence that social VR can enhance social interaction and communication while serving as a platform for professional mental health care, a venue that has yet to be explored in previous studies.

KEYWORDS
Virtual reality; social VR; mental health; virtual interaction; virtual worlds

INTRODUCTION
In recent years, there has been a growing concern over the mental health of college and university students, given the increasing number of students reporting mental health issues. According to the American College Health Association, the percentage of college students being treated for at least one mental disorder has risen from 18% in 2005 to 43% in 2022, with depression and anxiety being the most commonly reported issues (American College Health Association, 2022). What’s more, 77% of students reported moderate or high levels of distress, and 51.7% reported feelings of loneliness (American College Health Association, 2023).

To address this rising demand for psychological care, educational institutions have increased their investment in campus mental health services (Legislative Analyst’s Office, 2021). Despite these efforts, many institutions still struggle to meet the increasing demand (Xiao et al., 2017). With limited resources and the ongoing rise in mental health concerns among college and university students, it has become necessary to find supplementary tools and platforms that provide effective mental health care.

The emergence of digital technology has had a significant impact on all aspects of people’s lives, including the way individuals connect with each other. With the internet removing the burden of physical distance, online communities allow users to connect with their existing friends and make new connections with like-minded individuals, thereby expanding the scope and reach of their social support networks (Smith-Merry et al., 2019). These online communities also offer a level of anonymity and reduced social pressure, which enables individuals to share their experiences and emotions more openly. This facilitates a sense of belonging and social support, which can promote mental health and psychological well-being (Lattie et al., 2019).

As a unique type of computer-mediated communication channel, social VR platforms provide “3D virtual spaces where multiple users can interact with one another through VR head-mounted displays” (Maloney & Freeman, 2020, p. 510). With the offering of advanced verbal and non-verbal expression capabilities and diverse social activities, social VR platforms facilitate vivid spatial, temporal, emotional, and social experiences that are similar to face-to-face interactions (Maloney & Freeman, 2020; Maloney et al., 2020b; Sykownik et al., 2021; Zamanifard & Freeman, 2019). This natural and effective way of building social connections has made social VR increasingly popular, especially during the COVID-19 pandemic, where social contact has become highly sought after (Kelley, 2021; Sykownik et al., 2021). For instance, Rec Room, one of the social VR platforms, saw a threefold increase in active users during the 2021 holiday season compared to the same period in 2020 (Lang, 2022). Social VR’s growing popularity has prompted researchers to investigate the social practices and phenomena that take place in these emerging social spaces (Ahn et al., 2021; Kirchner & Forsberg, 2021; Maloney & Freeman, 2020; McVeigh-Schultz, 2018).

However, previous research reveals three limitations. First, while social VR platforms are accessible through multiple devices, such as desktops and smartphones, most academic studies have closely linked social VR with its VR component. Existing studies either limited their sample to users who access social VR through VR headsets (Maloney et al., 2021; Moustafa & Steed, 2018) or did not specify the devices used (Maloney & Freeman, 2020; Maloney et al., 2020a). Therefore, more research is needed to investigate the device types users use to access social
VR and whether these device types affect user interactions. Second, previous studies focusing on specific populations’ experience in social VR have shown that users in different age groups and types of relationships differ in their perceptions and experiences in social VR (Acena & Freeman, 2021; Maloney et al., 2020a; Maloney et al., 2021; Zamanifard & Freeman, 2019). Therefore, more input from college students is needed regarding how they perceive the design of social VR in terms of promoting social interaction with their classmates. Third, although research has focused on the diverse activities provided by social VR platforms, there is a lack of studies that connect the social aspect of these platforms to potential mental health benefits. Hence, further research is necessary to explore the potential of social VR platforms in providing mental health care and enhancing mental well-being. This paper aims to address the limitations mentioned above by investigating two research questions among college students who access social VR platforms through their preferred devices: 1) identifying the specific features of social VR platforms that enhance college students’ social experience; and 2) evaluating social VR’s potential as a platform for mental health care.

This paper contributes to the existing literature in three ways: 1) expanding the understanding of social interaction and communication in social VR platforms; 2) enriching the knowledge of social VR platforms’ impact on college students’ social experience by identifying specific features that foster social interaction; and 3) examining the potential of social VR to provide mental health services.

LITERATURE REVIEW SOCIAL RELATIONSHIPS TO MENTAL WELL-BEING
Social relationships play a critical role in human survival and are closely linked to achieving and maintaining good health and well-being (Haslam et al., 2015). Extensive research has established that positive and supportive social connections can enhance mental health and well-being, while the absence of social connections can have adverse effects on individual’s physical and mental health across all age groups (Asante & Karikari, 2022; Clark et al., 2018; McLouglin et al., 2018; Nabi et al., 2013; Newman & Zainal, 2020).

Social support and social connectedness are the two major concepts relevant to social relationships, and are frequently identified as mechanisms for enhancing health and well-being (Haslam et al., 2015). By definition, social support refers to one’s perception or experience of being cared for, esteemed, valued, and loved by others, as well as being a part of a social network where mutual assistance and obligations are present (Wills, 1991). It can be further categorized into different forms, such as informational support (e.g., resources and coping strategies), instrumental support (e.g., tangible assistance and specific aids), and emotional support (e.g., warmth and reassurance) (Taylor, 2011). Beyond these specific forms, social support, as the definition suggests, also encompasses the perception that such support is available and can be received when needed (Wills, 1991). Research has shown that perceived social support can trigger feelings of support, reduce levels of anxiety and depression, and enhance mental wellness (Nabi et al., 2013; Taylor, 2011; van Brakel et al., 2023).

Social connectedness, on the other hand, reflects the sense of belonging and attachment to a social network, and is characterized by the “subjective awareness of being in a social world” (Lee & Robbins, 1995, p.338). While social support involves the provision of assistance and emotional comfort from others, social connectedness is more focused on the sense of being part of a larger social network. The two concepts are interrelated, as social connectedness can be fostered through the continuous provision of social support. Research has shown that social connectedness is associated with higher levels of resilience and more positive mental health outcomes (McLouglin et al., 2018). Therefore, building and maintaining social connections can promote both social support and social connectedness, leading to positive effects on mental health and well-being.

COMMUNICATION CHANNELS FOR SOCIAL CONNECTION BUILDING
The way people build social connections has evolved significantly with the rise of internet-based technologies. While in-person interaction used to be the primary means of building social support and connectedness, a growing number of individuals now rely on computer-mediated communication to interact and connect with others. By engaging in online forums, gaming, and social media platforms, people can access large communities of individuals with diverse backgrounds and experiences that may not be available in their offline network, enabling them to build social connections that might be lacking in their daily lives (Smith-Merry et al., 2019; Walther & Boyd, 2002). Furthermore, online applications provide real-time messaging, making it easier for the maintenance of distant relationships. The anonymous nature of online communication also promotes a sense of freedom and reduces social inhibition, encouraging individuals to express themselves more honestly and openly, as well as a sense of privacy and protection, providing a safe space for the discussion of sensitive or personal topics (Baccon et al., 2019; Fox & McEwan, 2017; van Brakel et al., 2023).

Despite the many benefits of online communication channels, computer-mediated communication is still perceived as limiting when compared to face-to-face interaction due to the lack of social cues. In-person communication allows individuals to pick up on nonverbal cues, such as facial expressions and body language, which are lost in audio or text-based communication. Videoconferencing platforms, though providing nonverbal cues, require people
to maintain close-up eye gaze for extended periods, making communication less natural and more tiring than
in-person interaction (Bailenson, 2021).

Numerous studies conducted during the COVID-19 pandemic, when in-person interaction was restricted due to
social distancing, have reported on these setbacks of computer-mediated communication. For example, one study
investigated the relationship between different modes of computer-mediated communication and well-being during
the pandemic and revealed that text-based communication had a negative association with well-being, while face-to-
face interaction had a positive association despite the health threats (Newson et al., 2021). Although this study did not
find an association between well-being and video-based communication, another study suggested that extended
use of videoconferencing could lead to issues such as excessive close-up eye gaze, cognitive overload of processing
nonverbal cues, increased self-awareness and performance pressure, and lack of physical mobility, resulting in
feelings of exhaustion and stress, commonly known as “Zoom fatigue” (Bailenson, 2021). These studies indicate
that face-to-face interaction is crucial for maintaining good mental health, yet traditional digital technologies cannot
fully replicate such experience, and may even cause negative consequences when used excessively.

SOCIAL VR TO ENHANCE SOCIAL CONNECTION

Social VR platforms, unlike traditional computer-mediated communication channels such as social networking sites
and videoconferencing applications, offer a variety of experiences comparable to face-to-face interactions through
the incorporation of multiple modes of communication and diverse activities designed to facilitate social interaction
among users (Handley et al., 2022). As a type of social virtual worlds, social VR platforms are housed within 3D
computer-generated environments (Spanlang et al., 2014), and allow users, embodied in their digital representations,
also known as “avatars”, to interact with others synchronously in a way that closely resembles the way they interact
in the real world (Bailey & Bailenson, 2015). Additionally, social VR platforms provide users with great
imaginative freedom to generate their own content, such as customizing their avatars, creating thematic virtual
spaces, and launching events and activities of their interests (Acena & Freeman, 2021; Barreda-Angeles &
Hartmann, 2022; McVeigh-Schultz et al., 2019).

Social VR differentiates from other social virtual worlds in that it is primarily accessed using a head-mounted
display. This device provides users with a high level of immersion and realism in their virtual experience by
blocking out the perception of real-world surroundings, responding naturally to users’ actions, and transmitting
sensory feedback including visual, haptic, auditory, and olfactory cues (Bailey & Bailenson, 2015; Barreda-Angeles
& Hartmann, 2022; Markowitz & Bailenson, 2019). This immersive nature allows users to feel fully embodied and
physically located in the virtual environment, and interact with virtual objects and avatars of other users in a very
intuitive way, much like in the real world (Barreda-Angeles & Hartmann, 2022). Given the close resemblance to
face-to-face interaction, social VR platforms may overcome the limitations of other computer-mediated
communication channels, facilitating social interaction that is as beneficial to mental health as in-person interaction.

A growing body of research has provided evidence in support of this statement. For example, a quantitative survey
conducted among 1231 social VR users found that the heightened sense of presence, facilitated by social VR
platforms, leads to increased perceived social support, which in turn, positively affects the perceptions of overall
social support and subjective well-being (van Brackel et al., 2023). Similarly, a qualitative study focused on the
experiences of LGBTQ users highlighted several key benefits of social VR: 1) social VR facilitated natural and
immersive social interaction that closely resembled face-to-face communication; 2) social VR engaged users in
multi-modal communication, fostering more open and inclusive interaction within the LGBTQ community; and 3)
social VR constitutes a safe space for LGBTQ users to build close relationships, which would be beneficial for their
social lives beyond the virtual environment (Acena & Freeman, 2021).

In light of these findings, scholars have delved into specific features of social VR applications that promote social
interaction. Based on an analysis of 44 commercial and prototypical VR applications, Handley and colleagues
(2022) developed a taxonomy of design choices that classified features into three distinct categories. The "self"
category covers all aspects of avatar embodiment, including avatar representation, customization, manipulation, and
locomotion. The "interaction with others" category is focused on communication modalities, such as verbal and
nonverbal communication, user blocking and muting, as well as activities that facilitate social interaction. The
"environment" category includes design choices concerning the virtual space’s construction, manipulation, and
openness.

Several studies have utilized the generalized taxonomy to investigate the impact of design choices on user
interaction and experience in social VR (Freeman et al., 2020; Maloney & Freeman, 2020; Maloney et al., 2020a;
Maloney et al., 2020b; Sykownik et al., 2021; Zamanifard & Freeman, 2019). One study focused on couples’
experiences of using social VR to maintain their long-distance relationships and found that avatars played a crucial
role in enhancing intimate interaction between couples, as embodied physical contacts made them feel together
despite being physically apart (Zamanifard & Freeman, 2019). In another study, nonverbal communication was
identified as an essential facilitator of interaction in social VR, perceived as more effective and flexible in conveying social meanings than other communication channels. The study also noted that the variety of communication modalities, both verbal and nonverbal, contributed to an enhanced sense of connectedness (Maloney et al., 2020b). Existing literature has explored the efficacy of social VR in enhancing social interaction among individuals in various relationships and settings, such as long-distance relationships (Maloney & Freeman, 2020; Zamanifard & Freeman, 2019), colleagues (Kirchner & Forsberg, 2021), and in-group members (Acena & Freeman, 2021). However, little research has focused on college students’ experiences of building connections in social VR. One study involved 12 master’s students exploring social, educational, or entertainment VR applications across six weeks, and found that interaction in social VR enhanced the sense of connectedness and provided a better learning experience (McGivney et al., 2022). However, it was unclear which specific feature(s) of the VR applications attributed more importance to social interaction. The other study, conducted among 81 college students in a class setting, showed that avatar appearance had an effect on students’ sense of presence and perception in social VR, and their group dynamic and sense of connectedness increased over time. This study shed light on the role that avatars played in students’ experience in social VR, yet its quantitative perspective lacked details about how students connected and interacted with each other in social VR and the role that their avatars played in the process.

Given the high level of technological comfort among college students, and their struggles with increasing mental health issues (Lattie et al., 2019), they are most likely to benefit from social VR. Therefore, this study aims to enrich the understanding of college students’ experience in social VR, identify feature(s) of social VR platforms that promote interaction, and assess the potential of social VR to improve students’ mental well-being.

METHOD PARTICIPANTS
The current study drew data from a sample of 68 undergraduate and graduate students who 1) were enrolled in a course that included VR experiences and 2) had consented to share their data. Students were introduced to a variety of social VR applications during the course and spent time exploring and learning in the virtual space. As part of their grade, all students were required to complete a survey following each virtual reality experience. As a result, the 68 participating students generated a total of 224 data entries.

Thirty-two of the 68 participants provided demographic information. Gender was distributed evenly, with 16 males, 15 females, and one student who preferred not to self-identify. Participants are 25 years old on average (\(SD = 7.97\)), with the youngest being 20 and the oldest being 54 years old. According to the data, 13 participants identified as Asian or Asian-American, 12 as White, 4 as multiracial, and one as African, African-American or Black, Hispanic or Latinx, or Middle Eastern. In terms of prior VR experience, 21\% (\(n = 14\)) had never used VR before the course, 26\% (\(n = 18\)) had used VR before, and 53\% (\(n = 36\)) did not report this information.

MATERIALS
The current study drew data from a sample of 68 undergraduate and graduate students who 1) were enrolled in a course that included VR experiences and 2) had consented to share their data. Students were introduced to a variety of social VR applications during the course and spent time exploring and learning in the virtual space. As part of their grade, all students were required to complete a survey following each virtual reality experience. As a result, the 68 participating students generated a total of 224 data entries.

Description of the course
This study was part of a large-scale collaborative research project aimed at examining how students learn and interact in social VR platforms. The project was led by faculty members teaching VR-related courses at four institutions across the United States. The courses varied in their specific focus and structure, but all included virtual experiences as a key component, giving students direct experience with the technology and enabling them to put their learned concepts into practice. During each session, students participated in social VR visits chosen by the course instructor (see Table 1 for social VR platforms descriptions) and completed tasks assigned by the instructor. These tasks could involve independent exploration, forming project teams, conducting group meetings, virtual field trips, guest lectures, or presenting research posters. A videoconference was kept open throughout the VR sessions, with teaching assistants available to resolve technical issues.

Device Usage
In the social VR platforms, students employed a range of digital technologies to connect and interact with others, including desktop/laptop, VR headset, smartphone/tablet, and others (see Table 2). Desktops/laptops were used at least once by 84\% of the participants (\(n = 57\)), while 60\% used VR headsets at least once (\(n = 41\)). The most frequently used VR headsets included the Oculus Quest, Oculus Go, Oculus Rift, and HTC Vive. During multiple sessions, 51\% of the students (\(n = 35\)) utilized different devices, with 47\% (\(n = 32\)) alternating between desktops/laptops and VR headsets. The total sessions completed by students varied based on different courses’ requirements, ranging from one to six sessions (\(M = 3, SD = 1.59\)).
Analysis
The study employed thematic analysis following Braun and Clark's guidelines (2006). Initially, the author read through the students' responses with the research questions in mind to gain familiarity with the data. In the second round of reading, the author highlighted important pieces of data and noted down emerging ideas, which served as the basis for the initial list of codes. The author then grouped the notes and preliminary codes into meaningful categories and created a codebook that defined, labeled, and established criteria for each code. In the third round of reading, the author used the codebook to systematically code each response. During this process, the author identified new codes and refined code definitions as necessary. Once the codebook was finalized, the author completed coding all the responses. Finally, the author analyzed the codes to identify overarching themes and patterns, which were used to develop a rich description of students' social experiences in social VR.

RESULTS
During the courses, students had the opportunity to explore different virtual worlds, each with unique features and settings. This exposure allowed them to gain valuable insights into design choices that foster social interaction within virtual environments. Additionally, students' reflections on their virtual reality experiences indicated that social VR platforms have the potential to improve mental well-being. In this section, the findings will be presented in two parts: the first part will discuss the design choices that participants found beneficial for developing social connections, while the second part will identify aspects that could make social VR an ideal platform for enhancing mental wellness and providing mental support.

SOCIAL INTERACTION MADE EASY: KEY FEATURES IN SOCIAL VR PLATFORMS
The immersive, engaging, and inclusive environment affords user interaction
As the main area where users immerse and interact with others, the virtual space plays a significant role in the crafting of user experience and building of social connections. According to P49 (desktop), “The virtual world was very much designed to facilitate conversation, and created various spaces and opportunities for people to interact in different active and passive environments.”

Others echoed this view. They praised the virtual environment for providing the space for them to explore and interact with others, creating a shared experience and promoting the feeling of social connection: “The virtual rooms felt very immersive and the way you were able to walk through them and interact was absorbing.” (P18, VR headset); “The lab environment for which the speaker gave us a tour was very engaging and afforded different users to interact and connect. We could stroll from different parts of the environment and interact with each other efficiently.” (P35, desktop); “The virtual world was helpful via the interesting environments that were able to be explored with the people around you.” (P64, VR headset) As participants mentioned, the virtual environment felt very “immersive”, “engaging”, and “interesting”, it attracted users to “walk through” the environment with others, and this was why they felt the virtual space helped facilitate social interaction.

Participants went beyond evaluating the virtual environment as a whole and reflected on specific aspects that contributed to an enjoyable and engaging virtual experience. One aspect that received appreciation was the virtual environment’s ability to cater to various needs and interests. For instance, users entered the platforms with diverse group sizes and engaged in various types of conversations. The virtual space was constructed with these differences in mind, allowing users to choose the environment that best suited their needs and resulting in an optimal social experience: “It really helps [build social connection] since we can move to different rooms and each of them have different usages. For example, if we have few people, we can go to the classroom or conference room, while we have more people, we can go to the stadium.” (P53, desktop)

Regarding the nature of discussions, participants found it valuable to have a spacious and unrestricted area. This provided them with a personal and confidential environment for communicating with others, while also instilling a sense of safety and preventing privacy issues: “I did like how the world is very vast and wide open, allowing users to have private space if need be.” (P39, desktop); “I noticed no real threats to privacy, as individuals had to be friends with others in order to enter their rooms in the virtual world.” (P40, VR headset)

While some participants formed a feeling of “welcoming” and intimacy with others through private conversations, others preferred to engage in more public interactions. For example, P25 (desktop) derived pleasure from being stationed at the virtual space’s spawn point, where new participants would first appear when entering the application, and chatting with each of them: “The virtual world was key in facilitating social interactions, the way the space was set up it made it easy to talk with people. I was located in the spawn points so when people would appear I could talk with them, it was very nice to be the first point of contact when they entered and just have a brief chat.”

Social VR platforms have also developed dedicated areas for underrepresented communities to gather and connect with each other. These spaces were also intended for individuals outside of these communities to learn more about
them. One such example is the Crystal Ballroom exhibit. P63 visited this exhibit during one of the sessions. As P63 (desktop) described, “It had a little welcome structure that gave you information about it. I learned that this was built for someone named Keao, who is blind. In this informational message, they explain they wanted a ballroom because it was the first place they visited in [the virtual world] and they love to dance. They also explained some of the features like the chimes and talk about how they wanted a space that was inclusive for people to hang out in since there is a mixture of people with many interests in the blind community.”

In addition to the inclusive design that accommodated all kinds of needs, participants recognized the diverse offering of themes and room settings as key factors that influenced their virtual experience and social interactions. For example, P47 (desktop) indicated that the diverse designs and themes “helped build social connection” by making him feel a sense of presence and engagement within the virtual space: “the set environments may have helped in building social connections: seating, soccer fields, beaches. I found it enjoyable and oddly immersive.” On the other hand, P63 (desktop) thought that the different room settings were created with social interaction in mind: “I think the different room settings were a great feature to guide the social interactions to happen in a certain way.”

Others held this view as well and provided specific examples based on their close-up observations of how interactive objects encouraged user engagement and initiated interactions with both the environment and other users: “Users could interact with objects in the environment. Users picked up firecrackers, lit them up by getting close to the bonfire and played with them. This activity got many people engaged and interacting with each other.” (P11, desktop); “I think the buildings in this virtual world are very interesting, such as the circular painting gallery, the jungle wooden house, and the living area of the elephants, which are very diverse and interesting. The elephant will hit our avatar, and there are many interesting small objects to interact with.” (P19, desktop)

According to the participants, the diverse themes and interactive objects that were unique to each setting were greatly appreciated and were seen as an important factor in creating an immersive experience and promoting social interaction. In addition, they expressed a desire for even more interactive elements. This sentiment was expressed by P51 (desktop), who said: “I liked how I was able to interact with certain objects, chairs, boats, etc and wish there were a bit more interactive elements (but it was still nice nonetheless).”

As demonstrated in participants’ own account, having a wide selection of themes featuring unique interactive objects attracted individuals to fully engage and immerse themselves in virtual environments that suit their interests and preferences, thereby enhancing their overall experience. Furthermore, this diversity fostered the formation of distinct social interactions and even influenced the nature of interactions within the virtual space.

**Dynamic audio feedback supports effective communication**

Participants in this study believed that the use of audio feedback was an essential feature that improved their communication with others. One participant, P11, specifically appreciated the ambient noise present in each environment, which added to the realism of the virtual experience. P11 (desktop) stated, “The application gave importance to audio feedback. There was an ambient noise unique to each environment. Further, I could hear whispers of people talking if they were away from me and just like in real life I could go closer and become a part of the conversation.”

In support of his argument, P11 presented concrete examples to illustrate how the environment utilized distinct audio features to meet varying communication needs: “I found it extremely interesting and useful that the environment applied both spatial voice and flat voice depending on the requirements of the meeting. In conference rooms, flat voice was used which means everyone in the room could hear the speaker. On the other hand, if users moved into private areas or were outside the rooms spatial sound was used which promoted private conversations.” P11 found this approach to be both intriguing and beneficial, as it optimized the effectiveness of communication in different settings.

P63 echoed this view and further emphasized the positive impact of dynamic audio feedback on enhancing social connections in social VR. As P63 (desktop) noted, “[the virtual world] was helpful in that we could talk to the whole class or more privately to the people around us.” Moreover, P63 found that the spatial voice, which automatically adjusts the volume based on the user’s proximity to others, “makes it feel more personal”, creating a sense of closeness and connection.

**Being able to customize and control the avatar enhances user interaction**

The avatar, which is the representation of users in the virtual environment, was considered a critical element in fostering social connections in the virtual environment, setting it apart from other communication mediums. For instance, P39 (desktop) noted: “I think it helped me build social connections cause there was an added dimension of the avatar when compared to a Zoom call. In a Zoom call, you can only see a screen but in [the virtual world], you have the avatar to control which gives the interactions more depth.” According to P39, the avatar offered a unique dimension to interactions, enhancing the social engagement experience beyond what is possible on video.
conferencing platforms. Echoing P39’s opinion, other participants remarked on specific aspects of the avatar that promoted social interactions. One of these aspects is the ability to be customized based on user preferences, as noted by P63 (desktop): “Having avatars that are customizable to resemble you makes you feel more present.” P63 suggested that the personalized avatars heightened users’ sense of presence, leading to a more immersive experience. P11 (desktop) also appreciated the ability to modify the avatar’s appearance, stating that “everyone's avatars looked interesting and unique” after customization. P11 found this diverse range of visual representations enticing and suggested that the avatar’s customizability encouraged social bonding in the virtual environment.

According to participants, another crucial aspect of the avatar is its ability to mirror users’ movements and actions. P49 (VR headset) described how the avatar’s hand gestures and body motions were effective in indicating active listening and conducive to social connections: “[The avatar] was built for conversation, ... you could act out a series of hand gestures with a button click, and there were rendered hand gestures and body motions that showed that you were listening to others speak. It was very conducive for social connections.” P21 (VR headset) appreciated the avatar’s ability to resemble users’ real-life head and hand movements, making the interactions feel more natural and realistic: “It was quite interactive and I liked that our avatars would indicate who is talking. For those wearing the headsets, it was interesting to see the real-life head and hand movement.”

Furthermore, participants found that having control over their avatars enhanced their virtual experience and made it easier to interact with others. As P36 (desktop) put it: “The ability to do casual actions like dance made the experience a lot more informal and easier to connect with people.” Similarly, P41 (desktop) highlighted how the ability to control their avatar and perform real-world actions helped them build connections: “I could use my avatar to interact with other people's avatars using much of the same principles as the physical world. For example, I could run, jump, sit, shift gaze, dance, and interact with objects such as projectors, tables, soccer balls, and even drive a boat.”

In summary, the avatar’s customizability, ability to mirror users’ head and body movements, and to perform actions as in the real world elicited a strong sense of presence, immersed users in the virtual environment, and facilitated interactions and social connections among users.

**Communication modalities and social activities help build connections**

Guided by the principle of enhancing social interaction, social VR platforms have integrated multiple communication modalities to create a seamless and effective social experience. For example, P49 highlighted the value of face cams and microphones in building social connections as they enabled users to show expressions and observe the reactions of others. According to P49 (desktop), “utilizing face cams and microphones in addition to avatars in a virtual space mimics a real in-person experience”, making it possible for individuals to interact with each other in a more authentic and natural way.

Besides face cams, avatars played a crucial role in providing non-verbal cues in virtual spaces, such as head and body movements, and physical expressions. P14 specifically appreciated the use of head nodding by avatars, considering it to be “a very underrated non-verbal communication cue”. According to P14 (VR headset), the combination of verbal and non-verbal communication modalities in the virtual space made it “a lot easier to connect and communicate with people”. Additionally, P11 (desktop) noted that the tracking of hand movements “significantly improved communication”, while P29 (VR headset) concluded that synchronous head and hand movements of avatars created “a sense to talk in reality” that fostered a great feeling of communication.

In addition to verbal and non-verbal communication, the availability of various emojis also made the communication experience more enjoyable and interactive: “There were a variety of emojis such as hand raise, clap, blush, sad, happy, etc. to choose from to communicate.” (P11, desktop)

Alongside offering communication options that cater to users’ communication needs, social VR platforms have also facilitated numerous social events to promote interaction and engagement among users. P45 (desktop) expressed appreciation towards these events, stating “I liked aspects of it, like that there are live events and concerts, which makes it feel like a real place people can go to for socialization.” Likewise, P66 praised the feature of watching videos together. According to P66 (VR headset), this feature was “good for small group interactions” and “provides users with a shared sense of immersion” that enhanced community building. These social events and features helped create a sense of togetherness and community in the virtual experience.

**BEYOND CONNECTION: THE ADDED BENEFITS OF SOCIAL VR**

**Social VR offers a cozy and secure setting for disclosure**

While the survey question focused on the ways in which social VR platforms enhanced social interaction, some participants also discussed their effects on self-disclosure. For example, participant P64 (VR headset) noted that “the virtual world made it easy to talk to people in my class because we were all hidden behind avatars and online.” P64’s experience suggests that the use of avatars could potentially encourage greater self-disclosure in virtual
environments. Since self-disclosure typically necessitates a private setting, the platforms included designated areas for private conversations, as described in the first section. These features were highly valued by participants, who noted that they "took privacy into account" and helped foster personal connections. As P33 (desktop) described, "there were privacy zones where only people in the zone could hear each other talk. The doors to some rooms were also lockable." P19 (desktop) even suggested that such rooms "could be used for student consultations."

### Social activities bring relaxation and help overcome social anxiety

As presented in the first section, social VR platforms organized various events and activities to bring users together and connect with each other. Not only did these activities foster connections among users, but they also "bring relaxation." One example is the 3D painting activity described by P25 (VR headset). As they noted, "the experience was pretty good because we had a goal to work towards rather than just chatting on a virtual space ... working together to achieve something works much better in developing a sense of relaxation than cold conversation does." The excitement of the activity also added to the enjoyment of the experience. Another participant, P43, recounted an experience where virtual reality enabled him to engage in activities that they may not have felt comfortable doing in real life. As P43 (desktop) described, "at first I just stood in the Haptics room watching people doing Gangnam Style and I felt awkward. But then I realized I am not the one dancing and was just going to make my character do it, and somehow in real life making my avatar dance made me feel more at ease." This example demonstrated that the sense of anonymity and distance provided by the avatar in the virtual environment can help individuals overcome social anxiety and enjoy social experiences that they may not have in the real world. As P65 (desktop) noted, "virtual worlds were a good method of creating social connections, especially for those who have trouble doing so in the real world." These findings suggest that social VR platforms can provide users with a unique social experience, which may help improve their mental wellness.

### DISCUSSION

The findings of the study suggest that social VR platforms have the potential to enhance social interaction and improve the mental well-being of college students in a class setting. Among the design choices listed in the taxonomy by Handley et al. (2022), virtual space construction, avatar representation, and communication types and activities were identified as key contributing features to students' social experiences in social VR. In addition, audio feedback, which was not included in the taxonomy, was also recognized as a key facilitator of social interaction in the virtual space. Moreover, there is evidence to support the findings from Freeman and Acena (2021) and van Brackel et al. (2023) that using social VR may improve users' social skills. Students reported that social activities brought relaxation and helped overcome social anxiety, encouraging them to do things that they found hard to do in the real world (e.g., dancing with a crowd). Such experiences may facilitate individuals' social interactions in the physical world and enhance mental wellness. Additionally, the study found that social VR platforms provided a safe and comfortable environment for students to disclose personal information. This discovery suggests that social VR platforms are capable of facilitating both casual and formal disclosure, making them ideal platforms for the delivery of mental health services, such as individual and group counseling. Finally, this study underscores the importance of offering students the flexibility to choose their preferred device for accessing social VR platforms. The results revealed that a considerable proportion of students may still prefer desktop access despite the lower level of immersion. Nevertheless, the key features of social VR platforms remain effective in promoting social interaction and providing an engaging virtual experience. Interestingly, the unique affordances of VR headsets, such as head and body movement tracking, have also been shown to benefit desktop users, as it helps them pick up on nonverbal cues from their VR counterparts. Overall, the study suggests that social VR platforms have the potential to enhance social interaction and promote mental well-being among college students, regardless of the device used for access.

### SOCIAL VR ENHANCES SOCIAL INTERACTION

This study confirms the findings of previous research that virtual environments have a significant impact on building social connections. One notable aspect that received appreciation was the diverse offering of themes, rooms, and spaces in the virtual environment, which catered to different group sizes and interests, enabling users to engage in various conversations. Furthermore, interactive objects that complemented the themes enhanced the immersive experience, increasing user engagement and enjoyment. These results align with previous studies that highlighted the role of virtual spaces' design in improving user experience and engagement (Jonas et al., 2019; Maloney et al., 2021; McVeigh-Schultz et al., 2019). This study also reveals that social VR platforms have developed dedicated areas for underrepresented communities to connect and interact, creating inclusive spaces that foster a sense of belonging. This finding is consistent with Acena and Freeman's (2021) research, which highlighted that social VR offered a safe space for marginalized communities.

Sound is a crucial component in creating an immersive virtual environment. However, previous studies evaluating design choices in social VR (Handley et al., 2022; Jonas et al., 2019; McVeigh-Schultz et al., 2018; McVeigh-Schultz et al., 2019) may have overlooked its importance. In contrast, participants in this study frequently cited sound as a key facilitator of social interaction. They praised the ambient noise for making the environment feel
more realistic, which supports Bulu’s (2012) statement that sound, along with texture, light, motion, and other details, can bring realism to the virtual space and thus create a more immersive experience. Furthermore, this study highlights the value of using a combination of spatial and flat sound to accommodate different communication needs. The flat sound, which projects the voice at an equal volume within a restricted area, was helpful during lectures and presentations in classroom settings. While the spatial sound, which adjusts the volume based on user proximity, promoted personal interaction, fostering a more intimate experience and a sense of closeness.

Students found the avatar to be a critical element in fostering social interaction in the virtual environment, providing an added dimension that sets it apart from other communication mediums. Specifically, the avatar’s customizability, combined with the ability to mirror users’ head and body movements, was found effective in enhancing the sense of presence and fostering social interaction. These findings align with those of Han et al. (2022), who observed that personalized avatars, particularly those resembling users’ appearance, were preferred by students as they allowed for a distinct self-presentation, thereby improving their experience and group dynamic in social VR.

There was also evidence to suggest that communication modalities, along with meaningful social activities, can enhance the authenticity and naturalness of social interaction in social VR. Namely, face cameras and microphones facilitated the exchange of verbal cues and non-verbal expressions, which are important for social interaction (Handley et al., 2022; Jonas et al., 2019; Maloney et al., 2020b; McGivney et al., 2022). Face cameras, in particular, complemented avatars by conveying minute non-verbal cues that were not reflected on avatars. This finding supports the research of McGivney et al. (2022) that having video chat open while using VR created a shared experience, making students feel more connected to their classmates. Emojis were also found to make communication more enjoyable and interactive. Moreover, this study aligns with previous research that social events enhance community building and create a sense of togetherness (Maloney & Freeman, 2020; Zamanifard & Freeman, 2019). As noted by Maloney and Freeman (2020), “these findings point to social VR’s potential to afford a wide range of social connectivity and forms of interpersonal relationships”.

SOCIAL VR PROVIDES UNIQUE BENEFITS REGARDLESS OF THE DEVICE TYPE

The study found that despite having access to VR headsets, most students in the study still used desktops to engage with social VR platforms at least once. This preference for desktop access has been observed in other cases, including virtual conferences (Ahn et al., 2021). However, the experience of non-VR users in social VR is still not well understood as most existing research has primarily focused on the VR perspective (Maloney & Freeman, 2020; Maloney et al., 2020a; Maloney et al., 2021; Moustafa & Steed, 2018). Previous studies have compared the differences in user experience between VR and desktop in VR gaming applications and found that users reported a greater sense of presence in the headset environment, leading to a higher level of immersion and engagement. Nonetheless, this increased presence did not necessarily translate to a more satisfactory experience (Carroll et al., 2019; Berkman et al., 2020).

While this study did not provide an empirical quantitative comparison of the user experience of social VR through different devices, the results suggest a similar trend: the lower level of immersion does not seem to hinder desktop users' interaction with others in social VR. They report similar appreciation and identify the same features as beneficial for building social connections. However, this study still indicates some discrepancies in user perception of the features. One notable difference is that the audio feedback in the platform primarily came from desktop users. This could explain why previous studies on social VR did not recognize it as a key feature. A potential explanation is that VR users were already so embodied in their avatars and immersed in the environment that audio feedback, especially spatialized sound, blended into their experience seamlessly. In contrast, desktop users are less embodied and still receive sensory cues from the real-world surroundings, making them more likely to notice the different audio feedback and recognize its role in facilitating social interaction.

Despite these differences, the study confirms that the benefits of social VR are not limited to VR headset users, but also extend to those accessing the platform via desktops. In particular, head and body movement tracking, previously highlighted as a unique advantage of social VR experience, also received appreciation from desktop users as it allowed them to perceive nonverbal cues when communicating with their VR interactants. Although desktop access may not provide the same level of immersion as a VR headset, it still offers a satisfying social experience, as well as potential mental health benefits. Based on these findings, future studies should delve deeper into the experiences of users who access social VR platforms through other devices to develop a more comprehensive understanding of how the experience differs.

SOCIAL VR ENCOURAGES SELF-DISCLOSURE AND SUPPORTS MENTAL HEALTH CARE

The finding that the level of anonymity provided by avatars can facilitate communication among students is consistent with Maloney et al.’s (2018) research, which suggests that people are more likely to share personal information when being anonymous. Furthermore, users were more comfortable disclosing their emotions and life experiences than other identifying information such as age, gender, and location. Baccon et al. (2019) also reported
that VR platforms tend to elicit more frequent cognitive and emotional self-disclosure than other computer-mediated communication channels, and they attributed this to the richer set of communicative cues available in VR, which makes VR an effective platform in eliciting self-disclosure, suggesting that VR has the potential to be as effective as in-person communication in eliciting self-disclosure.

This study adds to the discussion by emphasizing the importance of having private areas for self-disclosure in social VR, a factor that has received little attention in existing research. According to students, the designated privacy zones with lockable doors and enclosed audio feedback provided a safe and realistic environment for them to discuss personal and private topics with their close network. This finding suggests the potential of social VR to serve as a platform for the delivery of professional mental health care services, such as individual and group counseling, which require an enclosed and safe space.

Virtual reality has been gaining attention as a potential tool for delivering therapy and counseling services, particularly in light of the COVID-19 pandemic, which has led to an increased need for remote mental health services. While previous studies have demonstrated the effectiveness of VR in treating psychological disorders (Freeman et al., 2017; Hoffman, 2004; Maples-Keller et al., 2017; Paul et al., 2022) and providing counseling services (Lin et al., 2021; Sarpourian et al., 2022; Wray & Emery, 2022), these studies were typically conducted on self-developed platforms rather than publicly available social VR applications.

Despite the lack of literature, social VR platforms have shown promise as a means of providing mental health support. According to Kelley (2021), 17.8% of social VR users have used these platforms to cope with COVID-19 anxiety and social anxiety. Our study also found that participation in certain social activities in social VR helped students overcome social anxiety and feel more relaxed. Overall, these findings suggest that social VR platforms can serve as a valuable supplementary tool for mental health care, as they offer a secure and comfortable environment for self-disclosure and can facilitate the delivery of professional mental health services. In particular, the avatars, designated private areas, and additional communication modalities remove barriers and address concerns around revealing personal insecurities, making them ideal for personal disclosure and formal consultations. Moreover, the accessibility of social VR makes them a convenient and cost-effective platform for delivering mental health services: providers who lack the resources to develop a standalone VR system can easily customize their virtual space to provide the best possible service, and clients can still benefit from the social interaction and immersive experience of social VR even without a VR headset. As social VR continues to evolve, more research is needed to better understand how the platforms can be leveraged to support mental health care.

LIMITATIONS
Although the study was conducted across large educational institutions in the United States, the sample may not be representative of the general college student population. This is because students were asked to opt in to participate in the study, which could have biased the sample towards those who were more engaged and enthusiastic, and away from those who were more concerned about privacy and anonymity. Additionally, it is possible that students who enrolled in VR-focused courses had a pre-existing interest in the topic, which could have influenced their willingness to explore different options. To address these limitations, future studies could consider surveying students in non VR-focused courses to obtain a more representative sample of university and college students in general.

CONCLUSION
The study investigated the effectiveness of social VR platforms in promoting social interaction among college students, identified key facilitators, and examined the platforms’ potential to serve as a platform for mental health care services. The evidence gathered through this study demonstrates that the virtual space, sound, and avatars immersed students in the virtual environment, communication modalities facilitated an effective exchange of information, and social events created a sense of togetherness. These features were integrated to promote social interaction, which has been shown to enhance perceived social support and connectedness, and improve the mental well-being. In addition to enhancing social interaction, social VR has the potential to support the delivery of mental health services. The study found that the anonymous nature, communicative cues, and designated private areas provided by social VR platforms create a safe and comfortable environment for students to disclose personal information, opening up opportunities for formal consultations. The accessibility of social VR also makes it an attractive platform for mental health professionals to reach students who are reluctant to seek traditional forms of therapy or lack access to mental health services.

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Refueling Mental Health: Digital Reading Predicts Psychological Resilience for Left-behind Children in Rural China

Zhao, Liang  
Wuhan University, China | liangzhao@whu.edu.cn
Zeng, Zihan  
Wuhan University, China | 2020301041148@whu.edu.cn
Liu, Jiayi  
Wuhan University, China | 2020301041078@whu.edu.cn
Zhang, Yachen  
Wuhan University, China | 2020301041263@whu.edu.cn

ABSTRACT
Beyond the easy and equal access to massive online contents, will digital reading bring more social welfare values for disadvantaged groups? Take left-behind children (LBC) in rural China as example, whose mental health issue has widely aroused public concern. Lacking of sufficient parental supervision and educational resources leads to insufficient development of psychological resilience and makes them vulnerable to mental health problems. As psychological resilience is a critical protective factor for maintaining mental health, in this paper, we wonder whether digital reading could perform as an alternative way with easy accessibility and numerous resources to supplement LBC’s resilience development. We conducted a field questionnaire study on LBC (N=217) and investigated the predictive effect of digital reading on psychological resilience. After controlling sociodemographic variables and common resilience protective factors, hierarchical regression results demonstrated that digital reading predicted an additional 4.3% of the variation in resilience above the control variables, indicating digital reading a positive promoter of LBC’s psychological resilience. Moreover, by systematically exploring the fine-grained digital reading variables, we also found intrinsic motivation to read and recreational digital reading (e.g., reading comics and communicating online) to be the two most stronger predictors of psychological resilience.

KEYWORDS
Digital reading, left-behind children, psychological resilience

INTRODUCTION
The recent decades have witnessed the rapid progress of urbanization in Chinese society. Tens of thousands of people from rural areas have flooded into cities to join the labor force. To save the living cost in cities, most of them have to leave their children behind in the countryside. The social group of the so-called left-behind children (LBC for short) in rural areas has then been created, comprised of those under the age of 18 whose parents leave to work in cities and are taken care of by elderly relatives or even left unsupervised (Yan, 2022). According to the National Bureau of Statistics of China, the population of left-behind children in rural areas has reached more than 12 million by 2020 (http://www.stats.gov.cn/tjsj/ndsj/2021/indexch.htm). It is known that adolescence is a critical stage in the formation of one’s personality and values. Appropriate company and supervision from the family helps children grow up healthily. In comparison with other children, the lack of family companionship and mental health education in rural schools makes LBC more easily to suffer from a variety of psychological problems, such as anxiety, depression, etc. (Zhang et al., 2022), which negatively affects their growth. Thus, concerns for the healthy development of left-behind children in rural regions, particularly their mental health, has aroused wide attention in China.

Psychological resilience, as a personality or a coping process that enables individuals with continuous self-adjustment in a positive manner under adversity, is a critical protective factor to keep mental health (Connor & Davidson, 2003). Amid the adversity of low social support, resilience is a necessary asset for LBC’s growth (Fan & Fan, 2021). Resilience has played the role of a prominent mediator in the association between self-harm and suicidal ideation for Chinese LBC (Li et al., 2020). Unfortunately, well-established findings have shown that the resilience of LBC is significantly lower than that of non-left-behind children (NLBC), which means that LBC are more vulnerable when confronted with negative life events (Dong et al., 2019; Guang et al., 2017).

Therefore, to improve LBC’s mental health, it is of great significance to find the way to help develop enough resilience. Previous studies showed that psychological resilience of LBC positively correlated with mother’s education, intimacy with cohabitants, and the number of close friends. A higher level of mother’s education, more intimate with cohabitants, and more close friends are always related to stronger psychological resilience (Xiao et al., 2019). However, the dilemma comes on the one hand that most rural left-behind children are facing the situation of lack of parental supervision and family companionship (Xiao et al., 2019). On the other hand, the rural schools where left-behind children attend usually lack mature caring mechanisms and sufficient educational resources, making it difficult for rural left-behind children to make up for the lack of family care through campus life (Pan &
Ye, 2014). Obviously, it is necessary to explore other available channels to help develop their psychological resilience.

With the development of media technology and mobile devices, digital reading is now becoming increasingly prevalent and has brought tremendous changes in reading practices and behaviors (Clinton, 2019), speeding up and simplifying access to information (Lizunova et al., 2022). Reading on digital devices (e.g., smart phone, tablet, computer or e-reader) instead of printed paper, digital reading provides easy and equal access to massive knowledge and contents via the Internet for everyone (ChanLin et al., 2015; Kuhn et al., 2022). Recently, the number of young digital readers has increased dramatically as well (Mills, 2010). Statistics show that digital reading users in China reach 506 million by 2021, with 44.63 % aged 19-25 and 27.25 % under the age of 18 (http://m.cadpa.org.cn/3277/202206/41513.html). As a common daily activity, reading promotes children's physical and mental development. It can provide children abundant knowledge and information to develop their intelligence, broaden their horizons and enhance their cultural accomplishment (Arnesen et al., 2019). Moreover, reading has further been developed into psychological therapy. The popular bibliotherapy uses books or stories to help people understand personal problems and improve emotional healing, which inspires children to find unique solutions to control their lives through the identification of others (Bouchard et al., 2013). Children's literature has the potential to foster emotional growth and healing to some extent (Heath et al., 2005). Great stories change the way children think and feel, which in turn changes their behavior spontaneously (Heath et al., 2017). Quality picture books help children learn more about resilience theories or compare their own behaviors with the examples of resilience-based behaviors in the books (Tillott et al., 2022). Inspired by previous findings that traditional paper reading enhances children’s mental health development, we wonder whether digital reading may also contribute to it.

In this paper, we are aiming to shed light upon the relationship between digital reading and LBC psychological resilience by leveraging self-report questionnaires upon LBC in Lushan County, Henan Province. We systematically explored different fine-grained digital reading variables (e.g., reading frequency, reading motivation, digital reading types, etc.). Hierarchical regression model was exploited to calculate the incremental value of reading variables in the prediction of resilience after the effects of other well-known resilience-related factors (i.e. positive coping style (Wu et al., 2020), parental autonomy support (Wang et al., 2007), self-control (Wang et al., 2007), autonomous goal motives (Ryan et al., 1989), basic psychological needs satisfaction (Wang et al., 2007), parenting style (Arrindell et al., 1983; Perris et al., 1980), social support (Sarason et al., 1987), self-esteem (Rosenberg, 1965), and life satisfaction) and some sociodemographic variables (i.e., age, gender, etc.) were accounted for. Besides, we also carefully examined the significance of each fine-grained digital reading variables when LBC resilience was concerned. To the best of our knowledge, this is the first study investigating the predictive effect of digital reading on psychological resilience and illustrating the potential social welfare value of digital reading.

LITERATURE REVIEW

Common Protective Factors of Resilience

In the field of psychology, great efforts have been made to investigate the protective factors of resilience, which could be categorized as social and personal factors (Wallace et al., 2001).

Social factors

Family and social supports provide people positive resources to lift themselves up from difficult situations (Friborg et al., 2003; Wilks & Spivey, 2010). Autonomy-supportive family environment, where parents accept children as who they are and encourage them to be themselves, makes children more resilient because such environment protects vulnerable individuals from shame and depression caused by negative information about their identities (Legate et al., 2019). Meanwhile, parental involvement has been likewise proven to be a significant positive and significant predictor of resilience (Asanjarani et al., 2023). Especially for LBC, psychological resilience was proved to be associated with mother's education, intimacy with cohabitants, and the number of close friends. A higher level of mother's education, more intimate with cohabitants, and more close friends are always related to stronger psychological resilience (Xiao et al., 2019). In addition, the LBC who have less contradiction with their guardian or more concerns about migrating parents have better resilience (Guo et al., 2015).

Personal factors

Numerous studies have revealed that self-esteem, self-control, life satisfaction, positive coping style, autonomous goal motives, and basic psychological needs satisfaction functions as personal resilience-protective factors.

A recent meta-analysis observed that self-esteem and life satisfaction played a larger positive relationship with resilience (Lee et al., 2013). Self-esteem is an important predictor of resilience (Lee et al., 2008; Major et al., 1998; Wallace et al., 2001). Researches showed that there is an essential connection between self-esteem and resilience, as resilience is strongly associated with positive affect, which in turn is associated with self-esteem (Benetti & Kambouropoulos, 2006; Tugade & Fredrickson, 2004). A similar pattern has also been found between life satisfaction and resilience (Maria et al., 2014; White et al., 2010). Resilience and positive emotions build on one
another, and both will rise life satisfaction (Cohn et al., 2009). The basic psychological needs satisfaction also positively affects resilience (Lera & Abualkibash, 2022).

Coping style refers to using cognitive or behavioral strategies to handle and resolve the stressful events (Billings & Moos, 1981). Higher resilience is associated with a better coping style, for these people may exhibit more positive behaviors to cope with the stressful event and psychological problems they face (Yu Wu et al., 2020). Self-control is a skill that people consciously chosen the behavior, which enable them to overcome difficulties related to their thoughts, feelings, behaviors and cope with pressures (Agbaria et al., 2012). Recent research about problematic Internet use has shown that the development of a level of self-control increases one’s resilience level (Yilmaz & Karaoglan Yilmaz, 2022). Autonomous goal motives are based on personal interest and joy. Research has confirmed the mediational role of autonomous goal motives in the relationship between their mental resilience and subjective vitality (Martinez-Gonzalez et al., 2021).

In general, vast majority of researches on resilience explored the role of common psychological variables, yet not much research on digital reading.

**Digital Reading and Mental Health**

Digital reading, broadly defined as reading texts in electronic format on digital devices such as smart phones, tablets, computers or e-readers, includes reading news, encyclopedias on phones or computers and searching the Internet, as well as reading online novels, joining online groups or forums, reading comics, and chatting online (Notten & Becker, 2017). Currently, new digital technologies offer unprecedented opportunities for mental health interventions (Rost et al., 2020). There are also trials for promoting mental health via digital reading. The most direct way is to provide information about mental health and wellbeing as digital reading contents for the purpose of educating in the forms of web-based/computerized training modules, MOOCs (Massive Open Online Courses), advices and resources (Childline, 2020; Minds, 2020). A study using Lexplore (i.e. a reading assessment using eye-tracking technology to assess reading ability and detect early atypicality) and Lincus (i.e. a digital support and well-being monitoring platform) revealed the feasibility of embedding a low-cost, scalable, and innovative digital mental health intervention in schools in the Greater Manchester area (Davies et al., 2021). Besides, reflection and involvement also highlighted the influence of digital reading on mental health. Interventions that focus on enabling reflection through participatory learning in digital space include digital storytelling, games, problem-based learning exercises, reading and writing reflection activities (Rost, Samuels, Leon-Himmelstine, & Marcus, 2020). Furthermore, the impact of digital reading is also reflected in the aspect of group-based digital support which tend to use social media groups or multimedia platforms to encourage young people to connect with others in similar situations (Sobowale et al., 2016). Many adolescents want to use internet technologies to socialize with their peers, discuss concerns, offer advice, and relate to others’ experiences (Kenny et al., 2016).

Obviously, the existing explorations of mental health promotion through digital reading are limited within mental health related contents specifically, which requires the users to be aware of their mental problems and positively expose themselves to reading such information. However, for immature LBC, they may not even realize with mental problems. Thus, it will be more universal to investigate the relationship between general digital reading and mental health.

**METHODOLOGY**

**Participants**

We went to Lushan County of Henan Province and conducted a field survey upon left-behind children. Left-behind children in three elementary and junior high schools in Lushan County participated in our study. We adopted the form of electronic questionnaire. Before releasing the questionnaire, we invited 20 primary school students in fourth to seventh grade to answer the questionnaire in advance, adjusted some expressions and topics in the questionnaire based on their feedback to make questionnaire in easy-to-understand text and thus guaranteed children can fully comprehend the questions. All participants completed the questionnaire through digital devices. Confidentiality and authenticity were proclaimed. They were not paid for their participation but received gifts and individual guidance of personal growth. 217 left-behind children from fourth to seventh grade recruited in our study. We check the credibility of each questionnaire by instructing participants to answer using specific response options by indicating items (“Please select C for this term”). Then we successfully collected 207 valid samples, with the effective response rate of 95.4%. Among the 207 participants, 97 were males and 110 were females, with the average age M = 11.2 years old (SD = 2.96, range 8-13). This research was approved by ethical committee of Department of Psychology, Wuhan University.

**Variables and Instruments**

**Dependent variable**

We took psychological resilience as the dependent variable in the study. The 10-item version of the Resilience Scale (RS) (L. Campbell-Sills & Stein, 2007; Connor & Davidson, 2003) assesses the ability to recover from adversity. It
reflects the ability to cope with experiences such as change, personal problems, illness, pressure, failure and painful emotions. Answers are given on a 5-point Likert scale from 1 = not at all true to 5 = almost always true. A total score was calculated.

**Digital reading variables**

Inspired by the theoretical framework of Baron’s ABC model (Baron et al., 2001) which comprises three components of affection, behavior, and cognition, we organized digital reading variables with the following aspects, digital reading behavior, digital reading content that contains affection, and digital reading perception. Specifically, we distinguished the behavior by the actual behavior of the LBC when they engage in digital reading, and the motivation which drives their actual behavior. We systematically abstracted the digital reading variables into the four categories, digital reading behavior, digital reading content, digital reading motivation and digital reading perception (see in Figure 1). The corresponding scales were involved.

**Figure 1. Fine-grained digital reading variables in the study**

For digital reading behavior, we designed the digital device scale (DD, in Table 1) to quantify the number of digital devices in students’ home. Smartphones, laptops, tablets, and e-books (e.g. Kindle) are included. Besides, the concentration and immersion problems scale (Aguilar et al., 2013; Kuhn et al., 2022) is leveraged to measure the reading behavior and experiences via digital reading. It’s a 5-point Likert-type custom-designed scale from strongly disagree (=1) to strongly agree (=5).

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>0 1 2 3 ≥ 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Which of the followings are in your home?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q5: A link to the Internet.</td>
</tr>
<tr>
<td>Q6: Educational software</td>
</tr>
</tbody>
</table>

**Table 1. Digital Device scale**

For digital reading content, we adopted the categorization of Notten and Becker (2017), and identified two dimensions of digital reading, informational digital reading (IDR) and recreational digital reading (RDR), distinguishing the frequency of different kinds of digital reading. The former involves reading news, encyclopedias on phones or computers and searching the Internet, while the latter includes reading online novels, joining online groups or forums, reading comics, and chatting online (chatting on WeChat or QQ) (Notten & Becker, 2017) which is more emotional. As in Table 2, we designed the two scales with 5-point Likert scale from 1 = never, 2 = several times a month, 3 = once a week, 4 = more than once a week, 5 = per day.

<table>
<thead>
<tr>
<th>Informational digital reading scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you do the following reading activities?</td>
</tr>
<tr>
<td>Q1: Watching the news on mobile phones or computers.</td>
</tr>
<tr>
<td>Q2: Online dictionaries or encyclopedias.</td>
</tr>
<tr>
<td>Q3: Searching for information on the Internet.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recreational digital reading scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you do the following reading activities?</td>
</tr>
<tr>
<td>Q1: Read online novels.</td>
</tr>
<tr>
<td>Q2: read comics.</td>
</tr>
<tr>
<td>Q3: Conduct online chat (chat on WeChat or QQ)</td>
</tr>
<tr>
<td>Q4: Join online groups or forum.</td>
</tr>
</tbody>
</table>

**Table 2. Details of digital reading scale**

For digital reading motivation, we chose three motivation variables in the Chinese Reading Motivation Questionnaire (Lau, 2004), Intrinsic motivation (IMO), extrinsic motivation (EMO) and social motivation (SMO). They all used a 4-point Likert scale to measure (1=very different from me, 2=a little different from me, 3=a little like me, and 4=a lot like me).

For digital reading perception, perception of competence in reading (PCR) and perception of difficulty in reading (PDR) scale (OCED, 2017) were adapted to assess students’ reading self-concept. Both scales employed a 4-point Likert scale (1=very different from me, 2=a little different from me, 3=a little like me, and 4=a lot like me).
**Sociodemographic variables**

Five sociodemographic variables were implemented, age, gender (1=female, 2=male), highest parental qualification (HPQ, 1 = Primary and below, 2 = Lower secondary, 3 = High school and junior college, 4 = Undergraduate, and 5 = Master's degree and higher), subjective socioeconomic status (SSS), and home educational resources (HEP).

The MacArthur Scale of Subjective Socioeconomic Status (SSS) is an instrument proposed by Adler et al. (2000) for measuring subjective socioeconomic status which presents subjects with a 10-step ladder, representing the position of people with different incomes, education levels and occupations in society and asks subjects to judge their position in society or in the community.

Home Educational Possession (HEP) Scale (Tillott et al., 2022) was extracted from the PISA student questionnaire (OCED, 2017). It consists of six items and asks if students have these educational resources at home. The items are shown in Table 3.

<table>
<thead>
<tr>
<th>Which of the following are in your home?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1: A desk to study at.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2: A quiet place to study.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3: A computer you can use for school work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4: Educational software.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q5: Books to help with your school work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q6: A dictionary.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 3. Home educational possession scale*

**Resilience protective variables**

Coping Style (CS) Questionnaire is used to assess the positive or negative attitudes and practices that the subjects may adopt when they experience setbacks or encounter difficulties in life which consists of 20 items and two dimensions of positive and negative. Multi-level scoring is adopted, from 0= not using, to 3= often using (Zhang & Xie, 1995).

Parental Autonomy Support (PAS) scale was revised by Wang et al. (2007) based on the scale compiled by Steinberg et al. (1992), with a total of 12 items (for example, my parents gave me many opportunities to make my own decisions about what I was doing.), using 5 Points Likert scale from 1=very inconsistent to 5=very consistent. The higher the score, the higher the adolescent's perceived parental autonomy support.

Social Support Questionnaire (SSQ) (Sarason et al., 1987), which contains 27 items, is used to measure perceptions of social support and satisfaction with that social support. Each item has two parameters. The first part asks the interviewee to list up to nine people available to provide support that meet the criteria stated in the question. The second part uses a 6-point Likert scale to indicate their degree of satisfaction with the support from the above people ranging from "1 - very dissatisfied" to "6 - very satisfied".

Self-Esteem (SE) scale was originally developed to assess adolescents' overall feelings about self-worth and self-acceptance (Rosenberg, 1965). The 10-item scale is divided into four levels, and the subjects directly report whether the descriptions correspond to themselves. The total score is recorded, with higher scores indicating higher levels of self-esteem.

Self-Control (SC) Scale (Tangney et al., 2004) was developed to assess dispositional self-control, which is divided into five dimensions: impulse control, healthy habits, resistance to temptation, concentrate on work and restrain entertainment.

General Need Satisfaction (GNS) Scale was developed with 21 items in total, among which, higher scores represent a higher level of satisfaction of basic psychological needs (Gagné et al., 2003).

EMBU (Egna Minnen av Barndoms Uppfostran-own memories of parental rearing practice in childhood) is a questionnaire developed to evaluate parenting attitudes and behavior (Arrindell et al., 1983; Perris et al., 1980; Sarason et al., 1987). Four dimensions of parenting style: rejection (REJ), emotional warmth (EW), overprotection (OP) and preference (PF) were extracted and involved in our study.

Autonomous motivation was measured by the self-regulation questionnaires (SRQ-Academic) (Ryan et al., 1989) which were administered to upper elementary and middle school students. Subjects rated each item on a 5-point
scale (1-strongly disagree to 5-strongly agree). The 26-item questionnaire has 4 subscales. In these subscales, identification, integration, and internal regulation scores were added to get autonomous motivation.

**Data Analysis**

In natural scenario, one’s resilience could be affected by complex factors. To investigate the relationship between digital reading and resilience, we need to control other resilience-related variables like sociodemographic and common resilience protective variables. Hierarchical regression is essentially based on regression analysis, with the difference being that hierarchical regression can be divided into multiple levels and is used to examine differences between two or more regression models, which are used in this study to explore differences between three regression models. Hierarchical regression places the core study variables in the last step into the model to examine the contribution of the core study variables to the regression equation when the contribution of other variables is excluded. If the variables still have a significant contribution, then a conclusion can be made that the core study variables do have a unique role that cannot be replaced by other variables. To test the incremental value of digital reading in the prediction of psychological resilience, after considering the effects of the above resilience protective factors and sociodemographic variables, we conducted a hierarchical regression, with the first step inputting socio-demographic variables, the second step inputting resilience protective variables, and digital reading variables in the final step. In our study, multicollinearity diagnostics were well within acceptable limits (i.e., the variance inflation factor of each variable was below 5), which ensured the validity of the hierarchical regression.

**RESULTS**

**Reliability Test**

Cronbach's Alpha reliability coefficient is used to test the reliability of the scales involved in this study. As shown in Table 4, the Cronbach's Alpha values of all variables ranged from 0.600 to 0.937, with the average of 0.813, indicating the scales used in this study with good reliability.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach’s alpha</th>
<th>Variable</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilience</td>
<td>0.892</td>
<td>Preference of parenting style</td>
<td>0.922</td>
</tr>
<tr>
<td>Household educational possession</td>
<td>0.600</td>
<td>Rejection of parenting style</td>
<td>0.919</td>
</tr>
<tr>
<td>Coping style</td>
<td>0.827</td>
<td>Overprotection of parenting style</td>
<td>0.709</td>
</tr>
<tr>
<td>The parental autonomy support</td>
<td>0.991</td>
<td>Intrinsic motivation</td>
<td>0.928</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>0.700</td>
<td>Social motivation</td>
<td>0.840</td>
</tr>
<tr>
<td>Self-control</td>
<td>0.731</td>
<td>Concentration and immersion</td>
<td>0.824</td>
</tr>
<tr>
<td>Autonomous motivation</td>
<td>0.937</td>
<td>Perception of competence in reading</td>
<td>0.846</td>
</tr>
<tr>
<td>The general need satisfaction</td>
<td>0.717</td>
<td>Perception of difficulty in reading</td>
<td>0.775</td>
</tr>
<tr>
<td>Social support</td>
<td>0.731</td>
<td>Informational digital reading</td>
<td>0.752</td>
</tr>
<tr>
<td>Emotional warmth of parenting style</td>
<td>0.935</td>
<td>Recreational digital reading</td>
<td>0.681</td>
</tr>
</tbody>
</table>

Table 4. Cronbach's Alpha values of the variables

**Descriptive Statistics of LBC Digital Reading**

Figure 2 shows the digital reading preference of LBC. According to Figure 2(a), the largest proportion of left-behind children prefer reading through traditional paper books (47.34%), indicating that paper reading is still the mainstream trend of reading for left-behind children. However, it is noteworthy that e-reading ranks second with 21.26%, indicating that many rural left-behind children also benefit from digital reading and accept it well as an emerging way of reading, given the rapid development of information technology. In addition, 14.49% of left-behind children equally preferred digital reading and paper reading. Figure 2(b) shows the electronic devices used by left-behind children for digital reading. 83.96% of left-behind children choose to use smartphones for digital reading, which may be related to the high penetration rate of smartphones in China and the convenience of smartphones; while other electronic devices, such as laptops (4.81%), tablets (4.28%), desktop computers (4.81%), and e-readers (2.14%) all account for a very small percentage. The stacked bar chart in Figure 2(c) illustrates the frequency of different types of digital reading among the left-behind children, where sometimes (= once a month to once a week), often (= once a week to every day). The LBC participants most often chatted online and rarely participated in BBS. The most involved type of digital reading was searching for information on the Internet. Through the descriptive statistics of digital reading of left-behind children, we can find that most of the left-behind children could easily access to digital reading and have richer digital reading experiences, which proves the feasibility of promoting resilience through digital reading.
Figure 2. Descriptive statistics of digital reading among left-behind children


Intercorrelations Between Digital Reading and Resilience

Figure 3 illustrated the Pearson correlations between each pair-wise variables. The results showed that all digital reading variables produced a significant positive correlation with LBC psychological resilience, except digital device (non-significant).
### Table 5. Hierarchical regression predicting resilience for left-behind children

The correlations were particularly strong for intrinsic motivation ($r = 0.590, p < .001$), extrinsic motivation ($r = 0.540, p < .001$), social motivation ($r = 0.510, p < .001$), perception of competence in reading ($r = 0.480, p < .001$), and perception of difficulty in reading ($r = 0.360, p < .001$). Most of the digital reading variables significantly correlated with resilience protective variables, except digital device, informational digital reading and recreational digital reading. It can be also found that digital reading variables share little correlations with sociodemographic except for household educational possession.

<table>
<thead>
<tr>
<th>Sociodemographic Variables</th>
<th>STEP1</th>
<th>STEP2</th>
<th>STEP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-0.732</td>
<td>0.385</td>
<td>0.730</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.048</td>
<td>-0.099</td>
<td>-0.154</td>
</tr>
<tr>
<td>HPQ</td>
<td>-0.384</td>
<td>0.301</td>
<td>0.325</td>
</tr>
<tr>
<td>SSS</td>
<td>0.514</td>
<td>0.000</td>
<td>0.062</td>
</tr>
<tr>
<td>HEP</td>
<td>1.600</td>
<td>0.843</td>
<td>0.758</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resilience Protective Variables</th>
<th>STEP1</th>
<th>STEP2</th>
<th>STEP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>0.368</td>
<td>0.301</td>
<td>0.352</td>
</tr>
<tr>
<td>PAS</td>
<td>1.023</td>
<td>1.122</td>
<td>0.149</td>
</tr>
<tr>
<td>SE</td>
<td>-0.024</td>
<td>0.616</td>
<td>0.149</td>
</tr>
<tr>
<td>SC</td>
<td>0.442</td>
<td>0.243</td>
<td>0.356</td>
</tr>
<tr>
<td>AM</td>
<td>0.144</td>
<td>0.060</td>
<td>0.022</td>
</tr>
<tr>
<td>GNS</td>
<td>-0.129</td>
<td>0.209</td>
<td>0.356</td>
</tr>
<tr>
<td>SS</td>
<td>0.000</td>
<td>0.204</td>
<td>0.176</td>
</tr>
<tr>
<td>EW</td>
<td>0.442</td>
<td>0.243</td>
<td>0.427</td>
</tr>
<tr>
<td>PF</td>
<td>0.576</td>
<td>0.488</td>
<td>0.442</td>
</tr>
<tr>
<td>REJ</td>
<td>0.352</td>
<td>0.356</td>
<td>0.352</td>
</tr>
<tr>
<td>OP</td>
<td>-0.006</td>
<td>0.046</td>
<td>0.046</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital Reading Variables</th>
<th>STEP1</th>
<th>STEP2</th>
<th>STEP3</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMO</td>
<td>0.382</td>
<td>0.382</td>
<td>0.382</td>
</tr>
<tr>
<td>EMO</td>
<td>0.134</td>
<td>0.134</td>
<td>0.134</td>
</tr>
<tr>
<td>SMO</td>
<td>-0.064</td>
<td>-0.064</td>
<td>-0.064</td>
</tr>
<tr>
<td>CI</td>
<td>-0.045</td>
<td>-0.045</td>
<td>-0.045</td>
</tr>
<tr>
<td>PCR</td>
<td>-0.066</td>
<td>-0.066</td>
<td>-0.066</td>
</tr>
<tr>
<td>PDR</td>
<td>-0.046</td>
<td>-0.046</td>
<td>-0.046</td>
</tr>
<tr>
<td>IDR</td>
<td>-0.120</td>
<td>-0.120</td>
<td>-0.120</td>
</tr>
<tr>
<td>RDR</td>
<td>0.361</td>
<td>0.361</td>
<td>0.361</td>
</tr>
</tbody>
</table>

$R^2_{adj}$: 0.057

$F_{change (df_1, df_2)}$: 3.493(5, 201)

$\Delta R^2$: 0.080**

Note: *p < .05, **p < .01, ***p < .001
Regression Analysis Predicting Resilience
Table 5 shows the hierarchical regression analysis. 9 digital reading variables together predicted an additional 4.3% of the variance in psychological resilience, which was statistically significant ($p < .001$). This result supports our hypothesis that digital reading could serve as an easy but effective way refueling resilience development for left-behind children. More specifically, intrinsic motivation to read and recreational digital reading were significant predictors of psychological resilience when all variables (i.e., 5 socio-demographic variables, 11 resilience protective variables and the 9 digital reading variables) were included in the model simultaneously. The other significant predictors of LBC psychological resilience in this model were, in descending order, household educational possession, preference and rejection in parenting style, self-esteem, respectively.

DISCUSSION
Previous work exploiting digital reading as psychological therapy focus on mental health specific reading contents (Childline, 2020; Davies et al., 2021; Minds, 2020). Getting out of the content limit, this study investigates general digital reading variables and provides primary evidence for the link between digital reading and psychological resilience for left-behind children in rural China. Both feasibility and effectiveness of digital reading were validated. As feasibility is concerned, more than 80% of the LBC participants had digital reading experiences via multiple devices, indicating digital reading as an available access for LBC to obtain online information and resources. For effectiveness, digital reading proved to contribute a significant predictive value when other factors associated with resilience were carefully controlled, such as common resilience protective variables (e.g., stress coping styles, self-esteem, basic psychological needs satisfaction, general social support, etc.), and sociodemographic variables (e.g., gender, age, etc.). Furthermore, diving deep into the fine-grained digital reading variables, intrinsic motivation to read and recreational digital reading, were significant predictors of psychological resilience when all variables studied were included in the model simultaneously.

Although age and gender has been reported as resilience-related factors in previous work (Campbell-Sills et al., 2009; Lamond et al., 2008; Werner, 2013), in our study, at least for LBC, neither correlation analysis nor hierarchical regression results showed significant associations between those two and resilience. The reason perhaps still lies in the specific fact that different from ordinary children, LBC lacks sufficient parental and schooling resources to develop good resilience throughout each age stage, regardless of gender, so that it is difficult for them to accumulative resilience strengths with age. This again suggests the urgent need to open alternative and effective way for LBC resilience development.

It is proved that digital reading could promote mental health in a device-free manner and validates once again its low-cost and high feasibility for LBC who are not rich. As fine-grained digital reading variables covering reading behavior, reading content, reading motivation, and reading perception are concerned, all digital reading factors except digital device produced significant positive correlations with psychological resilience. Most of the digital reading variables positively correlated with common resilience protective variables (e.g., positive coping style, self-esteem, etc.) as well. The result is partially consistent with the findings of that reading helps children understand personal problems, improve their mood by allowing them to identify with others, and find unique solutions to control their own lives (Bouchard et al., 2013), which in turn strengthens resilience-protective factors. Moreover, it is noticeable that digital reading shared little correlation with age and gender, additionally suggesting digital reading could serve as an equal and universal channel for LBC of all ages and both genders.

There are also some other valuable insights from the study. Firstly, it is quite interesting to note that when considering digital reading content, instead of informational digital reading, only recreational digital reading significantly predicted psychological resilience ($p = 0.035$). Similar findings have not been demonstrated in any previous study. The results seem counter-intuitive, as we often tend to the viewpoint that recreational digital reading like chatting or reading comics cannot provide enough “useful” knowledge and skills compared with informational digital reading like scanning news or encyclopedia. Although our study used cross-sectional data and did not infer any causal relationship, this result may be explained from the emotional perspective of empathy. Empathy is the understanding and sharing of others' feelings (Knafo et al., 2010), “the glue that makes social life possible” (Hoffman, 2000). Existing research has demonstrated that recreational reading (e.g., reading fiction) may sharpen readers' understanding of real society (Mar & Oatley, 2008; Mar et al., 2006) and promote the development of empathy (Tabullo et al., 2018). Moreover, the enhancement of empathy positively drives the development of psychological resilience (Sang et al., 2022). We thus infer that recreational reading, represented by reading fiction, improves psychological resilience through the pathway of developing empathy. Secondly, among all the reading variables, reading motivation factors (i.e., intrinsic motivation to read, extrinsic motivation, social motivation) and reading perception factors (i.e., perceived ability, and perception of difficulty in reading) enjoyed larger correlation than others. As examined by previous work how different factors might influence children’s performance in digital reading, reading motivation could substantively predicted individual differences of fourth graders’ digital reading comprehension (Cho et al., 2021). Potential explanation may lie that reading motivation positively correlates with
the level of digital reading comprehension, which in turn deepens the empathy and thus correlates more with resilience. Thirdly, of the 5 sociodemographic variables, only household educational possession (HEP) significantly predicted LBC’s resilience. The result could be explained in the similar manner. Many studies have shown that household educational possession factors, such as home resources for learning (Cho et al., 2021), and the number of books in the home (Chen et al., 2022), have overarching influences on children’s digital reading development. Richer HEP leads to better digital reading literacy, in turn triggers much empathy, and finally develops a higher resilience level.

This study contributes to previous literature on digital reading and psychological resilience in both theoretical and practical aspects. Theoretically, this study reveals the relationship between digital reading and psychological resilience for left-behind children, and the findings are consistent with previous studies conducted in the field of traditional paper-based reading. To the best of our knowledge, this is the first study on digital reading among left-behind children, and pioneeringly fills a gap in the field of digital reading and psychological resilience for left-behind children. In addition to theoretical contributions, this study also has important implications for real-life social issues, extends the social welfare values of digital reading for disadvantaged groups and the results of the study point to a new path for improving the psychological health of left-behind children. As convenient, diverse, and easily accessible digital reading effectively provides significant supplement to improve the psychological resilience of left-behind children, this study inspires practical implications for LBC digital reading services as follows. When designing children’s reading materials, especially for LBC, beside mental health specific contents, rich and interesting topics which help arouse and cultivate children’s intrinsic reading motivation would be encouraged to contribute to children’s resilience development. Such contents appropriately presented in the forms of recreational reading (e.g., fictions, comics, etc.) with rich emotional experiences would be more promising ways to enhance the resilience promoting effect. On the other hand, from the perspective of the government, it is better to increase the investment in the construction of libraries and public cultural services in rural areas, improve the household educational possession of LBC, and thus promotes LBC’s resilience development from the level of family environment.

Of course, there are some limitations to be considered in the current research. Although 77.7% LBC in China enjoy the access to the Internet and electronic devices (CNNIC, 2020), there are still about 22.3% LBC could not be exposed with digital reading. And this study investigated the correlation between digital reading and psychological resilience through regression analysis, but did not further discuss the causal relationship between the two. On the other hand, the data in this study were all obtained from the self-reports of the study participants, and the study lacked observational and multiple-informant approaches. In future studies, we consider exploring the causal relationship between digital reading and psychological resilience through reading experiments. Second, because of the difficulty in identifying the left-behind children and the weak social ties between the left-behind children and the outside world, it is difficult to obtain a large amount of research data via the Internet as in general empirical studies, and we need to cooperate with local governments and schools to target specific families of left-behind children and distribute questionnaires in a targeted manner, which makes it extremely difficult and costly to collect data, resulting in a small amount of data.

CONCLUSIONS

As the mental health issue of left-behind children in rural China is concerned, we shed light upon the relationship between digital reading and psychological resilience and extend the potentially social welfare values of digital reading especially for disadvantaged groups. Fine-grained digital reading variables covering reading behavior, reading content, reading motivation as well as reading perception have been systematically explored through a hierarchical regression model. Promising conclusion comes that digital reading significantly predicts resilience for left-behind children, indicating it an easy but potentially effective way to enhance resilience. Among the fine-grained digital reading variables, intrinsic motivation to read and recreational digital reading (e.g., reading comics and communicating online) were the two most stronger predictors of LBC’s psychological resilience.

ACKNOWLEDGEMENTS

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Digital Ownership: The Case of E-Books

Zhu, Xiaohua Awa University of Tennessee, Knoxville, USA | awazhu@utk.edu

ABSTRACT
Ownership of digital information products in the digital age presents an intricate issue. While research has shown that individuals experience a sense of ownership over their digital possessions, the scope of digital ownership rights in comparison to physical entities remains unclear. Amongst various digital products, e-books stand out due to their ubiquity. This paper presents the results of an empirical research study that used an online survey to examine e-book consumers’ perspectives on digital ownership and digital rights. The study revealed that while most participants value and desire ownership rights, certain conventional ownership rights, such as reselling, gifting, and lending, are deemed less significant and can be relinquished by consumers due to cost-related factors. Furthermore, contrary to prevailing assumptions, the study found no discernible generational gap concerning people’s perceptions of digital ownership rights. These findings hold implications for researchers, policymakers, and public-interest groups seeking to advocate for the public’s digital rights.

KEYWORDS
Digital ownership; digital information products; digital consumption; e-books; digital rights

INTRODUCTION
In early 2010 when e-book publishing and consumption started to surge, the Electronic Frontier Foundation (EFF) issued a document titled “Digital Books and Your Rights: A Checklist for Readers,” in which EFF warned the public about the potential negative impacts of the “digital book revolution” on our rights and expectations, including privacy, censorship, DRM, access, reuse, and ownership (EFF, 2010, p.1). They suggest that “readers should not accept a world where all we can ever do is ‘rent’ a book, subject to the whims of a digital ‘landlord’” (p. 9). Thirteen years later, while today’s public is increasingly aware of privacy and censorship issues, they seem to be accepting the new norms of renting, or more accurately, licensing, e-books. By clicking through the end-user license agreements without actually reading them, most consumers voluntarily give up certain rights associated with traditional ownership, such as reselling and sharing.

This is understandable—after all, the US Copyright Office advised, merely three years after the enactment of DMCA, that extending the first sale doctrine into the digital realm was not workable and such concerns should be addressed by the marketplace before Congress would revise the copyright law (Copyright Office, 2001). The most recent government white paper upholds that recommendation (Department of Commerce & Internet Policy Task Force, 2016). Since the copyright law does not protect consumers’ first sale rights, at least not in a straightforward manner, licensing has been widely accepted as the form of governance over intangible digital information products—e-books, digital music, software, games, and more. The success of streaming services and information subscription models since the mid-2000s likely indicates the viability of the licensing model. In a similar vein, libraries have been licensing electronic resources from vendors and publishers since the 1990s despite the ongoing debate over ownership versus access.

While licensed, controlled usage seems to be replacing ownership in the digital marketplace, other voices and trends exist. On the one hand, the call for a new digital ownership norm never ceased (Perzanowski & Schultz, 2016). On the other hand, research shows that people feel a sense of ownership toward digital virtual possessions, even though such ownership is partial, fragmented, and untraditional (Watkins et al., 2016; Zhu & Cho, 2021). Meanwhile, the digital marketplace is far from stabilization. A recent marketing survey indicates 77% of Americans (and 81% of Gen Z) prefer owning digital items over streaming. It concludes there was a shift from the streaming era to “a new age in which consumers seek to acquire, store, and curate digital items” (Virtua, 2022). However, what does digital ownership mean to consumers? How have their ownership/use expectations changed over time? Eschenfelder and colleagues (2011)’s “use regime” theoretical framework views use rights as part of a sociotechnical ensemble composed of interrelated dimensions—market, law, cultural expectations, and technology. The assumption in this research is that the cultural expectation component is particularly fluid because users’ expectations are constantly influenced by other elements in the sociotechnical ensemble. In other words, although users and technology are often shaped by each other (Oudshoorn & Pinch, 2003), in the current digital environment, the relationship between users and technology is asymmetric. Therefore, users’ perceptions and expectations deserve more attention from information researchers, if we want to make positive impact on users and the digital world.

This paper presents findings from an empirical research study using an online survey to examine e-book consumers’ perceptions of digital ownership and rights. It tries to answer three research questions:
RQ1: What ownership rights are considered essential for consumers to feel they own an e-book?
RQ2: What ownership rights are consumers willing or unwilling to alienate for the cost factor?
RQ3: Are there generational gaps in people’s perceptions of digital ownership rights?

Ownership rights examined here include rights associated with personal properties, such as permanent possession, resale, lending, gifting, inheritance, etc., and rights enabled by digital technologies, such as downloading, backup copying, annotating, etc. Some scholars define digital rights as “human and legal rights that allow individuals to access, use, create and publish digital content on devices such as computers and mobile phones, as well as in virtual spaces and communities” (Pangrazio & Sefton-Green, 2021, p. 19), which excludes digital ownership right; but this paper argues ownership is an essential digital right that information researchers should examine and advocate for.

LITERATURE REVIEW
Marketing and Consumer Research
Ownership is a research topic in several disciplines. Marketing and consumer behavior researchers study consumers’ digital experience, especially psychological ownership—a cognitive–affective state or a feeling of possession that can arise without legal ownership (Pierce & Peck, 2018). Much research explores the relationship between psychological ownership, product designs, and consumers’ intention to purchase or to make recommendations (Kirk & Sarstedt, 2016). Research on psychological ownership has also demonstrated consumers do develop feelings of ownership toward digital technologies—such as social media, software applications, and online communities—and digital content—such as gaming items and scores, virtual IDs, and avatars, which are often called digital virtual possessions (Kirk & Swain, 2018). Following this research stream, Virtua, the metaverse platform, surveyed more than 2,000 people in the UK and the US, respectively, about their ownership feelings of “digital items” and “digital collectibles” (Virtua, 2022). Their Digital Ownership Report shows the top five digital items purchased by consumers include music, movies, games, books, in-game items, and images. They found over half of the US consumers surveyed had bought, sold, or traded digital items, 77% preferred to own digital items, 65% felt they had more control over digital items, 54% preferred digital items as gifts, and 65% agreed owning digital items felt no different than owning physical (Virtua, 2022).

One limitation of this line of research, from the information science perspective, is that it often treats ownership as a rather fixed construct. Based on an abstract notion of ownership, it focuses on feelings, attachments, and other psychological factors when studying users’ ownership, and it often ignores the changing notion of what “ownership” means in terms of the activities associated with digital possession beyond cognitive states. As Watkins and colleagues (2016) pointed out, the ownership of digital virtual goods was “fragmented” and “partial” (p. 45), and there were multiple ownership configurations. Some relevant research has taken into account the materiality and affordances of ownership or possessions (Denegri-Knott et al., 2022; Morewedge et al., 2021; Watkins et al., 2016), but such analyses are often more theoretical than empirical, especially regarding e-books which are arguably quite distinct from and more complicated than other forms of digital virtual goods such as game items.

Legal Studies
Ownership research in legal studies, in contrast, focuses on property rights, logic, materiality, and practicality of ownership. Ownership is defined as a legal and social arrangement between people with respect to a thing or property, including material objects or intangible objects (Gaus, 2012). Legal ownership is often studied in terms of property law. After the US Copyright Office stated they “cannot at this time recommend extending the first sale doctrine to apply to digital transmissions of copyrighted works” (2001. p. 101), many legal scholars investigated whether the first sale doctrine could still apply in the digital marketplace and pointed out the challenges and the need for changing the mechanism (Gratz, 2010; Mezei, 2015; Reis, 2014).

Digital legal ownership research is best represented by Perzanowski and Schultz’s (2016) End of Ownership: Personal Property in the Digital Economy. The authors argue notions of ownership have already shifted in the digital marketplace and that it is imperative to “craft a notion of ownership applicable to digital goods” by introducing aspects of personal property and private property into the digital marketplace in order to protect consumers’ rights (p. 193).

Empirical Research on Digital Rights and Digital Ownership
Studies on users’ media consumption and preferences are abundant, but few studies have explored digital consumers’ perceptions, needs, and expectations regarding digital ownership rights from an empirical angle. An early study on media use, piracy, and users’ attitudes about DRM asked participants what rights were important to them (Arnab & Hofman, 2005). Respondents were given three options—“an absolute necessity,” “would pay extra to have the right,” and “would pay less not to have the right”—for 11 digital rights. Many of them were deemed absolute necessities, including portability—any OS (82.19%), portability—any number of devices (78.77%), converting digital to physical format (74.32%), converting between different digital formats (71.92%), choices of formats (68.84%), temporary rights transfer (59.93%), permanent rights transfer (57.19%), and portability—pre-
determined number of devices (55.14%). Other rights, such as annotating, modifying, and redistributing a work, were less critical. This survey was conducted nearly twenty years ago in a different digital environment and on a tech-savvy population, but the method helped design this current study.

Perzanowski and Hoofnagle (2017) designed an experiment/survey to understand consumers’ expectations—what do they expect when pressing the “buy now” button? 86% of participants who saw the “buy now” button believed they would “own” an e-book, 87% believed they could keep an e-book indefinitely. 81% thought they could use the e-book on any device, 48% believed they could lend it to others, 38% thought they could gift the e-book, 26% believed they could leave it in their will, 12% believed in reselling, and 9% assumed copying. The results also show that consumers’ perceptions of ownership rights are often unclear and misled when purchasing digital products.

Some researchers examined digital ownership perceptions and preferences. Zhu and Cho (2018) identified six ownership configurations from “purchased DRM-free digital copy” to “subscription content hosted by content provider only.” We found users’ perceptions of digital ownership encompassed a spectrum—the more restrictions, the fewer people would associate ownership with the products. Most users felt they owned the purchased, downloadable copies, even if these copies were software or hardware dependent; while few users felt they owned the subscribed or streaming-only content. The study did not find what rights (except downloading) were associated with the ownership and to what degree. We also surveyed the importance of ten digital rights and ranked them as follows: downloading (4.36), multiple devices (4.34), choosing format (3.65), multiple software (3.49), sharing (2.90), converting formatting (2.81), making a copy (2.54), reusing (1.92), reselling (1.70), and modification (1.66). We noticed that ownership, especially owning physical books, was very important to most readers.

This current study continues and expands these empirical studies on digital rights and digital ownership, focusing on e-books because previous studies indicate differences between e-book perceptions/preferences and other media.

METHODOLOGY
The survey method is commonly used for understanding human perceptions because of the relatively large sample size, anonymity, and structured questions. In this study, an online survey through Qualtrics was employed. The questionnaire includes five parts. The first part is about the importance of 16 features/rights associated with digital ownership. It asks: “For you, what is the importance of an e-book, how important is it to you to own an e-book?” The blank was replaced by the 16 rights, namely, (1) have permanent access, (2) have an unlimited number of uses, (3) be able to download, (4) be able to choose format, (5) be able to convert format, (6) be able to read on any device, (7) be able to read in different software, (8) be able to rent to others, (9) be able to resell, (10) be able to lend to others, (11) be able to give it to others as a gift, (12) be able to leave it in your will, (13) be able to highlight, annotate, and bookmark, (14) be able to copy the text in, (15) be able to make a personal backup copy, and (16) be able to keep it from being removed by seller. Rights (1) and (16) are similar, but pilot studies showed many users were especially concerned about sellers’ actions. A five-point Likert scale is used for choices from “not at all important” to “extremely important.” Rights (4) and (5) are not displayed to people who choose “not at all important” to right (3). The second part of the survey asks, if each right depends upon the price, whether they would be willing to pay for each of the 16 rights. The third part is about participants’ book reading and purchasing behaviors and preferences. The fourth part collects demographic information. The last part is two open-ended questions to allow free comments on digital ownership and comments on the survey itself.

Sampling
A snowball sampling strategy was used to recruit US residents 18 years or older. A major drawback of snowball sampling is the sampling bias and, therefore, the lack of generalizability. To overcome this drawback, the method was modified by sending the survey link to friends and family and asking them not to complete the survey; instead, they were asked to forward the survey link to people they knew, especially people who they thought were different (flexibly defined) from them. This strategy resulted in a diverse sample. A total of 288 respondents started the survey, with 257 completed ones that were used for the final analysis. These respondents were located in different types of geographic areas, with 67 urban residents (26.07%), 156 suburban (60.70%), and 34 rural (13.23%). The average age of the participants was 37.23 (median 32), with responses ranging from 18 to 83 years old. The sample was distributed in every age group, with more representation from ages 22-37. In terms of gender, 123 participants were females (47.86%), 111 were males (43.19%), and 23 were identified as other genders (8.95%). The majority of the sample was White (n = 207 or 80.54%), 16 participants were African American (6.23%), 11 were Asian (4.28%), 3 were American Indian or Alaska Native (1.17%), and 20 were identified as other races (7.78%). Most of the participants—177 of them (68.87%)—were working full-time or part-time. The education level of the participants also varied: 98 of them had a Bachelor’s degree (38.13%) as their highest degree, 83 had a Master’s degree (32.30%), 33 had some college (12.84%), 11 of them had a high school or GED (4.28%), 11 had an Associate degree (4.28%), 10 had a doctoral degree (3.89%), 10 had a professional degree (3.89%), and one did not complete high school (0.39%). In summary,
the study sample was diverse but not entirely representative of the US population. The participants overall were younger, more white, more gender various, and more suburban than the general US population, and they had higher educational levels, better employment status, and better income.

The modified snowball sampling also resulted in high-quality data. For the majority of the participants, it took between 10 and 30 minutes to complete the survey. A total of 229 participants left comments for the open-ended questions to talk about their additional thoughts on ownership, many of which were substantive, enabling meaningful qualitative analysis.

**FINDINGS**
This section first reports the findings regarding the non-demographic characteristics of the survey respondents to provide more context for the analysis. It then reports results regarding the research questions. Finally, it analyzes the participants’ textual comments on their views of digital ownership.

**Preferences and Other Characteristics**
Most of the participants had access to bookstores (240) and public libraries (236), less than half of them had access to academic libraries (131), and 33 of them had access to other types of libraries. Most participants had internet access from home, work, or school; only a few did not have broadband internet access.

The participants had various book consumption behavior. The e-books they purchased annually in the past three years ranged from 0 to 250, on average 11.66 per participant with a standard deviation of 25.09, which was lower than the number of their print book purchases—14.86 per person on average with a standard deviation of 16.71. They read 26.39 books per year, doubling the national average (Jones, 2022).

When asked what format they like in general, over half of them (n = 152, 59.14%) chose print books, 37 of them chose e-books (14.40%), 18 said they had no preference (7.00%), and 53 (20.62%) chose “it depends.” Answers to another question, which was about their preferences for different reading purposes, revealed more details about participants’ habits. In terms of e-book consumption, participants were likely to purchase e-books (n = 47) for leisure reading; they were more likely to rent digital copies for education (n = 35) and research (n = 23) purposes; and they were more likely to borrow e-books from libraries for research (n = 55) and leisure (n = 37) reading. For education and leisure readings, there was a clear preference for buying print material (98 and 118 respectively); in contrast, they had various consumption, with slightly more preferences for borrowing print (n = 70) or digital (n = 55) from the libraries and buying physical copies (n = 49).

Regarding their experience with e-book services, eight participants reported that they had never used any e-book services. All other participants have used one or more e-book services/platforms to purchase or read e-books, including Amazon (200), Overdrive/Libby via public library (77), Google (61), Barnes & Noble (58), iBooks (51), and Scribd (23). Other services (such as Kobo and BAM) had less than 20 users each.

**What Rights are Essential to Digital Ownership?**
To answer RQ1: What ownership rights are considered essential for consumers to feel they own an e-book? The survey asked the participants to rate the importance of 16 rights associated with digital ownership. Some of these rights are inherent in the ownership of print books, and some are (or can be) inscribed in e-books by design. Table 1 summarizes the importance of these rights viewed by the participants if they were to feel ownership toward an e-book. To save space, findings regarding the second research question are also presented in this table.

As Table 1 shows, (2) unlimited access, (1) permanent access, and (16) cannot be removed by digital services got the highest average scores, with the medians being 5, followed by rights (6) reading on any device, (3) downloading, (7) reading on multiple software, and (13) highlighting, bookmarking, & annotation, with 4 as medians. Some of the important personal property rights associated with physical books, namely (9) reselling, (10) lending, (11) gifting, and (12) leaving in the will, have become less important.

The last row was created based on a general question: “In general, how important is it to you to feel like you own an e-book that you buy or otherwise obtain, as opposed to only being able to access it?” Some details can reveal a clearer picture of the participants’ perceptions: for this question, 74 (or 28.79%) participants chose “extremely important,” 75 (or 29.18%) chose “very important,” 79 (or 30.74%) chose “moderately important,” 20 (or 7.78%) chose “slightly important,” and nine (or 3.50%) chose “not at all important.” In other words, nearly 90% of the participants felt digital ownership was moderately important to extremely important.
Table 1. Study Results Overview

<table>
<thead>
<tr>
<th></th>
<th>Importance measure</th>
<th>Willing to pay</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Std. Deviation</td>
</tr>
<tr>
<td>(1) Permanent access</td>
<td>4.64</td>
<td>5</td>
<td>0.71</td>
</tr>
<tr>
<td>(2) Unlimited number of uses</td>
<td>4.69</td>
<td>5</td>
<td>0.77</td>
</tr>
<tr>
<td>(3) Downloading</td>
<td>4.12</td>
<td>4</td>
<td>1.08</td>
</tr>
<tr>
<td>(4) Choosing format</td>
<td>3.47</td>
<td>3</td>
<td>1.16</td>
</tr>
<tr>
<td>(5) Converting format</td>
<td>3.14</td>
<td>3</td>
<td>1.30</td>
</tr>
<tr>
<td>(6) Reading on any device</td>
<td>4.16</td>
<td>4</td>
<td>0.93</td>
</tr>
<tr>
<td>(7) Reading in multiple software</td>
<td>3.81</td>
<td>4</td>
<td>1.06</td>
</tr>
<tr>
<td>(8) Renting to others</td>
<td>1.99</td>
<td>2</td>
<td>1.19</td>
</tr>
<tr>
<td>(9) Reselling</td>
<td>2.03</td>
<td>1</td>
<td>1.29</td>
</tr>
<tr>
<td>(10) Lending to others</td>
<td>3.03</td>
<td>3</td>
<td>1.34</td>
</tr>
<tr>
<td>(11) Giving to others as a gift</td>
<td>3.00</td>
<td>3</td>
<td>1.47</td>
</tr>
<tr>
<td>(12) Leaving it in your will</td>
<td>2.19</td>
<td>2</td>
<td>1.37</td>
</tr>
<tr>
<td>(13) Highlighting, bookmarking, &amp; annotation</td>
<td>3.49</td>
<td>4</td>
<td>1.31</td>
</tr>
<tr>
<td>(14) Copy the text</td>
<td>3.40</td>
<td>3</td>
<td>1.31</td>
</tr>
<tr>
<td>(15) Make copies for personal backup</td>
<td>3.03</td>
<td>3</td>
<td>1.37</td>
</tr>
<tr>
<td>(16) Cannot be removed by digital service</td>
<td>4.57</td>
<td>5</td>
<td>0.81</td>
</tr>
<tr>
<td>Ownership (vs. Access)</td>
<td>3.71</td>
<td>4</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Table 1. Study Results Overview

1, 2: Questions regarding choosing format and converting format are conditional and not displayed to participants who chose “not important at all” for the question about downloading.

Willingness to Pay for Digital Rights

Table 1 also shows the results of the questions regarding whether people would pay for each of the 16 rights, if having the right or not depended on the e-book price. The results are largely consistent with the importance with slightly different ranking. There is more willingness for the rights with higher importance scores, such as (16) cannot be removed, (2) unlimited access, (1) permanent access, (3) downloading, and (6) reading on any device. Again, participants were less willing to pay for the personal property rights such as (9) reselling, (10) lending, (11) gifting, and (12) leaving in the will, although (10) lending and (11) gifting appeared more important.

Therefore, to answer RQ2: What ownership rights are consumers willing or unwilling to alienate for the cost factor? The participants were more willing to give up their rights regarding traditional ownership/property rights associated with print books, and less willing to let go of rights associated with possession, use, and access.

Chi-square tests were used to find out the correlations between the importance of each right and users’ willingness to pay for the right, after recoding the Likert scale into two categories by combining “not at all important” and “slightly important” into a new “Not Important” category and combing "moderately important,” “very important,” and “extremely important” into a new “Important” category. Table 2 summarizes the results. It turns out, statistically, the more importance users assigned to the right, the more likely they would be willing to pay for that right if the right depended on the price. There are two exceptions—(1) permanent access and (6) the ability to read on any device. Both of them were ranked very high in terms of importance and willingness to pay. A possible explanation is that these rights were so necessary to users that they considered them deal breakers for the purchase.
Table 2. Results of Chi-Square Tests

<table>
<thead>
<tr>
<th>(1) Permanent access</th>
<th>Significant or not</th>
<th>$X^2$ Value</th>
<th>df</th>
<th>p</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>1.64</td>
<td>1</td>
<td>0.2</td>
<td>257</td>
<td></td>
</tr>
<tr>
<td>(2) Unlimited number of uses</td>
<td>Yes</td>
<td>14.63</td>
<td>1</td>
<td>0*</td>
<td>257</td>
</tr>
<tr>
<td>(3) Downloading</td>
<td>Yes</td>
<td>9.41</td>
<td>1</td>
<td>0.002*</td>
<td>257</td>
</tr>
<tr>
<td>(4) Choosing format</td>
<td>No</td>
<td>7.61</td>
<td>1</td>
<td>0.006*</td>
<td>249</td>
</tr>
<tr>
<td>(5) Converting format</td>
<td>Yes</td>
<td>10.97</td>
<td>1</td>
<td>0.001*</td>
<td>249</td>
</tr>
<tr>
<td>(6) Reading on any device</td>
<td>No</td>
<td>3.43</td>
<td>1</td>
<td>0.064</td>
<td>257</td>
</tr>
<tr>
<td>(7) Reading in multiple software</td>
<td>No</td>
<td>6.75</td>
<td>1</td>
<td>0.009*</td>
<td>257</td>
</tr>
<tr>
<td>(8) Renting to others</td>
<td>Yes</td>
<td>11.97</td>
<td>1</td>
<td>0.001*</td>
<td>257</td>
</tr>
<tr>
<td>(9) Reselling</td>
<td>Yes</td>
<td>16.35</td>
<td>1</td>
<td>0*</td>
<td>257</td>
</tr>
<tr>
<td>(10) Lending to others</td>
<td>Yes</td>
<td>16.03</td>
<td>1</td>
<td>0*</td>
<td>257</td>
</tr>
<tr>
<td>(11) Giving to others as a gift</td>
<td>Yes</td>
<td>41.07</td>
<td>1</td>
<td>0*</td>
<td>257</td>
</tr>
<tr>
<td>(12) Leaving it in your will</td>
<td>Yes</td>
<td>33.26</td>
<td>1</td>
<td>0*</td>
<td>257</td>
</tr>
<tr>
<td>(13) Highlighting, bookmarking, &amp; annotation</td>
<td>Yes</td>
<td>40.12</td>
<td>1</td>
<td>0*</td>
<td>257</td>
</tr>
<tr>
<td>(14) Copy the text</td>
<td>Yes</td>
<td>47.88</td>
<td>1</td>
<td>0*</td>
<td>257</td>
</tr>
<tr>
<td>(15) Make copies for personal backup</td>
<td>Yes</td>
<td>34.24</td>
<td>1</td>
<td>0*</td>
<td>257</td>
</tr>
<tr>
<td>(16) Cannot be removed by digital service</td>
<td>Yes</td>
<td>4.09</td>
<td>1</td>
<td>0.043*</td>
<td>257</td>
</tr>
</tbody>
</table>

1, 2: Questions regarding choosing format and converting format are conditional and not displayed to participants who chose “not important at all” for the question about downloading.

Generational Gaps
To answer RQ3: Are there generational gaps in people’s perceptions of digital ownership rights? The Pearson Correlation test was used to find the relationship between participants’ age and the importance they assigned to each of these 16 rights. There were three significant correlations: age and right permanent access ($r(257) = -.21, p < .001$), age and unlimited uses ($r(257) = -.297, p < .001$), and age and the ability to copy ($r(257) = -.20, p = .001$).

To find the relationship between participants’ age and their willingness to pay for each right, a series of $t$-tests were performed. The results show a few significant results, including older people being less likely to pay for unlimited use and copying the text and more likely to pay for choosing format and converting format.

A careful examination of all the test results and survey responses in context indicated these significant results were likely due to type I errors. In other words, there are probably no significant generational gaps between older and younger people’s perceptions of and willingness to pay for digital ownership.

Users’ Perspectives
With the help of NVivo software, multiple themes were identified from the 229 comments, including digital ownership rights, format/content preferences, concerns/confusion, cost, ownership feelings, etc. Focusing on the central theme—digital ownership rights, 216 comments were divided into five categories. Since these were free comments from the participants, the numbers were only reference points rather than definitive indicators.

Customer rights proponents (132 comments)
Over half of the participants can be categorized as rights proponents. Many used language such as “I paid for it; therefore I should own it,” or specifically, “[i]f I purchase something with the intention of ownership, I should be able to do what I want when I want without the company intervention, i.e. selling the book, lending it out,” or even more progressively, “[o]wning is very important, availability based on a corporation’s whim leads to totalitarianism.” One comment was particularly sharp:

Ownership is of the utmost importance. If I spend my own money on something, the purchased product needs to be mine and mine alone. As far as I am concerned a company that sells e-books voids ownership rights of
the book once the purchase has been made. In other words, it is now my property, not theirs. Digital rights, in other words need to be treated like property rights--especially IP rights and real property rights. It is unethical to editorialize ownership in any form or to question the ownership of an item once the purchase has been made. The buyer full and totally owns an item, digital or otherwise, in perpetuity and should not be subject to extra costs or another company to use or otherwise access their property. Anything else is financial servitude (i.e., renting) and unethical within a trade economy.

Among the 143 comments, 117 of them clearly expressed such opinions, within which 20 participants further indicated problems with rights made them less willing to buy e-books; seven of them pointed out that e-book purchases should be called renting; and four connected this issue with piracy. One participant said, “[i]f there are restrictions to these rights, consumers will be less likely to pay for a digital book and instead find a ‘free’ PDF version online.”

Those who felt strongly about ownership often used “I paid for it” as the reason and compared e-books with physical books, showing a strong association between “buy” and “own” and between physical ownership and digital ownership. While most of them did not define ownership clearly, some emphasized permanent access and downloading a copy as the basic components. For example, one said, “I would like to feel like I own my copy but rarely do unless I can download and share the copy without any restrictions.” Another comment reads: “I’ll even go so far as to pay for a book to support the author and then steal it after because I need it as a pdf I can edit.”

**Relaxed customers (43 comments)**

A considerable number of participants had a more relaxed attitude toward digital ownership. Four groups were further identified based on the essence of their comments. The first group stated the general unimportance of ownership but stressed the importance of certain rights, especially permanent, unlimited access, and no removal. For example, “as long as I have permanent access, I am ok with the level of ownership. Letting others borrow or selling to others is just a bonus.” Or, “I like being able to own an e-book and be able to access it without WiFi/ internet. Additionally, it’s important to me that the book can not be taken back. Other than that, I have no major defined opinions.”

The second group emphasized the importance of content—as long as they could consume the content, they did not care much about other things. For example, a participant said, “I care more about ease of use than anything else. Ownership is not a priority for me, I just want to be able to get to it when I need it and I want it to be easy to find.”

The third group valued the ease of use and access most and devalued other features: “For me, I mostly use e-books in my pursuit of knowledge. I have no real preference for the format that knowledge comes in as long as I’m provided with information.” Or, “[i]t’s not really that important to me. When I’m finished with a book I usually get rid of it anyway.”

The fourth group expressed their understanding and sympathy for the restrictions on ownership. For example, “[t]he main things I care about are ease of access and long-term access. I think I care less about things like being able to lend the book to others because I assume a big motivation for limiting that is preventing book piracy, which is harder to prevent with something as easy to duplicate as a digital file.”

Many e-book readers in this group accepted the fact that e-book purchase was different from physical books. The following quote is representative:

> When I buy an e-book, I acknowledge that I’m only buying the rights to view it, under whichever terms the company dictates. Usually, I purchase e-books that I only need temporarily (e.g. when it’s assigned for a class, but I can’t see myself ever wanting to own a physical copy). If I wish to own a copy, then I buy the physical book. However, there have been times that I chose to buy an e-book instead because it was cheaper. If cost weren’t an object in those cases, then I would have opted to buy the print version. Overall, I am content with not truly owning e-books in most cases. However, I would feel cheated if a company were to revoke my access to an e-book that was not specified as a rental.

However, there is also a sense of powerless in some comments. The following quotes are good examples:

- you never truly ‘own’ an e-book, more that you are purchasing the rights to use it, similar to software usage rights
- I would pretty upset if the seller just deleted the book from my devices or accounts, so I’d like the e-book sellers to respect that.
- I feel that without the knowledge that the book cannot be removed from my library I do not own it. I much prefer a paper copy for that specific reason. However, I know that many books are not available in any other form, so I’m trying to become comfortable with the e-book format.
It feels important to me to “own” my books, but I also mostly just go along with the way things are and don’t do anything to try to change it.

**Critical customers (27 comments)**

Some participants were critical of the current access model, and the following quote captures some ideas of these participants:

> The digital age has expanded access but removed rights. Ownership of anything digital is fleeting simply because it is digital and not only do you have to maintain and keep up with the product (e-book) itself, you also have to maintain to means with which you access it. This usually means more money as you must pay a subscription to your provider in addition to the cost of the product itself. What if my device fails? Can I reclaim ownership of my product if my data is all lost? Is it really even mine? Moreover, physical ownership can carry with it a sense of sentimental value. Knowing that this physical thing has aged with you over time. Has been with you through so many circumstances and places. A digital copy loses that character and charm. It’s just a product. Much more challenging to connect to.

A few participants raised even more significant issues, such as print culture, fair payment to authors, and who should own intellectual properties. For example, one participant said: “E-books, while convenient, ultimately hurt both authors and consumers who value enduring print culture.” Another participant commented as a writer:

> Ownership is very important for both authors and readers. The author benefits when his[her] ownership extends to offering his/her work for sale to customers who are guaranteed that their ownership is permanent. As an author myself, I want my readers to have my works available and in their possession permanently. And as a reader, I would pay more for this permanent ownership and I also want the author to get an adequate royalty too.

**It all depends (13 comments)**

These participants specified contexts where they would value ownership and where they would want access, which was often related to their book consumption habits and information needs. The cost was a factor often mentioned, both by participants in this category and other categories. For example,

> It all depends on cost. I have a Kindle Paperwhite that I enjoy using. If I’m paying a substantial amount I expect to own the book. If a paperback is $15, and the Kindle version is $10 or more, I expect to have the book for life. I also expect to be able to lend it to others just like I would a real book. I’d also like the option to sell it, where upon doing so it removes it from my device (an option Amazon doesn’t have).

**Non-users and non-buyers (11 comments)**

These participants said they did not care much about digital ownership because they rarely used or bought e-books. Some indicated they only bought physical books and borrowed e-books from libraries. It is worth noting that, for them, not caring about ownership was a result of not buying, in contrast to some rights proponents, who refused to buy e-books because of the ownership concern.

**DISCUSSIONS**

**Digital Ownership is Valued, but What is it?**

The survey results, especially regarding consumers’ general views on digital ownership (nearly 90% moderately to extremely important) and the textual comments (132 rights proponents), show that participants valued the ownership of e-books. This finding is consistent with other studies on digital virtual consumption (Virtua, 2022). But what does digital ownership mean to these participants? Many participants clearly expressed they would like to own digital books as they own physical books, and some even mentioned specific rights such as loaning and reselling. Without those questions in the first part of the survey regarding the 16 different digital rights, one would deduce that most users want to have all the rights associated with physical books. The answers to RQ1, however, do not support that assumption. Some fundamental property rights, such as unlimited use and permanent possession, were considered the most important, not surprisingly. But some of the essential personal property rights one would expect with physical books—the ability to resell them, lend them to friends, send them as gifts, and leave them in your will—were ranked low. They were less important than the rights regarding technology-enabled usage of e-books, such as reading on any device, downloading, reading on multiple software, highlighting, bookmarking, & annotation, copying the text, and making backup copies. Most participants were not willing to pay for those traditional property rights, especially reselling (only 57 participants were willing to pay) and inheritance (only 47 willing to pay).

These results appear to be not too different from previous studies on users’ perceived importance of various rights (Zhu & Cho, 2018). However, this survey is not about the importance of the digital features but about what made users feel ownership. The survey questions were clear on that point, and the participants followed the cue. It would have been more intuitive if the participants valued reselling, loaning, etc., as part of the ownership but would not pay
for it; however, the importance and willingness to pay were correlated. Therefore, the results may indicate consumers would willingly relinquish certain digital ownership rights both psychologically and financially.

There are several possible reasons for the discrepancy between the overall ownership importance/value and the assigned importance of several traditional property rights. First, when claiming they felt strongly about ownership, some participants might have mixed owning with buying; therefore, these participants might be simply indicating the importance of buying or obtaining a copy by “owning.” After all, ownership can be just “a consumer’s overall impression of a transaction” (Perzanowski & Hoofnagle, 2017). Second, when claiming “I pay therefore I own,” many might not have thought of certain traditional rights except those specifically mentioned those rights. Third, some participants may not have sold or traded physical books and, hence, did not automatically connect resale with ownership rights. Last but not least, some participants, by stating digital ownership should be similar to physical ownership, were merely making a normative claim and did not really believe they could. In any case, the study results indicate a narrower and more uncertain view of digital ownership than that of physical property ownership rights.

**Call it Rent!**

Digital ownership is complicated. Terms like buying, getting a copy, licensing, renting, and downloading are often used arbitrarily and have caused confusion. Perzanowski and Hoofnagle (2017) demonstrated users were often misled by these terms. However, some of the users’ assumptions/expectations found in their study were not too different from this study; for example, not many assumed they could resell the digital products they bought. It is worth noting that many participants in this study were aware of the differences between purchasing and licensing. Some of them even argued that e-book purchases should not be called “buying”—“renting” or “licensing” should be used by vendors instead. The fact that quite a few respondents stated they try not to buy e-books because of all the restrictions also shows participants’ deep understanding of the rights to digital ownership.

Meanwhile, as mentioned in the findings section, the participants’ comments indicate a sense powerless. Some participants would like to have ownership but felt they could not change anything. If participants in this study, a sample that is more educated, more white, more suburban, younger, and wealthier than the general population, felt powerless and had to purchase e-books for cost or other factors, even if they were concerned about their rights or actually preferred physical ownership, what does it mean for the rest of the general public? Customers are probably more and more used to leaving control of their “rights” to businesses rather than defining their own rights and claiming their ownership. In addition, as more and more people would like to buy, sell, and trade digital items and feel attached to them (Virtua, 2022), how to sell and trade should be redefined and included in users’ rights.

These findings indicate researchers should give more attention to the understudied area of digital ownership, get involved in policy-making, develop technological solutions, and help the general public to regain their rights.

**About the generational gaps**

There has been a general assumption that older people and young people consume and perceive information/media content differently (Aufderheide et al., 2015), and the Virtua (2022) report also identified many areas where Gen Z and older people had different behaviors and perceptions regarding digital items. This study, however, did not find many relations between age and e-book ownership perceptions. Even for the right of leaving it in your will (#12), older people did not feel more important than younger participants did. This result is consistent with the previous study on media consumption, which found the age factor might play a role in the e-book consumption preferences, such as borrowing, renting, or buying, but did not find specific relations between age and digital rights (Zhu & Cho, 2021). This finding may provide one reason why we should study digital books independently from other digital content. E-book are different from other digital possessions, such as game items and avatars, with which there may be more generational gaps (Virtua, 2022). Books stand out as a ubiquitous form of media content, surpassing all others in terms of prevalence. Their universal appeal transcends age and background. In contrast, the consumption of other digital items often remains a matter of personal choice.

**CONCLUSION**

As digital privacy, internet access, freedom of expression and communication, the right to anonymity, the right to be forgotten, and safe access without infringing the rights of children are becoming high-profile issues in scholarly literature and public discourses, digital ownership rights also deserve attention from scholars. Research focusing on users and their rights will not only contribute to our knowledge but help public-interest groups and policymakers initiate actions to renew customers’ digital rights. Digital rights are fleeting, and we should not leave the power entirely to the digital marketplace.

**REFERENCES**


Exploring Information Seeking and PIM Practices of Early-Career Researchers: Insights into Navigating Academic Transitions

Alon, Lilach  Cornell University, USA | lilachalon26@gmail.com

ABSTRACT
This study represents the initial phase of a broader investigation into the significance of information seeking and personal information management (PIM) practices during life transitions. It focuses on early-career researchers who experience multiple academic transitions and aims to identify the information practices they use and their role in promoting successful life transitions. To achieve this goal, in-depth semi-structured interviews were held with 15 early-career researchers who recently completed their PhDs or graduated. Findings suggest that the participants relied on iterative cycles of various information seeking and validation practices to transition between positions and academic institutions, which improved their knowledge about the transition and reduced uncertainty. Once a network of transition-related information was established, participants began utilizing PIM practices to organize their information and plan for the transition, thereby enhancing their sense of control over their information and maintaining it over the long term in an unstable environment. The study underscores the importance of information practices during life transitions and recommends interventions such as institutional support and information skills training programs to assist early-career researchers in challenging transitions. The subsequent study will build upon these findings to further examine the role of information behavior in facilitating life transitions.

KEYWORDS
Information seeking practices; PIM practices; Early-career researchers; Life transitions.

INTRODUCTION
Life transitions are a natural and inevitable part of human existence, occurring at different stages and under various circumstances, such as family, career, and academic transitions. Successful life transitions can foster personal growth and help individuals achieve their goals (Bauer & McAdams, 2004; Leal et al., 2021). However, they can also be challenging, with implications for personal and social aspects of one's life (Brissette et al., 2002; Kralik et al., 2006). Recently, Ruthven (2022) made a significant observation that life transitions consist of distinct stages, ranging from an understanding of an event to subsequent utilization of specific responses. These stages demand individuals to employ various forms of information behavior to effectively navigate through them. Hence, in today's information era, understanding information behavior during life transitions is crucial as access to relevant and updated information, along with efficient management and organization of such information, can be critical for a successful transition (Caidi et al., 2010; Moffatt & Heaven, 2017).

This study focuses on early-career researchers to examine the role of information behavior during life transitions. Early-career researchers were chosen as the target group due to their frequent experiences with academic transitions, as they transition from doctoral studies to the job market while aiming to establish a stable career in academia or industry (Fisher & James, 2022). Throughout these transitions, they face unique challenges that involve seeking and managing a substantial amount of information pertinent to their research and professional development (Nwagwu, 2023). However, little is known about how they navigate and manage information during these transitions. This preliminary study aims to fill the research gaps by exploring the information-seeking and personal information management practices of early-career researchers. The objectives of this study are to shed light on the information needs of early-career researchers and to suggest interventions to support them during challenging transitions.

BACKGROUND
Early-career researchers are commonly defined as those who are currently in their doctoral studies or were granted their PhD not more than a decade ago (Mula et al., 2021). Previous research has explored different aspects of information behavior among early-career researchers, including publication practices (Pickering & Byrne, 2014), the process of becoming independent researchers (Browning et al., 2017; Laudel & Gläser, 2008), information skills development (Exner, 2014), and PIM platforms needs (Cushing & Dumbleton, 2017). However, there has been limited attention to understanding how early-career researchers navigate career transitions using information behavior, and specifically, how they utilize information seeking and PIM practices to promote these transitions.

Information seeking is a research area that aims to understand how individuals seek and use information to master life's challenges (Savolainen, 1995). Information seeking practices involve searching for and acquiring relevant information items for a specific need (Savolainen & Thomson, 2022). On the other hand, PIM is a research area that explores the practices individuals perform in their everyday lives for acquiring, saving, organizing, maintaining, and retrieving personal information items (Jones et al., 2015; Krtalíč & Dinneen, 2022). These two information
behaviors are essential skills, especially during life transitions, when things might be uncertain or unclear (Moffatt & Heaven, 2017). Despite the potential benefits of understanding these behaviors, they have not been explored in the context of life transitions, and specifically, how they may support the transition experiences of early-career researchers. Hence, this first phase of the study aims to identify information seeking and PIM practices of early-career researchers and understand their importance for academic transitions.

METHODS

Research Approach

A phenomenological approach was utilized to understand the information behavior of transitioning early-career researchers. This approach facilitated a thorough exploration of subjective experiences and the significance attributed to them (Creswell, 1998; Malterud, 2012). It was chosen because it is a useful way to investigate a relatively new topic with limited empirical background (Alon et al., 2019).

Participants

Fifteen early-career researchers (11 female and 4 male) were initially recruited to participate in this study. The participants, with an age range of 28 to 45 years (Mean = 35.73, SD = 4.54), had completed their Bachelor’s and Master's degrees at various higher education institutions in Israel, and were either in the process of completing or had completed their PhD degrees in Israel or abroad. All participants expressed a desire to pursue or were already pursuing a postdoctoral fellowship in a higher education institution outside Israel, such as in Europe or the United States. The participants’ characteristics are summarized in Table 1.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Age</th>
<th>Discipline</th>
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<th>Academic stage</th>
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Table 1. Participants’ Characteristics

Tools and Procedure

Following the phenomenological approach, semi-structured, one-hour, interviews were conducted with 15 Israeli participants. The interview protocol consisted of three stages: oral consent, interview questions, and a closure. First, Participants were given the option to withdraw their participation at any time and choose the questions they were comfortable answering during the oral consent stage. The second stage involved asking participants ten open-ended questions that aimed to elicit detailed and reflective responses regarding their information behavior during doctoral studies, postdoctoral fellowships, and the transition between the two. The questions were carefully designed to gain a deeper understanding of the experiences of early-career researchers. Examples of the questions asked include "Describe the process of searching for doctorate studies or postdoc positions. How did you seek relevant information?" and "What aspects of your information seeking/PIM worked well during academic transitions, and what would you like to change?". In the third stage, participants were asked to provide contact details of additional early-career researchers who fit the study’s criteria and might want to participate. Snowball sampling was used to recruit participants. A request inviting early-career researchers to take part in a one-hour interview focused on academic transitions was posted on social media. After conducting the interviews, participants were asked to provide referrals of other researchers who might be interested in contributing to the research. Interviews were conducted via Zoom between July and October 2022, video recordings were deleted, and the audio files were transcribed. To ensure anonymity, identifying information was excluded (e.g., name, research area, university, department).

Analysis

The systematic text condensation method (Malterud, 2012) was used in the analysis process. It involved four stages: identifying general categories, classifying meaning units, condensing the findings, and synthesizing and explaining
the results. The coding scheme consisted of two categories, information seeking practice utilization and PIM practice utilization, which were predefined based on the research question. Sub-categories were identified based on previous literature and novel aspects that emerged from the transcriptions. During the analysis, quotes were carefully reviewed and checked for proper classification, and the overall coding scheme was refined and explained. Table 2 provides a description of the final coding scheme, including the identified categories and sub-categories.

<table>
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<th>Categories</th>
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<td>Information seeking practices</td>
<td>Networked information seeking and validation</td>
</tr>
<tr>
<td></td>
<td>Independent information seeking and validation</td>
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<td>PIM practices</td>
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<tr>
<td></td>
<td>Backing up information</td>
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<tr>
<td></td>
<td>Using individual PIM platforms</td>
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Table 2: Coding Scheme

**FINDINGS**

**Information Seeking Practices**

The utilization of information seeking practices was found to be vital for successful academic transitions, as one of the participants said: "When you start searching for information, you get the feeling of what you're looking for" (P12). The process of information seeking involved searching for and validating information collected from multiple sources, using both networked and independent information seeking practices. All of the early-career researchers in this study employed networked information seeking practices as a crucial first step in their transition journey. They reached out to other researchers both within and outside their social and professional networks in order to gain access to relevant information. Participants described three key networked practices. First, they initiated informal conversations with researchers and colleagues: "A friend in the lab told me about the job opening" (P9). Second, they attended professional conferences and gatherings: "I attended lectures on academic transitions and made connections with experienced scholars" (P14). And third, they utilized online social networks to seek information, with one participant stating, "I opened Twitter and found out about a website with job openings" (P12).

The early-career researchers in this study also utilized independent information seeking practices, which were solely conducted online and unrelated to their social and professional networks. These practices were often a second phase in their transition journey, following the networked information seeking phase. The participants described three online independent practices. First, they used multiple Google queries to find job openings and funding opportunities, as one participant stated, "I searched Google for universities and learned about researchers and their areas of expertise" (P7). Second, they sent emails to professors they knew within and outside their academic network and found them to be very responsive: "I contacted several professors I knew from my research, and they responded quickly" (P15). Lastly, one participant utilized an automated search by coding spiders, which are a few lines of code that retrieve relevant results for internet pages: "I learned how to code spiders to retrieve relevant information from internet pages" (P3).

After discovering potentially relevant transition-related information, they utilized iterative cycles of information validation. The validation process included using both networked and independent information seeking practices to establish a network of transition-related information: "You must validate every piece of information, and check if it's relevant and if it fits your values and perceptions" (P8). The validation process allowed early-career researchers to prepare their information items for the subsequent process of managing and organizing them in their personal spaces of information: "You feel like you're sinking, but then you slowly start to take out the water with a cup until it's organized" (P5). Overall, the iterative process of networked information seeking and validation helped the researchers to reduce uncertainty and better navigate the transition.

**PIM Practices**

Early-career researchers utilized PIM practices as a second stage following information seeking practices. Once they found relevant transition-related information items and validated them, they started organizing items in the personal spaces of information. Overall, three PIM practices were identified: (1) opening a folder; (2) backing up information; and (3) using individual PIM platforms. Opening a folder was a meaningful step towards the transition and was perceived by participants a way to plan for it: "My academic future is unclear, so I try to organize my information" (P2). They carefully thought about the correct timing to start utilizing filing practices that would help them plan for their transition, and often did so only when they had established a clearer direction for their academic transition. Changes in the use of filing practices occurred throughout the academic transition. Early-career researchers who were further along in their transition process were more likely to plan for it by developing a well-established hierarchical set of folders: "The more advanced the process became, the more I created folders and sub-
folders" (P1). However, another participant in an earlier stage remarked, "I haven't started my research or won a grant yet, so it's too early to open a folder" (P4). The creation of an organizing system reflected the necessity of early-career researchers to establish some certainty during an unstable phase of their lives and played a significant role in their ability to plan for the transition.

The second PIM practice identified was backing up information before, during, and after academic transitions. By regularly backing up their information, early-career researchers were able to safeguard against potential information loss, and to maintain access to important files and documents throughout their academic transitions: "Before I left [the lab], I backed up everything; this is something you should think about before you leave" (P4). The third PIM practice identified was using personal digital platforms for PIM instead of relying on the academic institution’s platforms. Managing information on personal, self-controlled, digital platforms gave participants a sense of control over their information and assisted them in maintaining information during multiple academic transitions: "I rather pay than deal with the organizational platforms. I only work with my personal cloud and email" (P14). Using individual platforms helped participants maintaining information for the long run and provided a sense of control in an unstable environment.

**DISCUSSION AND IMPLICATIONS**

This study confirms that information behavior plays a critical role in successfully navigating academic transitions. Early-career researchers used both networked and independent information seeking and validation practices during academic transitions. These practices enabled them to establish a stable network of transition-related information, acquire knowledge, and reduce uncertainty about the upcoming transition. These findings align with previous research that underscored the importance of information seeking practices in unfamiliar environments (Keller et al., 2020). The study also highlights the significance of seeking support from colleagues and peers while navigating academic transitions (Haimson et al., 2021; Gong et al., 2021), particularly for early-career researchers. Findings also revealed that early-career researchers employed various PIM practices after completing the information seeking phase to navigate academic transitions. These practices helped them maintain personal information over the long term (Krtalic & Ihejirika, 2022) and gain a sense of control over their information items (Alon & Nachmias, 2020; Kaye et al., 2006). As the transition progressed, the PIM practices became more refined and hierarchical, reflecting the increasing need for organization and planning. Overall, these PIM practices provided stability in the ever-changing academic journey typical of early-career researchers (Jackman et al., 2022).

Overall, we highlight the importance of information seeking and PIM practices in facilitating successful life transitions (Ruthven, 2022). These practices helped researchers to reduce uncertainty, provide a sense of control, and maintain information over the long term in an unstable environment. Theoretically, the study offers a fresh perspective on the significance of information behavior during life transitions, which could be further explored in larger, more comprehensive studies. Practically, the study underscores the importance of improving information seeking and PIM skills among early-career researchers. Academic institutions should recognize the significance of these skills and integrate them into the education of advanced PhD students and postdoctoral researchers to provide support throughout their academic journey. It is recommended to develop programs and resources that support these skills, including opportunities for individual reflection, peer activities and discussions, and learning about new information seeking and PIM practices and tools (Alon & Nachmias, 2019; Hardof-Jaffe & Nachmias, 2011).

This study is the first step in a larger project aimed at enhancing our understanding of the role of information behavior during life transitions. The limitations are primarily related to the limited sample size and narrow scope of analysis. In the subsequent phase, the analysis will be expanded to encompass the challenges associated with life transitions and their connection to information practices. Additionally, a framework will be developed to delineate the role of information behavior during life transitions.

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“I Am in a Privileged Situation”: Examining the Factors Promoting Inequity in Open Access Publishing

Ayeni, Philips
McGill University, Canada | philips.ayeni@mcgill.ca

ABSTRACT
Despite increasing advocacy for open access (OA), the uptake of OA in some disciplines has remained low. Existing studies have linked the low uptake in OA publishing in the humanities and social sciences (HSS) to disciplinary norm, limited funding to pay for article processing charges (APCs), and researchers’ preferences. However, there is a growing concern about inequity in OA scholarly communication, as it has remained inaccessible and unaffordable to many researchers. This study therefore investigated inequity in OA publishing in Canada. Using semi-structured interviews, qualitative data was collected from 20 professors from the HSS disciplines of research-intensive universities in Canada. Data was analyzed with NVivo software following the reflexive thematic analysis approach. Findings revealed three main causes of inequity in OA publishing among the participants. These are the cost of APCs, unequal privileges, and gender disparities. Hence, there is a need for concerted efforts by funding agencies, stakeholders, higher education institutions, and researchers to promote equity in OA scholarly communication. Some recommendations for improving equity in OA publishing are provided in this paper.

KEYWORDS
Scholarly Communication, Open Access, Equity, Publishing Practices, Canada

INTRODUCTION
Open access (OA) to research outputs is fundamental to promoting equity of access to scientific information and knowledge, thereby promoting and advancing the frontiers of knowledge, solving societal problems (Swan, 2012; Suber, 2012). The core ideal of OA publishing is to ensure that anyone with access to the internet can access research outputs without the barriers of cost and copyright restrictions (Bjork, 2004; Suber, 2003), thereby ensuring equitable access to knowledge. OA publishing has been promoted as a means of ensuring equitable access to research outputs (Evans, 2012). Researchers, practitioners, policy makers and other user categories are afforded equitable access to novel and ground-breaking research through OA publishing. In the same vein, OA is also beneficial to researchers as it increases the impact and citation of their research (Eysenbach, 2006; Ghane, Niazmand, & Sarvestani, 2020; Lewis, 2006; Mikki, 2017). As such, efforts to ensure immediate access to research outputs have increased across the globe recently. For instance, in 2015, the three main funding agencies in Canada (i.e., Tri-Council) jointly introduced an OA policy on immediate availability of research funded by them (Hurrell, Smith & Wake, 2017). Other recent efforts include 2018 Plan S open access mandate in Europe (Johnson, 2019), UNESCO recommendations on open science (UNESCO, 2021), and the White House Office of Science and Technology Policy (OSTP) policy guidance on open science (OSTP, 2022), among others.

As emphasized by UNESCO (2021), open science should be instrumental to ensuring equity, fairness, diversity, and inclusiveness among researchers from developed and developing countries. However, the current models of OA publishing seem to be proliferating inequities among researchers (Gray, 2020; Momeni, Dietze, Mayr, Biesenbender, & Peters, 2022), thereby working contrary to the ideals of OA. As more institutions in Canada and globally are increasing their diversity, equity, and inclusion efforts and commitments, it is also expedient to ensure equity in OA publishing among researchers. Fleming, Wilson, Hart, Therrien, and Cook (2021) defines equity in research as “fair and impartial access to the process and products of research” (p. 110). Ensuring equity in OA publishing is to reprioritize opportunities and support to reduce or eliminate systemic imbalances (Judd & McKinnon, 2021). Although, many researchers are beginning to adopt and increase their OA publishing practices, there seems to be several barriers limiting them from doing so effectively (Rodriguez, 2014; Zhu, 2017). With the growing inequity in OA publishing, there is a need to unravel factors responsible for these equity gaps with the hope of bridging those gaps. This study therefore fills the gap in knowledge by collecting data directly from researchers about the limitations of their OA publishing practices.

Objectives of the Study and Research Questions
This study seeks to uncover factors causing inequity in OA scholarly publishing among humanities and social sciences researchers in Canada. This study answered the following research questions:

1. What causes inequity in open access publishing practices among researchers in Canada?
2. How can we make open access publishing more equitable?
LITERATURE REVIEW
Several limitations to researchers’ engagement in OA publishing have been reported in literature. Apart from the resistance from researchers to publish OA or self-archive (Cullen & Chawner, 2011; Dlamini & Snyman, 2017), some studies have also identified other factors such as disciplinary differences (Laakso & Björk, 2021; Larivière & Sugimoto, 2018; Severin, Egger, Paul, & Härlimann, 2020; Suber, 2017), career stage and requirements for career advancements (Nicholas et al., 2020) and limited funding opportunities (de Winde et al., 2020; Eve, 2015).
Recently, equity in scholarly communication has received attention from researchers. In this paper, equity is considered through the lens of Equity Theory (ET), which has been applied in predicting performance level and turnover among managers (e.g., Dansereau, Cashman, & Graen, 1973). OA publishing will be equitable when researchers are not limited by cost, language barrier, gender disparities, and other factors associated with inequity.

Moreover, many studies have focused on how to mitigate the effect of article processing charges (APCs) on OA scholarly communication, which Klebel and Ross-Hellauer (2022) called the ‘APC-effect.’ This is because APC is one of the prominent barriers to OA publishing globally, especially in gold and hybrid OA journals (Halevi & Walsh, 2021; Klebel & Ross-Hellauer, 2022; Rodrigues, Savino, & Goldenberg, 2022; Scott, 2018). This is particularly worrisome as hybrid OA journals were found to be increasing inequities among researchers with limited funding, particularly those from the Global South (Demeter, Jele, & Major, 2021). Funding agencies and advocates of OA have recently been promoting the diamond OA as a viable and sustainable model of OA publishing (Holley, 2018). With diamond OA, authors are not charged any publishing fees (i.e., APCs) and users can access the published articles free of any cost and copyright restrictions. Hence, this model is preferred by researchers and funders alike (Baro & Eze, 2017; Bosah, Chuma Clement, & Baro, 2017). However, the majority of prestigious OA journals still operate the gold or hybrid OA model, perpetuating the increasing need for APCs (Laakso & Bjork, 2016; Sotudeh & Estakhr, 2018).

Aside the impediments to OA publishing caused by APCs, there are other causes of inequity in OA publishing. Few studies have found gender differences in OA publishing, as authors of male gender from prestigious institutions have higher likelihood for publishing OA articles (Olejniczak & Wilson, 2020; Zhu, 2017). On the contrary, a recent study found that articles with women’s contributions are published at a higher rate in OA compared to their male counterparts (Ruggieri, Pecoraro, & Luzi, 2021). This could be because female professors are generally more supportive of OA publishing (Rowlands, Nicholas, & Huntington, 2004). However, publication costs were of higher relevance for women than men in making publishing decisions, as found in a survey of Canadian and US academics (Niles, Schimanski, McKiernan, & Alperin, 2020). Hence, the inequity in OA publishing is caused by several factors, which have not been entirely captured in existing research. For the Canadian context, there is paucity of research on the factors responsible for inequity in OA publishing, and this research helps to fill this gap.

METHODOLOGY
This study employed qualitative research design (Pickard, 2013). Data was collected using semi-structured in-depth interviews, conducted online via Zoom. Participants included professors from the U15 (research-intensive universities) in Canada. Participants were drawn from HSS disciplines, as research has shown that OA uptake in HSS disciplines is lower when compared to the STEM disciplines (Piwowar et al., 2018). Hence, it is imperative to understand the factors limiting the OA practices of researchers in the HSS disciplines. The maximum variation sampling guided the selection of the interview participants (Teddlie & Yu, 2007). This helped to ensure that participants were drawn from a variety of disciplines in the HSS disciplines, which provided rich insights into the OA publishing of researchers from different disciplines. Ethics approval was received from the Research and Ethics Board of McGill university, Canada. Participants received consent forms regarding the study, which they digitally signed and returned to the researcher.

Invitations to participate in an interview were sent via email to 29 professors. Out of the 29 invitations, 20 professors responded and participated in the interviews, given 68.9% response rate. Interviews were conducted between March-April 2022. Interview sessions lasted for approximately 60 minutes and were audio recorded. Audio records were transcribed completely verbatim. Participants’ names and identities were anonymized using pseudonyms. Data was analyzed with NVivo software, following the (reflective) thematic analysis procedure (Braun & Clarke, 2021). The six phases of thematic analysis employed in this study are: (1) data familiarization; (2) systematic data coding; (3) generating initial themes from coded data; (4) developing and reviewing themes; (5) defining, refining, and naming themes; and (6) writing the report. Three main themes regarding inequity in OA publishing emerged from the analysis and informed the findings in this paper.

FINDINGS
Demographic information
Of the 20 participants, 11 participants (55%) are female, while nine participants (45%) are male. 11 participants (55%) are from the social sciences, while nine participants (45%) are from the humanities. Further, twelve
participants (60%) are associate professors while eight (40%) are assistant professors. This shows that interview participants who earned their PhDs within the last 7-15 years were more than those who did within the last 1-6 years. Hence, the mid-career researchers were slightly more than early career researchers in this study, and there were more females participants as well.

Factors causing inequity in OA Publishing
Findings revealed the rising inequities in participants’ OA publishing practices among the participants. Three themes that emerged from the thematic analysis are (1) Unaffordable APCs limited OA publishing; (2) Unequal privileges influenced OA publishing; and (3) Gender disparities stifled OA publishing. These factors have exacerbated the barriers in OA publishing among researchers in the HSS disciplines in Canada. Some participants realized these inequities and discussed their concerns on the impact it would have on OA publishing practices of researchers in other institutions. These three themes are discussed in the following sub-sections.

1. Unaffordable APCs limited OA publishing
The most frequently discussed cause of inequity in OA publishing by the participants is the cost of APCs which has systemically incapacitated them from publishing OA, particularly the early career researchers. For instance, as Jessica opined: “I think that open access in general in my area, is just accessible to a very small group of researchers who can afford it, which I don’t think is the point of open access.”

This means that the cost of APCs of many hybrid journals has made OA publishing inequitable to researchers who do not have funding for paying the associated fees. As funding is limited in the HSS disciplines compared to the STEM fields (de Winde et al., 2020; Eve, 2015), OA publishing has remained inaccessible to many participants. This is common among participants in their early career years, who cannot afford the cost of APCs. Hence, they either seek default OA journals (i.e., diamond OA journals) or publish in paywalled outlets. As Grayson confirmed: “There are people who don’t have that [money to pay APCs] then don’t have access to open access publishing unless they go with a default open access outlet.”

Relatedly, Sophia also revealed: “As a junior scholar with a limited budget, a research budget, I wouldn’t have paid the $6000 to publish open access ‘cause I would have an option to publish not open. I’m not about keeping research behind a firewall, but I also think that it privileges in some ways, people who have more funds.”

This suggests that APCs continue to be a huge barrier to OA publishing, especially among those who are not in the Western countries. Many researchers cannot afford the cost of making their research OA. As Olivia reiterated: “I think article processing charges inhibit publishing by early career researchers and doctoral students, and they inhibit publishing by people who are not in Western academia.”

This finding lends strong support to existing research which found inequities in OA publishing among researchers, particularly early career researchers and others who cannot afford APCs (Momeni et al., 2022; Nicholas et al., 2017). Furthermore, Gray (2020) found that perceived credibility and prestige of OA journals based in high-income countries was influenced by APCs. This implies that OA journals with low APCs or no APCs may be perceived as having low prestige. This was confirmed in another study (Demeter et al., 2021) which found a correlation between hybrid OA journals which charge APCs and high impact factors. By implication, authors who want to publish in high-impact factor journals but cannot afford to pay the associated APCs will rather publish behind paywalls. This explains the complexity in the APCs model of OA, and how it continues to entrench inequities in OA publishing.

2. Unequal privileges influenced OA publishing
Aside from the high cost of APCs, inequity in OA publishing was also linked to unequal privileges. As some participants revealed, they enjoy certain privileges because of their institutions and country of birth. Some interview participants recognized they are in privileged situations in terms of the language of writing and communicating their scholarship. As discussed by Georgia: “I am acutely aware that I am in a privileged situation. My university has the money. My university library does subscribe to a lot of journals. I publish in a language that I feel very comfortable writing in. It's one of my first languages. So, I'm in privileged position and so it really isn't fair for me to hold other people to this unreasonable standard that they have the very same things I do when I'm not paying for them.”
Many universities are now entering transformative agreements with journals to transition into full OA publishing while they maintain current subscriptions. Researchers from such institutions can publish OA without paying the associated cost of APCs, although not the best approach to achieve OA (Shearer, 2022). Researchers in universities with limited funding or developing countries do not enjoy this privilege; hence, their OA publishing is grossly limited. This finding supports existing studies which found that the current OA publishing models privilege researchers with funding and resources, and it limits OA uptake by researchers with limited funding (Gray, 2020; Momeni et al., 2022).

3. Gender disparities stifled OA publishing practices
Participants also discussed their inequity experiences caused by gender disparities. Some female participants lamented their low engagement in OA publishing because of family responsibilities and limited opportunities due to lack of time. For these participants, raising a kid and handling other family responsibilities mean that they have limited time to search for OA outlets, which they believe male faculty may not experience. For instance, Freya lamented: “I'm really busy with children. So, I'll publish as opportunities arise and they're not always an open access journal, so that limits the possibilities. It totally affects it 'cause I have less time to search out opportunities, I don't know all the open access journals in my area.”

Other female participants shared similar views with Freya when they identified family responsibility, childcare, service loads as some of the reasons for not publishing OA. For example, Evelyn indicated: “I published [open access] maybe one to two times a year more recently 'cause I had a kid. But otherwise, you know a couple times a year.”

This was further amplified by Farah, who clearly articulated: “It adds to that whole conversation of service load is considered for female faculty members and not for male faculty members, and they are the ones benefiting—like male without family. So, they don't have childcare duties... It adds pressure and workload and free labor on racialized and gendered faculty members... So, the load is for free on the shoulders of mostly women and racialized members.”

In general, research productivity of female professors has been found to be lower when compared to their male counterparts (Cui, Ding, & Zhu, 2022; Garner, Porter, Leidolf, & Baker, 2018; Sá, Cowley, Martinez, Kachynska, & Sabzalieva, 2020). This is the case with OA publishing as well, confirming existing studies which found that male professors are more likely to author OA articles because female faculty are usually less funded (Nguyen, Nguyen, Le, Ho, & Vuong, 2021; Olejniczak & Wilson, 2020; Zhu, 2017). This highlights gender disparities in OA publishing among HSS researchers in Canada. This paper considers gender as a binary; hence future work should consider race as a factor causing inequity in OA publishing. Also, exploring the differences in OA publishing among unmarried female scholars and male scholars might be worthwhile. This will help provide a holistic understanding of how gender disparities affect OA publishing among researchers.

**Recommendations for making OA publishing more equitable**

1. One of the ways of reducing the inequity caused by APCs is to fund and promote viable OA publishing models such as the diamond OA journals (Baro & Eze, 2017; Holley, 2018). It is also expedient to develop more prestigious OA journals to encourage participation across board (Baffy et al., 2020; Eve, 2015).

2. Inequity caused by unequal privileges could be reduced through equitable distribution of resources for scholarly communication (Seo et al., 2017). It can also be reduced by ensuring that researchers have unhindered access to knowledge through OA availability of research outputs. Self-archiving in institutional or subject repositories can also help to reduce the inequalities in access to research (Shearer, 2022).

3. To reduce gender disparity effect on OA publishing, there is a need to increase awareness of viable OA journals, particularly the diamond OA relevant to researchers’ fields of interest (Tenopir et al., 2017). Moreover, there needs to be strong support for female or other gendered faculty in their scholarly communication practices. This could be done by incentivizing OA publishing and recognizing OA engagement and advocacy as service loads. More conversations about OA are needed, and there should be more support for researchers with limited resources (Seo et al., 2017), thereby ensuring equity in OA scholarly communication.

**CONCLUSION**

This study examined the causes of inequity in OA publishing among HSS researchers in Canada. Although researchers are supportive of OA, barriers such as APCs, unequal privileges, and gender disparities are limiting their OA publishing practices. Hence, there needs to be concerted efforts in promoting viable and sustainable OA models which shift the burden of OA publishing from researchers. As many higher education institutions are embedding equity, diversity, and inclusion plans in their strategic goals, it is equally important to actively plan for and promote equity in scholarly communication landscape. There is a need to normalize OA within academia. This study provides a preliminary understanding of inequity in OA publishing, as part of a large study that examines OA scholarly communication in Canada. Hence, further studies are needed to provide a holistic understanding of inequities in OA publishing, considering factors such as race, and comparing the HSS and STEM disciplines.
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From Ice Cores to Dinosaurs: Curation Behaviors of Physical Collections Managers

**Bishop, Bradley Wade**  
University of Tennessee-Knoxville, USA | bbisho13@utk.edu

**Gavel, Sidney Wanda Taylor**  
University of Tennessee-Knoxville, USA | sgavel@vols.utk.edu

**Chapin, Emily Grace**  
University of Tennessee-Knoxville, USA | echapin2@vols.utk.edu

**Kansa, Sarah**  
University of California, Berkeley, USA | sarahkansa@gmail.com

**Thomer, Andrea**  
University of Arizona, USA | athomer@arizona.edu

**Ramdeen, Sarah**  
Northrop Grumman, USA | sarah.ramdeen@gmail.com

**ABSTRACT**

Large investments of public funds to curate huge volumes of various physical samples acquired and stored over decades, and in some cases centuries, provide ample reasons to make these items as openly accessible, as easily discoverable, and as well-documented as possible to ensure this investment results in reuse. The purpose of this study is to understand the curation behaviors of managers of physical collections. Six focus groups were conducted with twenty participants from several physical sample communities. Participants responded to open-ended questions that relate to the entire data lifecycle for their research objects. Results indicated that physical collections would benefit from use of universal metadata and data storage standards to increase sharing across domains. Both of these factors contribute to access and use obstacles all these collections face in different ways. In the context of managers requiring more investments to encourage reuse of these invaluable items, this study hopes to provide preliminary domain-agnostic data to inform design of collections cyberinfrastructure, resources, and services using actual curation behaviors.

**KEYWORDS**

Physical Collections, Research Data Management, Research Data, Science Data, FAIR Data Principles

**INTRODUCTION**

The state of samples and sample data management in the U.S. and globally is highly fragmented across many stakeholders, including museums, federal agencies, academic institutions, and individual researchers, with a multitude of institutional and discipline-specific catalogs and repositories, as well as varied practices for sample curation workflows. This complex context results from fractured and uneven funding that established and supported infrastructures built by and for generations of scientists whose research interests and data needs changed with scholarly practices and technological advances. Today, data-intensive science and computational approaches drive the future of all scientific domains.

Revamping the cyberinfrastructure, support services, and research data management (RDM) tools, for all domains now grows in importance and physical collections in particular face a number of obstacles to enable science data to align with machine-actionable aspirations like the FAIR Data Principles (to be as Findable, Accessible, Interoperable, and Reusable as possible), ethical considerations such as the CARE (Collective benefit, Authority to control, Responsibility, and Ethics) Principles for Indigenous Data Governance, and new US and other national mandates across funding agencies for as open data as possible (Wilkinson et al., 2016; Carroll et al. 2020; NIH, 2020). This study helps understand the curation behaviors of managers of physical collections. Six focus groups were conducted across communities that work with physical samples, including anthropology, archaeology, paleontology, ichthyology, herbaria, and geologic cores. Current perspectives on curation and use practices may inform design of cyberinfrastructure as well as RDM resources and services.

**LITERATURE REVIEW**

Physical collection managers work to provide access and enable reuse of these valuable items that are collected only once from the Earth and have potentially unknown scientific value as new techniques and research questions emerge. For example, an ice core may contain gases and other elements that capture the atmosphere from thousands of years ago, and the DNA of microscopic species trapped in the ice. A drawer of fossilized brachiopods may fill missing pieces in both their long evolutionary history as well as insights into the geology of the planet. Legacy data of all types that may have been collected long before the precision of today’s GPS or modern taxonomies or even before more systematic documentation or metadata standards have limitations on their reuse, but retain value considering that the specimen, rock, or other object is only discovered once in real-time.

The data story after data collection for objects varies across disciplines. The preservation and management strategies over time rely on the expertise of specialists with unique training. In today’s data-intensive paradigm for hard sciences, RDM provides another layer of considerations for making physical collections accessible and reusable. RDM entails appraising, preserving, storing, and transforming digital objects to enable reuse beyond the original...
data collector. Increasingly research institutions and funding agencies across the globe have both incentivized and mandated data sharing as a way of supporting a more open and data-intensive research enterprise. As AI and specifically machine-learning progresses, the need to understand how humans discover and evaluate science data will become increasingly important to build those heuristics that humans gain from years of experience into our tools and artificial research assistants. For the physical collection manager, their default data originate from actual tangible items that have ancillary data themselves. Associated data for physical objects may include a ton of extra derived data when aggregated, analyzed, and transformed. Although it depends on the discipline, this may include a minimum description of the object, additional metadata, provenance documentation, photographs, field notes, ancillary data of many types (e.g., DNA), and even CT and 3D scans in rare instances.

Since this study’s purpose is to understand the curation behaviors of managers of physical collections to improve organization, access, and use to these collections, a data lifecycle questionnaire from prior studies was used in these focus groups has several questions derived from the FAIR data principles in a physical collections context (Bishop, et al., 2020). Physical collections present their own unique challenges to making their data FAIR. Legacy and born digital data can be transformed and combined with other datasets and lead to new knowledge. The key to unlocking these potential discoveries in the exact sciences is to understand and gain knowledge of the best practices to move the entirety of tangible objects onto a functional cyberinfrastructure.

Across disciplines, there are increasing expectations for accountability and transparency in research, notably in open access (e.g., The White House 2013; G8 Open Data Charter, 2013; OSTP, 2014; OMB, 2015); research replicability through journal requirements for provision of supporting data (Nature, 2013; Vines et al., 2013); and data management that leads to effective data discovery, access, reuse, and long term preservation (e.g., funder requirements for Data Management Plans). These efforts align with long-standing ethical principles in archaeology and other disciplines concerning public ownership, stewardship, public education, and conservation of cultural resources. Despite these pressures, only a small fraction of projects produce data that is findable, accessible, or reusable. Digital data collected at enormous expense are continually, rapidly, and permanently being lost due to hardware failures, media degradation, software obsolescence, and inadequate documentation. Much of what is not yet lost, is not discoverable or accessible and will ultimately be lost unless data governance practices change dramatically (Kansa et al. 2014; Vines et al. 2014; Faniel & Yakel 2017). This study provides insights into current best practices of physical collection managers across several disciplines.

METHOD
The study uses past methodology using the data curation profile (DCP) approach to capture all actions across the data lifecycle (Bishop, et al., 2020; Bishop & Hank, 2016). Purposive recruitment occurred through personal contacts from related projects and organizations that focus on understanding and improving discovery, access, use, and curation of physical research objects. A total of twenty participants from several physical sample communities participated in six focus groups (https://isamplesorg.github.io/home/). Snowball recruitment led to participant managers of physical collections across disciplines, including anthropology, archaeology, botany, geology, ichthyology, and paleontology. The participants were not part of the research team, but all full-time collection managers working at institutions housing and making accessible physical collections. Participants responded to open-ended questions that relate to the data lifecycle. The focus group questions inquired about the organization, flow, and use of their collections throughout the data lifecycle, as well as the collections’ users, uses, and use constraints. This short paper shares results on only the organization and storage questions due to word count constraints. All questions were pilot tested with two collection managers and revised accordingly. Focus groups occurred and were recorded in Zoom with closed captioning. Additional transcription occurred prior to coding. The focus groups had 3-4 participants each. Focus group recordings were coded in NVivo. Open coding was used to capture activities and actions conducted in making these physical collections reusable. Coders revisited the codebook with each additional community to ensure consistent use of terms for concepts.

RESULTS
The following share preliminary results from the collection overviews, their accession, organization, and storage. The volume and variety of collections was best stated by participant C from focus group 3: “we cover the entire fossil record from micro fossils which are microscopic in scale all the way up to dinosaurs and whales.” The scope of the collections mirrors the complexity of each research area—osteological collections of humans and other species to a two-mile-long ice core to ancient artifacts from archaeological excavations. Overall, the size of the collections varied from a few thousand to millions when taking fragments into account; however, these numbers were typically much larger than the number of records due to the consolidation of similar fragments, sometimes thousands of them, into bagged groupings marked with a single label (such as “animal bones”). Additionally, for collections of geologic cores, discrepancies in how a collection’s sizes are determined were reported with some participants indicating they had pieces or cuttings of rocks while others described their collections in a total number of meters. Most collections were made up of individual items or specimens that ranged in size from the microscopic
to multiple meters in length. Generally, collections were at least fifty years old and began as a result of the explorations of one or a small group of professionals, typically in conjunction with an institution. Collections were reportedly managed by either one collection manager or a small group of managers and curators.

**Accession**

An important part of the acquisition process for physical collections is accession. In this phase, items in the collections are inventoried and may be assigned an accession number. In many cases the number may be included in the assignment of a persistent identifier (PID). Participants reported that PIDs given did not follow a universally accepted standard, instead adhering to an institutional convention (e.g., FMNH PR 2081). As mentioned, this number typically included the accession number and may have also included identifiers for locality, storage location, or taxon. In the case of ichthyology collections represented in this study, globally unique identifiers (GUIDs) are produced by collection management software for every object in the collection on a collection and institutional level—these collections also use what is referred to as a Darwin Core triplet, a PID consisting of the object’s institution code, a collection code and a catalogue number. In geology, the International Generic Sample Number (IGSN) is used, but more work is needed to go back and create these for older items.

**Metadata**

As expected, metadata from these physical collections and other digital representations of the collections are a critical part of curation. Metadata is added to either a local database or repository software. The most common software used was Specify which was mentioned by participants from herbarium, paleontology, and ichthyology collections. FileMaker Pro was prominent relational database software in archeology, geologic cores, and occasionally ichthyology collections. Another common type of metadata stored is locality information that reveals the physical place and time the specimen was found, collected, and accessioned. Most collections stated that locality information is currently captured largely by GPS, but that items accessioned into the collection before GPS was implemented tend to have spotty or unhelpful locality descriptions. Ichthyology collections cited georeference tools such as GEO Locate, which is specifically used for natural history data, as well as the research domain’s history of extensive field notes that were later transcribed and entered into databases. In some instances, locality data is not publicly findable due to the necessity of protecting the locations where certain protected or endangered specimens were found.

**Storage**

Storage methods differed by domain, but tended to be the same across different collections within the same focus group, with almost all involving the use of cardboard boxes. For example, archaeological collections are often sorted into zipped plastic bags before being stored in an appropriately sized box with a lid of either cardboard or steel. This is quite similar to anthropology collections which are stored in standard size bankers boxes. Furthermore, participants in archaeology, anthropology, paleontology, and rock cores all reported the use of flat drawers. Herbarium collections all featured similarities in the size and type of the sleeves used to enclose specimens and were reportedly stored in “standard herbaria cabinets” across collections. These collections were all intended to be kept in humidity and temperature-controlled facilities, though participants indicated this was not always the case. The differentiating collection storage types were found to be ice cores which rely on cardboard tubes with a silver outer layer kept in freezers, as well as ichthyology specimens. Ichthyology collections house their ethanol- and alcohol-preserved specimens in stainless steel tanks, glass jars of various sizes, and 5-gallon plastic buckets.

**Summary of results**

Results from the focus groups revealed multiple issues in curation behaviors of managers of physical collections that could be preventing the value of these collections from being recognized. One such issue is the lack of standardization across collections within a field regarding the metadata and repository software used. Without these systems in place, the findability and reuse potential of the collections suffers greatly. An example of remedying this comes from the herbaria collections where all participants uploaded information about their specimens to the same data portals resulting in rich multi-faceted uses of their collections.

Additionally, many collections are finding funding a challenge as the dual costs of both the upkeep current collections and their digital counterparts. One participant described their database as “The problem is with old Access databases. Once it's an old version, you can't open it. So we've had to keep really old computers running to try to access [them]. And it's not just the problem with Access. There's a bunch of other older software that were used to create anything from maps or drawings or other types of things for archaeology, that again, we can't access those files.” This issue also extends to staffing, resulting in backlogs of work that must be completed to have fully complete metadata records. A similar backlog of work was mentioned by several participants with one stating “We have most everything digitized that's been accessioned into the collection, but we also have a backlog of probably 10,000 records, or something like that, so we have quite a large backlog of things that we just haven't gotten to.” These factors contribute to a growing perception that physical collections do not hold enough value to warrant
additional funding for both their continued management and the growing importance of having these collections digitally accessible for reuse through improved cyberinfrastructure and RDM tools. If this continues, we may find a sudden loss of many irreplaceable physical items.

Limitations of the study
Focus groups allowed for several collection managers working with similar collections to share their practices, but willing participants may be more motivated to make their collections as accessible as possible and not representative of practices across all physical collections. Anthropology, archaeology, paleontology, ichthyology, herbaria, and geologic cores although a broad range of sciences still lacks a few other physical collections considering a variety of other types of geological, biological, and archaeological physical items exist. Future work will explore other collection manager communities of practice and attempt to conduct more quantitative data on these behaviors through surveys.

CONCLUSION
This study investigated the curation behaviors of physical collections managers through focus group discussions from anthropology, archaeology, paleontology, ichthyology, herbaria, and geologic cores collections. The results indicate that physical collections vary greatly across fields and institutions in both size and age. The metadata collected for each item depends not only on the field, but oftentimes on the collection. This difference extends to the data repositories used to share collections and their level of accessibility. Increasing the standardization of metadata and data storage across collections of a similar field as well as reinforcing requirements for research to return results of their analysis of the collections’ specimens should improve the accessibility and usability of these collections. This in turn could serve to increase the use and perceived value of these invaluable resources. Certainly, continued investment is also necessary to unlock these invaluable data using machine-actionable tools to advance and reveal knowledge still trapped within these physical collections.

ACKNOWLEDGMENTS
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The Causality between Offensive Language Use and Negative Emotions in the Public Event—An Empirical Study Using Convergent Cross Mapping

Chen, Miaomiao Center for Studies of Information Resources, Wuhan University, China | chenmiaomiao2020@foxmail.com
An, Lu School of Information Management, Wuhan University, China | anlu97@163.com
Li, Gang Center for Studies of Information Resources, Wuhan University, China | ligang@whu.edu.cn

ABSTRACT
The mutual causal interdependence between offensive language use and negative emotions has been largely underexplored in the public event. Using 784,179 posts about the Tangshan violence event collected from Sina Weibo, nine themes were recognized based on framing theory. The mutual causal relationship between offensive language and negative emotions under each theme was examined through Convergent Cross Mapping. Results suggested that the mutual causal relationships between offensive language and negative emotion intensity under various themes were different with bidirectional causality under moral judgement, emotional venting, and power conflict, unidirectional causality under the vulnerable framework and the trust framework, and no causality under other themes. More detailed examination revealed special bidirectional or unidirectional causality between offensive language and some fine-grained negative emotions under the vulnerable framework, the trust framework, and secondary opinion. This study provides insight into the interaction between offensive language and negative emotions and helps emergency managers make targeted strategies to solve the problems of offensive language use and negative emotions.

KEYWORDS
negative emotions; offensive language; causality; social media; public event

INTRODUCTION
Offensive language is a globally prevalent and concerning issue. Especially during times of public events, social media users are more likely to use offensive language (Kim et al., 2021; Song & Wu, 2018). The use of offensive language could result in various consequences such as inflaming polarization, warping people’s opinions, and exacerbating existing tensions and conflicts (Suhay, Bello-Pardo, & Maurer, 2018; Kim et al., 2021). Another typical phenomenon in the public event is negative emotions expressed online (Qiu et al., 2020). Through the process of “emotional contagion”, various negative emotions (anger, disgust, fear, and sadness) can be amplified, leading to panic of the public and ultimately undermining social harmony and stability (An et al., 2021). These two factors have been two major obstacles for the authorities to guide public opinion.

Several studies have highlighted the relationship between offensive language use and negative emotions. On the one hand, most of these studies examined that offensive language use evoked negative emotions (Song & Wu, 2018; Kwon & Gruzd, 2018). Specifically, offensive language was considered a linguistic cue for emotional expressions. The use of offensive language can act as an emotional stimulus, elicit physiological responses, and contribute to the atmosphere of informality (Cavazza & Guidetti, 2014). On the other hand, only a few other fields such as workplace and gaming investigated that negative emotional activation could induce offensive language use (Stephens & Zile, 2017; Lawrence, 2008). They found that swearing was more likely to occur when a strong negative emotion manifested or when people intended to express how intensely they felt about others.

Two research gaps can be identified. First, although prior methods provide quantitative analysis to examine the correlation between offensive language use and negative emotions, explicit causal knowledge is scarce in most scenarios. Second, little research has been conducted on how offensive language use and negative emotions (including negative emotion intensity and fine-grained negative emotions) interact under different themes in the public event. Offensive language and negative emotions are products of contextualized social interactions (Kwon & Gruzd, 2018; An et al., 2021), yet this issue has been overlooked in earlier research. Thus, the purpose of this study is to answer the question: what is the causal relationship between offensive language use and negative emotions?

To bridge the literature gaps, 784,179 posts about the Tangshan violence event were obtained from Sina Weibo to carry out the empirical analysis. Specifically, different thematic contexts in the public event based on framing theory were firstly recognized. Second, a new causal inference tool, Convergent Cross Mapping (CMM), was employed to uncover the mutual causal relationships between offensive language use and negative emotions in different thematic contexts. Theoretically, such an investigation would deepen our understanding of the interaction between offensive language use and negative emotions. Practically, the results provided an empirical basis for developing scientific and effective strategies to mitigate the use of offensive language and the propagation of negative emotions.

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FRAMING THEORY
The central idea of framing theory is that frames are cognitive structures that people use to understand and interpret the world, making an otherwise meaningless succession of events into something meaningful (Borah, 2011). Every frame can be thought of as a distinct context as it presents a unique viewpoint on the issue or subject, emphasizes certain aspects of the message, and downplays others.

Since the majority of social issues are risky in nature, many scholars have applied framing theory to examine public or media depictions of risks to learn how these hazards are staged and characterized (Wang & Mao, 2021). Classic frame analysis includes four frame functions (i.e., problem definition, moral judgement, cause diagnosis, and remedies suggestion) developed by Entman (1993) and five generic frames (i.e., economic consequences, conflict, attribution of responsibility, human interest, and morality) proposed by Semetko and Valkenburg (2000). Referring to these two studies, we make additions, deletions, and adjustments to the themes based on the actual topic modeling results.

METHODS
Data collection and preprocessing
This study took the Tangshan violence event as an example, which was about a man misbehaving against and beating a female customer at a barbecue restaurant in Tangshan on June 10, 2022, drawing widespread public attention online. To collect posts about this incident from Sina Weibo, the most popular microblogging platform in China, Tangshan Beat (“唐山打人”) and Tangshan barbecue restaurant (“唐山烧烤店”) were used as keywords to crawl original microblog posts and retweets between June 10, 2022, and June 26, 2022. An initial corpus of 1,998,768 posts including original microblog posts and retweets was obtained.

The microblogging data were preprocessed as follows. First, retweets without additional comments and with meaningless comments were admitted for subsequent processing. Second, all posts were cleaned by removing special elements such as HTML, “#xxx”, and “@xxx”. Third, posts without any content were deleted again. A total of 784,179 posts were admitted for subsequent processing.

Topic modelling
Given the abundance of short texts on the Sina Weibo platform, the LDA technique is unsuitable for generating a meaningful topic distribution (Wu, Yang, & Shen, 2021). Hence, a combination of Word2vec, K-means and LDA, which is more suitable for short text analysis than the LDA technique, was chosen to identify topics and themes of the Tangshan violence event. A five-step process was carried out. Initially, each post was segmented into words using Jieba, a widely used Chinese word segmentation tool (Zhang, Ridings, & Semenov, 2022). Second, the Word2vec model, well-capturing semantic information (Mikolov, Yih, & Zweig, 2013), was trained to represent word vectors and map each post to vector space. Third, the K-means module, a simple and efficient clustering algorithm (Kanungo et al., 2002), was used to cluster posts. The optimal number of clusters was determined by the elbow method (Bholowalia & Kumar, 2014). Fourth, as K-means results did not mark the topics, the Latent Dirichlet Allocation (LDA) model was applied to find topic words in each cluster (Zheng et al., 2022). Finally, each cluster was labelled based on the top 10 topic words and similar topics were grouped into one theme based on framing theory.

Offensive language detection and negative emotions measurement
To detect whether the post contained offensive language, the Chinese offensive language detection model with high accuracy of 82.75% developed by Deng et al (2022) was employed in this study. This model was trained on a Chinese Offensive Language Dataset from Weibo proposed by the authors, comprising 37,480 comments from diverse topics of race, gender, and region with binary offensive labels.

Measurement of negative emotions included calculating the negative emotion intensity and fine-grained negative emotions. Negative emotion intensity was measured using Bi-LSTM in Baidu's sentiment analysis model Senta (Tian et al., 2020). For subcategories of negative emotions (anger, disgust, fear, and sadness), following the study of An et al (2021), the emotional intensity was calculated based on the Chinese Affective Lexicon Ontology (Xu et al., 2008) while taking into account the modificatory effect of the degree adverbs and negative words on emotional words.

The Causality test using Convergent cross mapping
Before examining the causality between offensive language use and negative emotions under different themes, time series of offensive language and negative emotions should be constructed (Qiu et al., 2020). We defined one day as a time window and calculated the number of posts that used offensive language, the total intensity of negative emotion, and the total intensity of each fine-grained negative emotion within the time window under different themes.
The Convergent cross-mapping (CCM) technique was employed to infer causality between offensive language use and negative emotions. This method can detect causality by checking if two variables exhibit consistency when revisiting similar states (Sugihara et al., 2012). It is advantageous for reliably finding a causal relationship in nonlinear dynamical systems and has been used in IS studies recently (Chung & Zeng, 2020; Azqueta-Gavaldón, 2020).

**RESULTS**

**The results of themes and topics**

The Word2vec, K-means, and LDA techniques were employed to extract the topics of the corpus. A total of 28 topics, which showed the best performance based on the elbow method, were extracted and described according to the topic words. Thereafter, referring to themes proposed by Entman (1993), Semetko and Valkenburg (2000), these 28 topics were further divided into nine themes as shown in the online document:

https://docs.google.com/document/d/1Typ4NQ3ShLz8cVByj4E1PURNmn7raQ1esoeRHpQ5k/edit?usp=sharing.

The nine themes are as follows. **Moral judgement** put the incident in the context of values or moral prescriptions, expressing criticism of the perpetrators and condemnation of violent acts. **Emotional venting** reflected public direct emotional reactions such as anger, fear, and taunt. **Power conflict** emphasized the conflicts of interests between different stakeholders or levels of power. For example, the conflict between the public and authorities was suspicion of the local public security bureau protecting the perpetrators. **Vulnerable framework** stood from the vulnerable groups to express or discuss reasonable demands of protecting the safety and rights of the weak. **Problem definition** focused on the facts and the incident itself, hoping it to be resolved impartially. **Trust framework** highlighted social trust issues such as questioning the efficiency of the police. **Action advocacy** referred to the process of actively promoting a particular issue and its goal was to trigger public attention. **Secondary opinion** was about related incidents triggered by this incident. **Event tracking** denoted continuous public concern for the incident.

**Causal modelling**

CCM was employed to model the causal relationship between offensive language use and negative emotion intensity. One key parameter in CCM, the lag time \( \tau \), was set as one day as smaller lag periods could form cross maps with higher resolution, leading to more accurate test results (Kantz & Schreiber, 2004). Then using a procedure for simplex prediction as performed in dynamic modelling and CCM (Sugihara et al., 2012), the other key parameter, the optimal embedding dimension \( E \) was determined. After setting, CCM would automatically output the \( \rho \)-value and absolute value. Generally, it denoted a strong positive or negative causality when the result was significant statistically \((p<0.05)\) and the absolute value of CCM correlation was greater than 0.7 (Fonseca et al., 2018; Chen, Kang, & Yu, 2020).

The causal results were plotted in Figure 1, where correlation \( \rho \) was CCM correlation, library size was the period length, \( E \) was the embedding dimension, n.s indicated not significant, negativeEmos:offensive meant negative emotion intensity cross-mapped offensive language use (offensive “CCM caused” negative emotion intensity), and offensive:negativeEmos meant negative emotion intensity “CCM caused” offensive language use. It could be drawn from Figure 1 that there was causality in both directions under the theme of moral judgement, emotional venting, and power conflict since the correlation \( \rho \) of both directions exceeded 0.7 as the library size increased. Some CCM correlations were high only on one side (e.g., offensive language use driving negative emotion intensity happened under the vulnerable framework and the opposite effect happened under the trust framework). Besides, there was no CCM causal relationship in either direction under the themes of problem definition \((\rho < 0.7)\), action advocacy (not significant), secondary opinion (not significant), or event tracking \((\rho < 0.7)\).

![Figure 1. CCM results of offensive language use and negative emotion intensity under different themes](image-url)
To further study the causality between offensive language use and fine-grained negative emotions, the same CCM process was performed. The CCM correlations were tabulated in Table 1. “Offensive as Independent” examined how offensive language use “CCM caused” fine-grained negative emotions. “Offensive as Dependent” examined how fine-grained negative emotions “CCM caused” offensive language use. The data in Table 1 were the absolute values of the CCM correlation and were expressed as n.s if CCM results were not significant. Each fine-grained negative emotion and offensive language use still had a mutual causality under the theme of moral judgement, emotional venting, and power conflict. However, fear and sadness could not cause “offensive language use” under moral judgement. Under the vulnerable framework, offensive language use not only drove fine-grained negative emotions but excessive sadness and disgust could also lead to offensive language use. Under the trust framework, offensive language use could trigger fear while disgust, fear, and sadness could provoke offensive language use. Under the secondary opinion, offensive language use could generate disgust. No causal relationship was found in the rest of the themes.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Offensive as Independent</th>
<th>Offensive as Dependent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anger</td>
<td>Disgust</td>
</tr>
<tr>
<td>Moral judgement</td>
<td>0.775</td>
<td>0.797</td>
</tr>
<tr>
<td>Emotional venting</td>
<td>0.793</td>
<td>0.794</td>
</tr>
<tr>
<td>Power conflict</td>
<td>0.95</td>
<td>0.946</td>
</tr>
<tr>
<td>Vulnerable framework</td>
<td>0.717</td>
<td>0.734</td>
</tr>
<tr>
<td>Problem definition</td>
<td>n.s</td>
<td>0.58</td>
</tr>
<tr>
<td>Trust framework</td>
<td>n.s</td>
<td>0.674</td>
</tr>
<tr>
<td>Action advocacy</td>
<td>n.s</td>
<td>n.s</td>
</tr>
<tr>
<td>Secondary opinion</td>
<td>n.s</td>
<td>0.752</td>
</tr>
<tr>
<td>Event tracking</td>
<td>n.s</td>
<td>n.s</td>
</tr>
</tbody>
</table>

Note: n.s not significant. Bold indicates a strong causal relationship

Table 1. Causality between offensive language use and fine-grained negative emotions

DISCUSSION AND CONCLUSION
Offensive language use has become increasingly prevalent in digital culture, but its mutual relationship with negative emotions remains unknown. This research provides a novel insight for dissecting the causal relationship between offensive language use and negative emotions. Specifically, through the analysis of 784,179 posts regarding the Tangshan violence event, we first constructed nine thematic categories based on framing theory. Afterwards, causality between offensive language use and negative emotion intensity as well as fine-grained negative emotions were examined under each theme using CCM.

There are three key findings. First, a strong bi-directional causal relationship between offensive language use and negative emotion intensity under moral judgement, emotional venting, and power conflict is determined. The same result has been found by a detailed examination of the causal relationship between offensive language use and fine-grained negative emotions except for the theme of moral judgement. Second, despite the fact that there is only a unidirectional causal relationship between offensive language use and negative emotion intensity under the vulnerable framework and trust framework, partially fine-grained negative emotions under the two themes exhibit a bidirectional causal relationship with offensive language. Third, there is no relationship between offensive language use and negative emotion intensity under moral judgement, emotional venting, and power conflict. However, offensive language causing disgust is found in secondary opinion through detailed examination.

Most of the previous studies provided evidence that offensive language could promote negative emotions (Kwon & Gruzd, 2017; Kim et al., 2021). Our analysis results further demonstrate that this effect only occurs with specific themes and negative emotion sometimes inversely causes offensive language use in the public event. Besides, the causal relationships between offensive language and fine-grained negative emotions also vary. These findings can help emergency responders target effective strategies to reduce the use of offensive language and the spread of negative emotions. For example, under the vulnerable framework, the officials need to control offensive language use as it triggers negative emotions while in the case of emotional venting, both controlling offensive language and relieving negative emotions can achieve a joint alleviating effect on the use of offensive language and the spread of negative emotions among the public.

The preliminary results from this study enrich the discussion on the interaction between offensive language use and negative emotions. However, some questions remain unclear. Future work will involve understanding the reason why different themes have different effects between offensive language use and negative emotions. In addition, it will be interesting to explore how other factors such as personality traits and government intervention strengthen or weaken the causal relationship between offensive language use and negative emotions.
ACKNOWLEDGMENTS
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Computational Thematic Analysis of Poetry via Bimodal Large Language Models

Choi, Kahyun Indiana University, USA | choika@iu.edu

ABSTRACT
This article proposes a multilabel poem topic classification algorithm utilizing large language models and auxiliary data to address the lack of diverse metadata in digital poetry libraries. The study examines the potential of context-dependent language models, specifically bidirectional encoder representations from transformers (BERT), for understanding poetic words and utilizing auxiliary data, such as author's notes, in supplementing poetry text. The experimental results demonstrate that the BERT-based model outperforms the traditional support vector machine-based model across all input types and datasets. We also show that incorporating notes as an additional input improves the performance of the poem-only model. Overall, the study suggests pretrained context-dependent language models and auxiliary data have potential to enhance the accessibility of various poems within collections. This research can eventually assist in promoting the discovery of underrepresented poems in digital libraries, even if they lack associated metadata, thus enhancing the understanding and appreciation of the literary form.

KEYWORDS
Digital libraries, multilabel classification, context-dependent language model, auxiliary data, computational poetry analysis

INTRODUCTION
Recently, poetry has gained significant interest, stemming from the public's heightened awareness due to high-profile events and the rediscovery of its therapeutic values during the COVID-19 pandemic. For instance, following Amanda Gorman's recitation of her poem at the 2020 U.S. presidential inauguration, poets.org reported a dramatic surge in traffic to their site, with a 250% increase in visitors compared to the same day in the previous year (Academy of American Poets, n.d.). Her powerful performance and inspiring message, presented amid a global pandemic, successfully captured widespread attention and admiration. Moreover, poetry websites experienced a substantial uptick in traffic during the pandemic, as poetry positively influenced mental health during such challenging times (Acim, 2021). Indeed, the therapeutic benefits of literature have long been recognized (Hynes, 2019). For example, inscribed in the ancient Library of Alexandria was the phrase "The place for a cure for the soul," and Aristotle's Poetics highlighted the restorative power of literature through catharsis. Bibliotherapy, the active application of literature for healing purposes, has been practiced for decades, with poetry being a primary genre (Harrower, 1972; Mazza, 2016).

Given the social and therapeutic virtue of poems, increasing their accessibility through diverse metadata can benefit the readers. However, digital poetry libraries often struggle with limited availability of metadata. Some services offer theme metadata for a limited number of poems, often excluding amateur works. The scarcity of advanced metadata types can be attributed to the lack of automated poem analysis tools, such as AI-driven natural language processing (NLP) algorithms, capable of achieving human-level comprehension of poetry. Poetry's complexity, characterized by its figurative language and multiple layers of meaning, makes it difficult for both humans and machines to interpret. Consequently, poetry has seldom been the focus of computational analysis, unlike prose genres, such as news articles and product reviews. Only a handful of studies have focused on computational poetry analysis (Kao & Jurafsky, 2012; Rakshit, Ghosh, Bhattacharyya, & Haffari, 2015; Lou, Inkpen, & Tanasescu, 2015; Kaur & Saini, 2017; Navarro-Colorado, 2018).

To bridge this gap, we propose a poem topic classification algorithm utilizing a pretrained large language model, building upon the work of Lou et al. (2015) and Choi (2021). Lou et al. (2015) introduced the multilabel poem topic classification task and explored its potential using support vector machines (SVM) on Poetry Foundation's poem data. We extend this study by examining the applicability of pretrained large language models, inspired by findings from another work on song lyrics (Choi, 2021). Choi’s work focused on the song lyrics, which were assumed to consist of hard-to-interpret choices of words, making computational analysis difficult. Context-dependent language models, e.g., bidirectional encoder representations from transformers (BERT) (Devlin et al., 2018), was successfully introduced to discern the underlying meanings of certain figurative words better than non-contextual baselines, such as support vector machines (SVM). In the proposed system, we are based on the similar conjecture that pretrained large language models possess a certain level of inference power capable of understanding the underlying meanings of complex text, including poems, which is the focus of this work.

In addition, to overcome the limited straightforwardness of the poetic text, we propose utilizing supplementary information, such as author's notes. From both the AI model and human reader's perspectives, certain types of...
auxiliary data are easier to interpret due to their more straightforward language. In previous research on song lyrics, for example, music listeners’ comments successfully assisted AI models in understanding themes within song lyrics (Choi et al., 2016; Choi, 2021). In this work, we propose to use a different kind of auxiliary information, such as author's notes, by assuming that they can demystify symbolic text written by authors themselves. With this in mind, we focus on the following research questions:

Q1. Can context-dependent language models, such as BERT, decipher themes of poems more effectively than context-independent models, such as SVM?
Q2. Do authors' notes on their poems provide additional information to the poem topic classification system?

**EXPERIMENT DESIGN**

**Data**

In our study, we utilized data from poets.org, a nonprofit organization that offers online resources for poems, poet biographies, essays on poetry, and K-12 educational materials. Established in 1996, this pioneering platform has significantly contributed to the promotion and accessibility of poetry for a diverse range of audiences (Academy of American Poets, n.d.). For our research, we use the text of poems, their themes categorized by the platform, and supplementary information about the poems, such as author’s notes. The data were scraped in October 2022 using BeautifulSoup, a widely used Python library for parsing HTML documents (Richardson, 2007). Subsequently, data preprocessing removed non-ASCII characters and HTML codes to establish a clean, uniform dataset. After eliminating duplicates, we obtained a total of 11,803 poems. Among them, 3,581 poems include author explanations of their works in plain language, referred to as the auxiliary data in this study.

The auxiliary about-poem data has an average word count of approximately 18, significantly shorter than the poems themselves, which average around 207 words. Nevertheless, they tend to contain essential information about the poem. For instance, an excerpt from “Message to My Sistah” by Joe Balaz, “I just did // wat I talked about doing // wen we wuz visiting // on da smartphone,” illustrates that poems in Hawaiian Islands Pidgin (HIP) can be challenging for machines to understand due to the author’s intentional misspellings. In contrast, the author’s note complements it: “The idea for this poem came from an actual phone call that I had with my sister,” features correct spelling and a more straightforward style, allowing machines to understand the theme more easily. Likewise, despite its brevity, the about-poem data provides additional information in a more interpretable fashion, leading us to investigate its utility for the task in this paper.

The poems are labeled with 156 unique themes, primarily representing the subjects of the poems. However, some themes do not correspond to the poem's subject matter, such as public domain, audio, and translation, which we removed. Each poem can have multiple themes associated with it, with an average of 2 themes linked to a single poem. Hence, our classifiers are trained to predict an unspecified number of thematic classes per poem. Table 1 displays the top 50 most prevalent themes among the poems with the about-poem data, accompanied by their respective poem counts. These themes cover a broad spectrum of topics related to human experience, including both abstract (e.g., love, existential, etc.) and concrete subjects (e.g., animals, flowers, etc.).

Among the 156 themes, we employ two separate subsets based on their popularity: the top 10 and top 50 themes. This selection was made to ensure comparability with previous studies on poem topic classification by incorporating an equal number of themes (Lou et al., 2015).

<table>
<thead>
<tr>
<th>Theme (Count)</th>
</tr>
</thead>
<tbody>
<tr>
<td>nature (467), body (453), death (353), love (350), self (348), existential (334), identity (334), america (292), beauty (269), memories (264), ancestry (235), animals (220), time (208), loss (204), history (201), landscapes (193), thought (184), writing (182), family (174), violence (166), desire (155), grief (141), social justice (141), aging (139), flowers (136), language (133), childhood (132), past (127), birds (127), music (127), environment (126), mothers (123), night (119), politics (119), hope (114), oceans (111), cities (104), war (104), gender (103), fathers (102), earth (102), survival (100), religion (100), heartache (97), dreams (95), loneliness (94), illness (92), weather (90), spirituality (87), anxiety (86)</td>
</tr>
</tbody>
</table>

Table 1. Top 50 Popular Themes in Poems with About-Poem Data and Their Respective Counts.

**Classification Setup**

In this paper, we employ BERT and SVM for multilabel-multimodal poem classification, extending their previous application in single-label classification tasks (Choi, 2021, Choi et al., 2016). This key structural modification reflects the fact that real-world poems can contain multiple themes simultaneously. In addition, we investigate a novel combination of the bimodal input pair (poem and the author’s note), which is anticipated to be better suited to handle theme classification than the unimodal case (i.e., poem-only).
BERT (Devin et al., 2018) is a pre-trained natural language processing model based on the Transformer architecture (Vaswani et al., 2017). Unlike context-independent models, such as Word2Vec (Mikolov et al., 2013) and fastText (Bojanowski et al., 2017), BERT captures contextual information by learning embeddings for words in relation to their surrounding context within a sentence. This feature enables BERT to better understand semantic relationships between words and provides improved performance in various NLP tasks. BERT models are pretrained on large datasets and can be used effectively even with limited domain-specific data.

In our approach, illustrated in Figure 1, we utilize an ensemble method that combines two BERT classifiers, one for the poem and the other for the author’s about-poem note, respectively, by performing a weighted average of the two modality-specific results. The ensemble weight, where $0 \leq \alpha \leq 1$, is a trainable parameter optimized during the model training process. We start from the pretrained BERT model available in the ktrain package (Maiya, 2022). The pretrained BERT model performs inference on the “CLS” token-appended input sequence. Subsequently, a softmax layer follows to capture the CLS token’s embedding, which encodes discriminative features. This process is performed separately for both input modalities, with their results combined using the fusion weight. Due to computational constraints and the relatively small dataset size, we freeze the BERT layers; instead, the softmax layers of both modalities and their fusion weights are updated during training. We employ a one-cycle policy for optimization (Smith, 2018) and follow a five-fold cross-validation process to validate the results. The implementation is based on the Keras deep learning framework (Ketkar & Ketkar, 2017).

We also build an SVM-based baseline classification model with the ordinary TF-IDF representation, following the approach demonstrated by Lou et al. (2015). SVM has proven to be effective in a variety of studies on music and text classification (Hu et al., 2005; Yang & Chen, 2012). Based on Choi et al. (2016), which highlighted the robust performance of linear kernels in SVM models, we choose to use the linear kernel for the SVM model. We also employ the ensemble method, using two classifiers for the poem and the author’s about-poem note, and combine their results with a trainable fusion weight, $\alpha$, as in the BERT-based model. For implementation, we utilize the scikit-learn library (Pedregosa et al., 2011).

For the performance measure, we utilize the Area Under the ROC (Receiver Operating Characteristic) Curve, abbreviated as AUC, in accordance with previous multilabel classification studies (Lou et al., 2015; Choi et al., 2016). Unlike the conventional accuracy measure, which is primarily used in single-label classification tasks involving balanced datasets, AUC offers a more appropriate and robust single-value summary for multilabel classification in imbalanced dataset scenarios: the metric adjusts the number of theme classes per poem from the most conservative choice (i.e., a poem is classified into the most promising single class) to the most aggressive case (i.e., a poem belongs to all classes) to observe the sensitivity of the classifier. AUC values typically fall between 0.5 and 1.0, where a score of 0.5 signifies poor classifier performance and a score of 1.0 indicates perfect performance.

RESULTS AND DISCUSSION

This section presents a comprehensive analysis of the multilabel poem classification results, focusing on three main aspects: the comparison of BERT-based and SVM-based models, the comparison of three input types, and an analysis of the classification performance across various themes.

In comparing the BERT-based and SVM-based models to answer Q1, Table 2 demonstrates the superior performance of the BERT-based model across all input types and datasets. For both the 10-themes and 50-themes...
datasets, the BERT-based model achieved higher AUC scores than the SVM-based model in all cases, including poems, notes, and bimodal inputs. The low AUC score for the unimodal (poem-only) SVM model aligns with the findings of Lou et al. (2015), despite using a different poem dataset. The BERT model's superior performance may stem from its ability to leverage contextual information, which the SVM model struggles to capture with its TF-IDF input. Interestingly, the relatively small performance difference between the 10-themes and 50-themes datasets implies that the multilabel classification systems can effectively maintain performance even when addressing a larger number of themes.

<table>
<thead>
<tr>
<th>System</th>
<th>The Proposed BERT-Based Model</th>
<th>The Baseline SVM</th>
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<tbody>
<tr>
<td>Input</td>
<td>Poems</td>
<td>Notes</td>
</tr>
<tr>
<td>10-themes</td>
<td>0.77</td>
<td>0.74</td>
</tr>
<tr>
<td>50-themes</td>
<td>0.75</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Table 2. Performance Comparison of BERT-Based and SVM-Based Models: AUC Scores for Different Input Types and Datasets

Among the three input types, bimodal models outperform unimodal models in both BERT- and SVM-based models, emphasizing the complementary nature of the poem and about-poem data, which affirms Q2. The estimated ensemble weight of the BERT-based model is not significantly different from a simple average: $\alpha = 0.50$, with a nearly zero standard deviation for both datasets. This illustrates that both input data contribute equally to the performance improvement. Conversely, the ensemble weight of the SVM-based model reveals a greater contribution from poems, with $\alpha = 0.62$ and a standard deviation of 0.07 for the 10-theme dataset and $\alpha = 0.84$ with a standard deviation of 0.05 for the 50-theme dataset. Among the unimodal inputs, poem-only model outperforms the note-only model. The note-only model's lower performance, notwithstanding the benefit of its straightforward language, may be due to the brevity of the notes compared to the poems, as the notes constitute only 8.7% of the poems' length. Thus, we anticipate that incorporating additional auxiliary data, such as commentaries, could further improve performance.

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</tr>
</thead>
<tbody>
<tr>
<td>Poem</td>
<td>0.86</td>
<td>0.80</td>
<td>0.76</td>
<td>0.86</td>
<td>0.73</td>
<td>0.68</td>
<td>0.76</td>
<td>0.83</td>
<td>0.72</td>
<td>0.73</td>
</tr>
<tr>
<td>Notes</td>
<td>0.79</td>
<td>0.75</td>
<td>0.70</td>
<td>0.82</td>
<td>0.66</td>
<td>0.68</td>
<td>0.77</td>
<td>0.84</td>
<td>0.70</td>
<td>0.67</td>
</tr>
<tr>
<td>Both</td>
<td>0.88</td>
<td>0.83</td>
<td>0.83</td>
<td>0.87</td>
<td>0.73</td>
<td>0.73</td>
<td>0.80</td>
<td>0.86</td>
<td>0.76</td>
<td>0.74</td>
</tr>
</tbody>
</table>


Table 3 presents the proposed BERT model’s AUC values across 10 key themes for unimodal (poem and note) and bimodal (both) models. The bimodal model consistently demonstrates strong performance in classifying themes such as nature, love, America, body, and death. Conversely, it demonstrates weaker performance in themes such as existential, self, and memories, perhaps due to their more abstract nature and the potential overlap among these correlated themes. They share similar vocabulary and concepts, which makes accurate differentiation more challenging for the model.

CONCLUSION
In conclusion, this article addressed the scarcity of diverse metadata in digital poetry libraries and proposed a multilabel poem topic classification algorithm that leveraged large language models and auxiliary data. The study demonstrated the potential of context-dependent language models, such as BERT, for understanding poetic words. It also showed that incorporating auxiliary data, like author's notes, alongside these models can substantially improve the performance of the classification system, with an AUC increase from 0.72 to 0.80, despite the challenging nature of the task. The results suggested that multilabel classification systems maintain performance while handling a large number of themes. The study highlighted the importance of utilizing advanced technology, such as large pretrained language models, to enhance the accessibility of various poems within collections. With continued performance improvement, this approach will be valuable for discovering works from new authors or uncovering hidden gems with limited or no metadata, promoting a more inclusive representation of poetry. Ultimately, this research can assist in fostering the therapeutic benefits of poetry and enhancing the understanding and appreciation of the art form.

ACKNOWLEDGMENTS
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Exploring Applications and User Experience with Generative AI Tools: A Content Analysis of Reddit Posts on ChatGPT

Choi, Wonchan  
School of Information Studies, University of Wisconsin-Milwaukee, USA | wchoi@uwm.edu
Zhang, Yan  
School of Information, University of Texas at Austin, USA | yanz@utexas.edu
Stvilia, Besiki  
School of Information, Florida State University, USA | stvilia@fsu.edu

ABSTRACT

As part of a larger project, this paper reports on preliminary findings of a study exploring use cases of ChatGPT and associated behaviors and experiences among users of an online forum. Posts on a ChatGPT-related forum on Reddit \((n = 452)\) were analyzed using qualitative content analysis. This paper reports on themes relevant to this study, including the types of tasks for which users used ChatGPT, user experiences, and perceived impacts of ChatGPT. ChatGPT was often used to facilitate various writing tasks (e.g., writing an essay), academic tasks (e.g., finding scientific references for a research paper), everyday tasks (e.g., creating a meal plan), and conversational purposes (e.g., having a simulated conversation about a past event). Users expressed positive (e.g., excited, amazed) and negative (e.g., fooled, concerned) feelings toward the technology. They raised various issues and problems with ChatGPT at the content (e.g., inaccuracy, incompletes) and system (e.g., unavailability, instability) levels. Users discussed the perceived impacts of ChatGPT on individuals (e.g., unemployment) and society (e.g., AI divide). Study findings can inform the design of policies and guidelines for mitigating AI problems and promoting the effective and ethical use of emerging AI technologies.

KEYWORDS

generative AI, ChatGPT, information behavior, AI user experience

INTRODUCTION

Innovative artificial intelligence (AI)-powered tools have generated a tidal wave in people’s daily and working lives. Large language model (LLM)-based chatbots, such as OpenAI’s ChatGPT, can support various user tasks, such as summarizing texts, answering questions on different topics, and creating plans and instructions for tasks (e.g., diet and exercise, household budget). Despite the promising capabilities and expanded role of AI in people’s daily lives, some experts have raised concerns regarding the potential loss of individuals’ control over the process of making essential decisions that may have significant effects on their lives (Anderson & Rainie, 2023). Such concerns seem to reflect the public’s attitude toward AI—according to a recent survey by the Pew Research Center (Kennedy et al., 2023), only 15% of the respondents reported being more excited than concerned about the use of AI, whereas 38% expressed greater concern than excitement; 46% indicated an equal mix of concern and excitement.

As new information tools, LLM-based chatbots like ChatGPT extend the main function of traditional information-retrieval systems, such as search engines, from supporting access to existing information sources to producing convincing, synthetic humanlike content in natural language. However, they do not “know” truth or lies or fully comprehend the context (Gozalo-Brizuela & Garrido-Merchan, 2023; Ouyang et al., 2022). Also, the AI-returned content may include potential biases and lack creativity (Anderson & Rainie, 2023). Because LLM-based public chatbots are less than 1 year old, there has been little scholarly examination of people’s information behaviors related to why and how they use such tools, what they feel and think about them, and how they perceive their impacts. As part of a larger project, the current paper starts to explore this research gap by addressing the following research questions: (1) For what tasks and how do users use ChatGPT? (2) What are their feelings toward and challenges and problems related to ChatGPT? (3) What are the perceived impacts of ChatGPT?

METHOD

Data collection

To investigate these research questions, we analyzed discussion threads from the r/ChatGPT subreddit. Reddit is one of the most highly used social media platforms, with millions of daily active users and more than 100,000 active subject-based subreddits (Auxier & Anderson, 2021). The study’s sample features 452 posts and 10,620 associated comments collected from the r/ChatGPT subreddit on January 30, 2023. The median number of comments was three. r/ChatGPT was created on December 1, 2022, and at the time of data collection, it had more than 170,000 members. Reddit does not share the overall number of posts made in each subreddit at a particular time. The study used Reddit’s application program interface (API) to assemble the sample. We requested submissions marked as “hot” or “top” only. Top submissions are those that have earned the most upvotes, whereas hot submissions are those that have recently received a large number of upvotes or comments. We downloaded hot and top posts as
separate datasets and limited the number of API requests for each type of posts to 1,200. Next, we merged the datasets and removed duplicate and garbled threads. The resultant dataset of 452 posts was used as the study sample.

Data analysis
The data were exported to NVivo 1.7 to facilitate analysis. Only the titles and texts of the posts were used in the analysis. Three authors each coded one third of the data independently using thematic content analysis. Main thematic categories, such as mental models of the system, use of the system, how to use the system, system issues and problems, user experience, impacts, need for support, user barriers and challenges, and credibility and quality evaluation, emerged from the data. The authors held multiple collective coding sessions to examine the content for each code. In the process, the codes were compared and consolidated, resulting in a revised coding schema with several levels of hierarchies. Disagreements were resolved by discussion.

RESULTS
Of the themes emerged from the analysis, we report on those deemed relevant to our research questions. We paraphrased quotations supporting our findings to avoid violating the privacy of authors of the posts analyzed in the study.

Uses of ChatGPT
Types of tasks
ChatGPT was used to facilitate various writing-related tasks, including creating new content (e.g., writing an essay, story, or email); revising existing content, such as rewriting a certain text into a different style (e.g., rewriting William Wordsworth’s “The Solitary Reaper” in cyberpunk style); summarizing a large amount of text (e.g., a book); and translating content from one language to another.

Education is a domain where writing tasks often occur. Members of the forum reported using ChatGPT to support academic tasks, such as finding references for research papers, although multiple users reported accuracy issues with the references suggested by ChatGPT (we discuss this issue further in the Challenges and Problems section). Another use case in academic settings was creating instructional materials—one member used ChatGPT to create three levels of a task for people at three reading comprehension levels. ChatGPT was also used for programming tasks, such as writing, editing, and managing codes. For example, one member used ChatGPT to write a REST API in C. Another member mentioned that ChatGPT helped them focus more on an algorithm (i.e., what the code is intended to do) and less on syntax.

ChatGPT was also used to support various everyday tasks. For example, ChatGPT created customized meal plans based on the user’s needs. Similar tasks included creating a shopping list, identifying recommended exercises considering the user’s health condition, and revising a monthly household budget.

Members used ChatGPT to converse or ask questions on a wide range of topics (e.g., music, vehicles, technology). A noteworthy application of ChatGPT was observed in the form of simulated conversations concerning people’s past negative experiences, such as conflicts with partners in a romantic relationship or regretful decisions. Such conversations were aimed at facilitating emotional resolution of the associated negative affect (i.e., for therapeutic purposes).

How to use ChatGPT
Members also discussed how to use the tool effectively to complete tasks. Specifically, they sought and shared experiential tips for creating good prompts to generate answers meeting their expectations. Such tips included making a prompt specific by providing best-practice examples to help ChatGPT better understand the prompter’s instructions and preferences. Some technical tips aimed to accommodate the limitations or behaviors of ChatGPT, such as telling ChatGPT to continue from the last sentence when ChatGPT “cuts off” midsentence, a known issue that frequently occurs when editing large blocks of text.

Also, members discussed the possibility of integrating ChatGPT with other existing tools (e.g., web browsers, calendar or email applications) or creating a new tool using ChatGPT. Other topics related to how to use ChatGPT included creating multiple accounts to avoid echo chambers, evaluating and avoiding AI detectors, and the value of the fee-based version of ChatGPT.

User experience with ChatGPT
Feelings toward ChatGPT
Members expressed both positive and negative emotions toward ChatGPT. Positive ones were mainly reactions to ChatGPT’s functions and abilities, ranging from “like,” “special,” “cool,” “amazed,” “grateful,” and “excited” to “incredible,” “mind blown,” “life-changing” and “my only hope.” Negative emotions were due to different reasons. Some related to ChatGPT’s system behavior, such as feeling frustrated when the server was down and annoyed by how ChatGPT responds to certain prompts (e.g., “As a language model, I…”). Some emotions were tied to their
reflections on the impact of ChatGPT on individuals, society, and humankind. They reported feeling “dumber” and expressed concern that ChatGPT could be creating an “AI-divide,” “replacing future jobs,” and “taking over the world.” One member expressed a feeling of “existential dread” due to how capable they perceived ChatGPT to be.

Challenges and problems
Members reported different kinds of barriers and problems they encountered when using ChatGPT. In particular, they expressed concerns about the privacy and security of the information they shared with ChatGPT (e.g., how the company used and shared that information). Members also expressed concern over the ownership of the content generated by ChatGPT and whether their use of the content could be considered or flagged as plagiarism.

Service unavailability-related problems were often mentioned. Members expressed frustration at being unable to access the service due to network errors, service downtime, unavailability in some developing countries, or overloaded with too many requests. In addition, members expressed frustration with ChatGPT’s waitlist and the opaque nature of how that waitlist worked.

In addition, members referenced different types of information quality problems. For example, members said ChatGPT provided inaccurate information and referenced nonexistent or irrelevant publications as sources. Furthermore, it exhibited a tendency to be open to “persuasion” in a conversation and eventually agree with the user’s statement, even if the statement was false. Members also complained about incomplete answers—they observed ChatGPT stopping in the middle of the conversation or generating incomplete code.

Another type of quality problem referenced in member conversations can be labeled as consistency problems. Members described ChatGPT losing the context of the conversation and generating inconsistent answers. They reported on ChatGPT regurgitating the same information in response to the same prompt in different contexts.

To evaluate the quality of information (i.e., accuracy) returned by ChatGPT, members used external reference sources such as Google Scholar and Wikipedia. They also observed ChatGPT’s internal quality checks to avoid generating offensive or discriminatory responses. If the user’s request contained such language, the system declined to complete the request and pointed to the problem. Some members found that self-censorship frustrating in their attempts to use ChatGPT to write fictional stories or engage the system in roleplaying conversations. Members expressed concern about how AI censorship and bias could affect the creative work of writers and visual artists.

Perceived impact of ChatGPT
Members contemplated ChatGPT’s impact at different levels. At an individual level, some people were concerned about personal employability and experiencing internal crises. Some people were more positive, considering that ChatGPT could have a positive impact on individuals in both work and personal life. For work, they considered that ChatGPT could be a “writing partner,” “guide,” “tutor,” “teacher,” “coding assistant,” and “research assistant.” For personal life, particularly in terms of companionship and growth, they considered that ChatGPT could be a “storyteller,” “AI friend,” and “pressure reliever.”

Viewing ChatGPT primarily as a technology or a tool, several members were concerned about its impact on the existing internet infrastructure. For example, one member asked, “Is ChatGPT a threat to Wikipedia?”

At the societal level, members’ thoughts about ChatGPT’s impact were multifaceted. Some expressed worried about the divide that ChatGPT might create among members of society, including the access divide and power imbalance. For example, one member commented that ChatGPT’s base version should remain free because “such advantages can’t be kept to people who pay, it must be accessible by everyone, especially with the world becoming more and more revolved around AI.” Another member feared that ChatGPT would increase power imbalance in the society because it can be viewed as the ultimate authority on various topics and matters yet can be programmed with a bias benefiting people in power. Some members expressed concerns over censorship, posing questions about the potential ramifications of OpenAI imposing its system of morality on a tool that may become an essential part of the internet infrastructure. Members also mentioned ChatGPT’s impact on a specific domain, such as education and economics, including the future relevance of existing jobs and labor exploitation in developing countries.

DISCUSSION
Interpretations of key findings
Our analysis identified different types of tasks for which people use ChatGPT, such as writing, academic work, and daily activities. We also identified tactics and strategies employed to effectively interact with this newly emerging tool, such as how to create good prompts. The frequent mentions of ChatGPT as a writing or research assistant in our study sample are in line with ongoing discussions on the need for a paradigm shift in learning, education, and research that supports a constructive integration of generative AI tools based on clear and practical guidelines that facilitate responsible and ethical use of such tools (Anderson & Rainie, 2023; Susnjak, 2022; Zhai, 2022).
These challenges and problems identified by our analysis can be mapped or classified into the six criteria of information system evaluation from the literature: information quality, system quality, service quality, privacy, access, and ownership (DeLone & McLean, 2003; Mason, 1986). The information quality problems referenced by members can be further classified into information accuracy, completeness, consistency, and novelty problems (Stvilia et al., 2007). The findings show that users continue to use traditional characteristics of ethical and successful information systems when they evaluate new generative AI-based technologies.

Some members demonstrated being critical consumers of ChatGPT. This resonates with the Pew Research Project’s recent survey results that more people are wary about the increasing use of AI in daily life (Kennedy et al., 2023). The concerns suggest that it is critical to study end users’ mental models and perceived impact of AI-based tools to ensure that these tools are ethical and thus sustainable. At the same time, the potentially significant social and economic impact of AI tools like ChatGPT calls for responsive policies to regulate their use and prevent them from causing a drastic social and economic divide.

**Limitations and future research**

The findings of the study should be interpreted in light of limitations of the study. First, our dataset included only user posts from a Reddit forum. Users of such technology-focused forums on Reddit tend to be tech savvy or highly interested in technology; thus, they represent a biased sample. Second, our data were collected during January 2023; thus, the content does not reflect people’s use or experience of more recent releases of ChatGPT. Third, the data were forum posts, and we could not follow up on some important aspects of ChatGPT use, such as motivations and use contexts.

In our future work, we plan to conduct interviews with users to generate more in-depth insights into their perceptions and mental models of generative AI tools such as ChatGPT; motivations and use cases of these tools for academic purposes; practices and strategies for evaluating the quality and credibility of information returned by AI-empowered tools; challenges and issues with such tools; and need for support at different levels.

**CONCLUSION**

Identifying the uses of ChatGPT and its users’ mental models, feelings, and experiences can help the designers and developers of ChatGPT and similar generative AI-based technologies to better align the design and functionalities of their systems with users’ needs and practices. In addition, the study’s findings can inform the design of policies and guides to mitigate the impact of problems and facilitate effective and ethical uses of these emerging AI technologies.

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Studying Lived Experience and Automated Systems: The Case of Universal Credit

Currie, Morgan  
University of Edinburgh, United Kingdom | morgan.currie@ed.ac.uk

Podoletz, Lena  
University of Edinburgh, United Kingdom | lena.podoletz@ed.ac.uk

ABSTRACT
This paper applies the concept of ‘lived experiences’ to understand people’s subjective and everyday encounters with automated systems. We reflect on how qualitative longitudinal research methods are useful for capturing the affective and emotional dimensions of these experiences; these flexible methods also allow for iterative changes that can react to new findings and participant feedback. Using our empirical study on Universal Credit (UC), the UK’s largest social security payment, we demonstrate how studying lived experiences via qualitative longitudinal research helps us reflect on both the topic of the research and our position as researchers in relation to study participants. We argue that the lived experience framework is extremely valuable for understanding the consequences of automated decisions for users of these systems and to redress the uneven power dynamics of representing the voices of those sharing these encounters.

KEYWORDS
Lived experience; Automated and algorithmic decisions; Digitalisation; Qualitative longitudinal research; Digital social security systems

INTRODUCTION
In this short paper we argue for using the concept of ‘lived experiences’ to understand people’s everyday interactions with automated and algorithmic systems. This framework is also useful for reflexively considering research study design, as it calls for researchers to examine their own position vis-à-vis their object of study. We draw on the idea of lived experience to reflect on our ongoing study of an automated social security system in the UK. The study, Automating Universal Credit, deploys qualitative longitudinal research as its primary methodology.

We begin with an overview of literature theorising lived experience generally and more specifically in relation to automated and algorithmic systems. We discuss how this framework encourages researchers to consider their own experiences while interpreting and presenting the findings of a study, particularly as they undertake representing the lived experiences of others. We then introduce Universal Credit (UC) and describe the study’s qualitative longitudinal methodology, which has proven useful for capturing the experiences of UC claimants and for allowing an iterative approach that can react flexibly to new findings and participant feedback. We find that the idea of lived experience centres participants’ emotions as they interact with an impersonal but vital automated system of social support. This framework also helps us reflect on methodological approaches that can redress the uneven power dynamics of representing the voices of those sharing their everyday interactions with this system. These findings can be useful to the ASIS&T community interested in exploring the social values and ethics underpinning data-driven, algorithmic information systems and in incorporating participant voice into research design.

THEORIZING LIVED EXPERIENCE
Studies of lived experience and everyday life focus “on ordinary, everyday events (language, rituals, routines) while privileging experience as a way of knowing and interpreting the world” (Boylorn, 2008 p. 490). The concept of lived experience proposes that we come to understand the world based on these everyday subjective events and interactions. Intimate components of our identity—our race, ethnicity, gender, class, religious or political affiliation—shape these experiences and, as a result, our ways of knowing. These studies are also attentive to how subjectivity and emotions are embodied and grounded in a person’s historical and social context, including societal hierarchies and inequalities.

Studies on lived experience draw from philosophy, humanities and the social sciences, including the sociology of subjectivity and emotions and feminist theory. Scholars have grounded their understanding of the term ‘experience’ in 20th century phenomenology, which explores how we encounter phenomena as embodied beings (Young, 2005; Kruks, 2014; McIntosh & Wright, 2018). Simone de Beauvoir’s work centred female experience in this lineage of thought; later, intersectional approaches led by Black and lesbian feminism decentered female subjectivity from a presumed white, heteronormative identity aligned with earlier work (Ahmed, 2006; Alcoff, 2006).

Researchers bring rigour to these studies through systematic observation and data collection along with more humanistic approaches of poetry and drama. Many studies of lived experience focus on marginal subjects and unorthodox accounts ignored in conventional academic studies (Scott, 1991), such as researchers’ own descriptions of working as strippers (Ronai & Ellis, 1989), as undergoing abortions (Ellis & Bochner, 1992), and as wheelchair bound with MS (Mairs, 1996). Studies of lived experience, according to critical auto-ethnographer Robin Boylorn...
Importantly, much of this literature argues for researchers to reflect on how their interpretations of what they study are also grounded in lived experience – researchers in this tradition commonly interrogate their own positionality. Researchers may deploy auto-ethnography, detailing intimate accounts of an experience, or they may bring the relationships they build with research subjects to the fore of the research design. Such approaches offer a way to understand “the positions from which we speak” and shed light on the often-hierarchical dynamic between researcher and research participant (Ellis & Bochner, 1992, p. 6). This framework therefore aligns nicely with qualitative longitudinal research methods, which, as we detail below, allow a reflexive, iterative approach to research design and ethics that can support reflecting on the dynamic between researcher and research participant.

Lived Experience and Automated Systems

Directly relevant to our research are the small number of studies that have applied the concept of lived experience to algorithmic and automated systems. This work often focuses on how these systems are now part of quotidian life; they also alter our fundamental understandings of what we mean by ‘experience’ itself, as they turn instances of everyday life into quantified units that can then be processed and used to control those interacting with them (Pink et al., 2022). Nikidehaghani et al. (2022), for example, write about welfare recipients in Australia who confront a punitive automated debt recovery system programmed to ignore the individual lived experiences of recipients. In her in-depth ethnography, Virginia Eubanks (2018) intimately details the personal toll of those subject to automated decision-making in social security, childcare and housing benefits systems in the U.S. Other studies in this vein examine people’s situated, mundane interactions with algorithmic systems, such as users talking to Amazon’s Alexa (Strengers & Kennedy, 2022) and news teams maintaining a news ranking algorithm (Svensson, 2022). Ziewitz and Singh (2021) use their study on credit scoring to highlight both the potential and difficulties of studying the lived experiences of data subjects who interact with opaque algorithmic systems.

People’s lived experiences with automated systems also entail their emotions as they engage with them (Evans et al. 2021). Shank (2014) states that “the use of technologies can be intricately tied to affective processes, both with emotions altering technology use patterns and technology use altering one’s emotional state” (n.p.). Drawing on Latour’s actor-network theory, Stark (2019) conceptualizes digital technologies as emotive actants that can intensify the “experience and expression of human feeling,” and he calls for further research on affect and emotions related to digital and computational media (p.118).

Our research responds to Stark’s call by studying the lived experiences participants have with an automated system, with a focus in this paper on the emotions this system elicits. In the next section, we offer some detail about our study of Universal Credit using longitudinal qualitative methods before drawing on the lens of lived experiences to present our findings on participants’ emotional engagement with UC and to reflect on the study design itself.

QUALITATIVE LONGITUDINAL RESEARCH OF AN AUTOMATED SOCIAL SECURITY SYSTEM

Our project investigates how recipients of Universal Credit experience its digital and automated features. UC is a conditional social security benefit in the UK introduced in 2012, and it is digital-by-default: recipients apply for it through a website and communicate with case managers through an online account. Recipients also use the online account to submit necessary documentation and check the statement they receive reporting their upcoming UC payment. In-person interactions related to this benefit are limited, though recipients not able to carry out tasks online may opt for phone calls instead. Conditions of receiving the benefit may include the requirement to work or to look for work, in which case recipients will have regular face-to-face meetings with work coaches in Job Centres.

UC is also partly automated: claimants’ monthly payment is based on an automated system that calculates entitlements based on personal circumstances, monthly income and deductions made by the Department for Work and Pensions (DWP) (such as for past benefit overpayments, advance UC loans and so-called third-party deductions, which may include rent and utility arrears). Despite personal circumstances, such as number of children or disabilities, being quite stable over time, factoring in recipients’ monthly income and deductions can lead to hugely fluctuating UC payments. Recipients’ monthly income is determined based on data pulled from HMRC’s (HM Revenue & Customs, the UK’s tax agency) Real-Time Information (RTI) system, which reflects reported earnings by employers, or recipients themselves, in the case of self-employed people. The monthly income is taken into account in the calculation of one’s next monthly entitlement: above a certain threshold, the more a person or household earns, the less UC payment they will receive.

Our study uses one-off interviews and qualitative longitudinal research to understand the experiences of recipients interacting with this dynamic system. Qualitative longitudinal studies are a powerful way to understand lived experiences, as they track changes over time (Patrick et al., 2021; Dwyer & Patrick, 2021; Neale, 2016) and can allow trust to build between researcher and participants (Millar, 2021; Holland, 2006; Lewis, 2007); they also
provide an opportunity to invite participants to retell their stories (Pulkingham et al., 2010) and for researchers to reflect ethically on the dynamics constructed through research contact (Neale & Hanna, 2012; Treanor et al., 2021). Longitudinal qualitative studies allow researchers to be flexible and adjust the research design through participant feedback and as findings come to light (Holland, 2006; Hollstein, 2021); thus, they also are an ideal method for reflecting on the positionality of the researchers, as called for by the literature on lived experience.

We began recruiting participants for the study in spring of 2022 with the help of local charities who advertised the project on social media, newsletters, on physical leaflets and invited us to attend in-person events. The longitudinal study seeks out UC recipients who are working or are actively looking for work and agreed to participate for six or twelve months. We have 25 participants in the cohort who take part in approximately 30-45-minute-long entry and exit interviews, for which they receive £25 per interview, in addition to providing us with roughly bi-weekly prompted updates via text message asking about their interactions with UC (a common text message prompt is: “Hi [participant’s name] – hope all’s been well. Just checking to see if you’ve had any interaction with UC in the last few weeks.”). Participants primarily respond via text, with some sending screenshots of their UC accounts and interactions over the UC journal with UC staff. The interviews and the bi-weekly updates provide us with rich material for understanding recipients’ everyday experiences with Universal Credit. The screenshots in particular show context and archival-style data, giving us insight into a rarely seen aspect of social security: the interaction between case worker and benefit recipient. A few participants have also chosen to ask for phone calls to share updates. We have additionally conducted 19 one-off interviews with UC recipients who did not qualify for the longitudinal study; they received £25 for taking part.

REFLECTING ON OUR STUDY ONE YEAR ON
In this section we draw on the literature on lived experiences to highlight two issues of analytical importance that emerged during the first year of our study: the role emotions played while recipients interacted with UC and our own positionality vis-à-vis our participants.

Reflecting on Participants’ Lived Experiences
Participants expressed minimal emotions towards UC so long as it functioned as expected (just as most infrastructures recede into the background unless they break, per Star and Ruhleder (1996)). Most emotional expressions we encountered, consequently, occurred when participants experienced errors or unexpected behaviors. Our longitudinal study allowed us to trace participants’ emotional reactions to anomalies in UC’s automated payment in their communication with us and as captured by screen shots of their responses to UC case workers. In the following paragraphs we highlight some high-level findings on two types of unexpected UC behaviors that generated these emotions.

First, some participants told us they felt frustration, powerlessness and anxiety due to unexpected errors caused by automated features of the UC payment calculation. During our study, some participants’ employers misreported monthly earnings to the HMRC’s RTI system, which automatically shared the resulting errors with UC. Catching these mistakes, initiating procedures to fix them and “chasing” the matter – as one participant put it – is almost always up to the recipients. Cases of overreported earnings led to a reduced UC payment and impacted participants’ budgeting for everyday necessities, including food; some described the stress of borrowing funds as a result. Such mistakes can take a toll on the mental health of UC recipients. A participant shared with us a screenshot of a conversation in which she was explaining to her case manager that not being able to resolve the error “[adds] to [her] mental health as [she is] not sleeping worrying.”

Second, generating some of the most intense emotional reactions in our participants were problems occurring in the process of applying for childcare costs reimbursement (UC will pay 85% of childcare costs in arrears after recipients present receipts). Despite the subset of participants engaging with this procedure being very small (n=4), we were able to record that this duty caused anxiety when expected reimbursement did not show up in claimants’ payments. This occurred either due to error or the demands of complex reporting procedures, which include tight deadlines for reporting costs. For instance, one participant described her frustration of having to “chase” the reimbursement in “half [of] the months,” and this has remained a reoccurring theme in her updates for the study. Someone else shared her story of trying to query a reimbursement she did not receive, updating us on new developments via text messages over a three-month period. This participant concluded this experience by being “quite gutted” over not being able to get all her costs back.

Compounding these experiences, participants expressed frustration over the lack of in-person contact with case managers and UC staff in general (with the exception of those with regular job coach meetings). In our small sample, people who had no troubles with their claim and received a stable amount of UC payment (for instance, due to stable monthly income) appeared content with the system and appreciated not having to travel for in-person meetings. Contrary to this, those experiencing errors reported frustration and annoyance due to the lack of opportunities for in-person meetings or phone calls with their assigned case managers. As one participant put it: “I
can’t physically speak to a bloody human being on the Universal [Credit] phone [helpline].” Overall, the frustrated helplessness participants expressed towards UC relates to their identity as low-income claimants of social security negotiating the fundamental power imbalance between themselves and the state.

**Reflecting on the Researchers’ Lived Experiences**

While the lived experiences of recipients bring to the fore the emotions elicited by an automated system they feel they have little control over, reflecting on our own lived experiences also requires us to confront issues related to power – this time in relation to participants themselves. All phases of our research process are shaped by existing societal and interpersonal power dynamics: as researchers we have a dominant role in decision-making about the study and reaping the benefits of the research through academic recognition, such as journal publication, in ways that our participants cannot.

Our position also gives us representational power. Social policy scholar Peter Beresford points out that modern social policy research expects experts to mediate the knowledge and experiences of others (2016): their voices are interpreted and reported by the researchers, just as we did in the section above. Beresford calls for researchers to redress this dynamic between so-called expert and subject by “equalizing the relations between the two” (p. 223) through participant involvement in the research, by using multiple and adaptable methods that can respond to participants’ changing needs, and by only undertaking research that has a practical benefit to those taking part. The latter requires a political commitment to the research that disavows positivist claims of scientific objectivity and instead acknowledges the interpretive nature of all research practice, as well as the value of first-hand experiential knowledge of recipients.

We cannot overcome the “epistemic injustice” entailed in conducting research on behalf of a UK higher education institution with participants without this affiliation (Fricke, 2007). However, we do believe we can mitigate some of the potential harms by following some of the tenets of Beresford’s (2016) call for “user-controlled research” (p. 223). We see three ways forward. The first is to incorporate the views of the participants by asking whether our descriptions of their cases and quotes reflect their views prior to publications – our ability to do this is helped by the ongoing relationships we have formed with participants through the longitudinal research design, and we have now begun consulting participants before our publications go to print. The second is to make sure our research is fed back to policymakers themselves in attempts to make practical changes that could benefit our recipients; so far we have done this by turning our research into reports that we share with contacts at the DWP, submitting findings to special inquiries held by the Scottish and UK governments, and pitching findings to the press (see Booth, 2023). Finally, we can carry out research in partnership with user-advocacy organizations that have a long history of activism in social security reform, positioning ourselves more firmly as political allies of our participants. We are currently working on the latter in the second year of our study.

**CONCLUSION**

This paper has argued for using the lens of lived experience to understand how people interact with an automated welfare system and to reflect on our roles in telling these accounts. Rather than investigating the policy or design level, we have focused on the mundane experiences of people encountering a somewhat unpredictable system. Our study found that errors, complex rules, and the impersonal nature of UC created enormous frustration, sense of helplessness and stress for recipients. For recipients who work while receiving UC, the monthly payment reacts dynamically to their pay and to circumstances such as childcare needs. Instead of a straightforward calculation, the discrepancies in pay due to any errors or claimant misunderstanding create anxiety, especially if claimants must worry whether they will have enough money to pay basic bills and for food each month. We also reflect on our own lived experiences as researchers and how to mitigate the epistemic hierarchies created by the research process. We propose three ways to incorporate these reflections on power dynamics into the study itself, a process that is greatly aided by our methodology of qualitative longitudinal research, which allows for adaptations and participant input.

We hope this article contributes to the growing interest within the ASIS&T community around data-driven systems and algorithmic fairness and justice (Rosenbaum & Fichman, 2019; Udoh & Yuan et al., 2022; Hoffmann & Roberts et al., 2019). Theories of lived experience and qualitative longitudinal research may also be of interest to LIS (library and information science) scholars of everyday information behaviours and practices interested in incorporating reflexive and iterative research design into their studies.

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Conversations on the Invisibility of PIM, Approaching Themes, and New Avenues of Research

Cushing, Amber L. 
School of Information & Comm. Studies, University College Dublin, Ireland | amber.cushing@ucd.ie
Reyes, Vanessa 
School of Information, East Carolina University, USA | vreyesherridge@gmail.com
Ferguson, Robert D. 
School of Information, McGill University, Canada | robert.douglas.ferguson@mail.mcgill.ca

ABSTRACT
This short paper reflects on previous personal information management (PIM) research using the theme of “invisible PIM.” Three scholars gathered to reflect on how this theme is relevant to their research. After comparing reflections, the following threads of invisibility are highlighted as holding potential for future exploration: the role that PIM can play in reinforcing invisibility, the concept of maintaining information over time as being more likely to be labeled as invisible labor, and a focus on non-work experiences of sample populations. This work in progress concludes with suggestions of how reflecting on themes versus following PIM activities (a departure from previous practices for these researchers) was a useful activity to think about a future PIM research agenda.

KEYWORDS
personal information management; information management; personal archiving

INTRODUCTION
PIM has been defined as activities, “work related or not” that help an individual “fulfill life’s many roles and responsibilities” (Jones, 2008, p. 5). “Work related or not” can be understood as a setting where PIM takes place, such as the office investigated by Lansdale (1988). While what these activities include has been explored, the ways in which these activities are characterized has received less attention. Noting a similar conceptual vagueness that results in challenges with theorizing, writing, and studying “information activities”, Dalmer and Huvila (2019) suggest revisiting the concept of “information work” as a “helpful way to differently study about or advocate for the ways people interact and engage with information and can complement a parallel focus on, for instance, information practices, behaviors, and activities.” (p. 97). Information work becomes invisible when the time, effort, and value generated through information processing and records management is unpaid, unnoticed, and marginalized to hidden places and delegated to unseen people. In particular, these authors advocate for adopting a research approach inspired by institutional ethnography that “acknowledge[s], name[s], bring[s] value to, and count[s] the often invisible forms of information work that make everyday life possible” (Dalmer & Huvila, 2019, p. 100).

Inspired by Dalmer and Huvila (2019)’s informal approach of “hosting a series of spirited conversations and debates stemming from selective review and close reading of earlier literature” (p. 97), we used an autoethnographic approach to reflect on our research from the perspective of the following prompt: How does the concept of invisibility manifest in our own PIM research? This conceptual paper presents reflections by three PIM researchers on the theme of the invisibility of labor in their disparate bodies of work, highlighting the unifying and theory-generating potential of the concept of invisible information work in PIM.

RELATED WORK
PIM “refers to both the practice and the study of the activities a person performs to acquire or create, store, organize, maintain, retrieve, use, and distribute the information needed to meet life’s many goals and to fulfill life’s many roles and responsibilities” (Jones, 2008, p. 5). Foundational research in PIM was motivated by the desire to improve efficiency via strategies and tools that focused on information retrieval situated in the context of the white-collar office (Malone, 1983; Lansdale, 1988; Kwasnik, 1989; Whittaker & Hirschberg, 2001). With the advent of the personal computer, research focus shifted towards information work with virtual desktops (Barreau, 1995; Barreau & Nardi, 1995; Jones, Phuwanartmurak, Gill and Bruce, 2005), email (MacKay, 1988; Whittaker & Sidner, 1996) and information tools to support task management (Bellotti et al., 2003; Boardman & Sasse, 2004; Capra, 2009; Gwizdka, 2002). More recently, a growing body of work slowly explores how PIM is integrated into everyday life practices (such as health and personal finance) and management of the home and family (Moen & Flatley, 2005; Piras & Zanutto, 2010; Kaye et al., 2016). In this paper, we aim to contribute to this small but growing body of work to reduce the invisibility of PIM in non-office settings.

Despite these difficulties, there are several notable examples of PIM research that succeed at acknowledging, naming, valuing, and counting forms of invisible labor in PIM. These including acting (Cole, 1982), finding and reminding (Malone, 1983), task management (Malone, 1983; Gwizda, 2000; Whittaker & Hirschberg, 2001; Bellotti et al., 2002; Henderson, 2005), unification (Karger & Jones, 2006), and invoking ideas (Jones, 2007, Bernstein et al., 2007, 2008). Piras and Zanutto (2010) identify three distinct forms of invisible work in the context of personal health information management: (1) annotating; (2) underlying and highlighting; and (3) integrating rendered invisible by power differentials between professionals and laypeople, and the general trend of neo-liberalization.

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These results simultaneously indicate (1) a lack of recognition of the value added by laypeople’s information work, and (2) the shifting of the responsibility of some information work, (e.g., information seeking and unification) from professionals to laypeople (p. 599). More recently, Feng & Agosto (2019), note a greater frequency of engaging in (1) maintaining and organizing, (2) managing privacy and access, (3) measuring and evaluating, and (4) making sense of and using personal information, as automation in information systems reduces demands on users to keep and find personal information.

REFLECTIONS ON INVISIBLE WORK IN PIM

Autoethnography is a research approach that combines elements of ethnography and autobiography, using personal experience as examples to analyze and illustrate “facets of cultural experience”, rendering them visible and accessible to insiders and outsiders (Elis et al, 2011, p. 4). As layered accounts, autoethnographies reflect upon and analyze personal experience in parallel with empirical data and literature to produce holistic accounts of social phenomena, with a particular emphasis on rendering intrapersonal and subjective experiences that inform understandings and conclusions more visible to readers.

Some terminologies we use throughout this paper are related to what is invisible and visible in the context of PIM. For the prompt, our working definition of invisibility refers to practices in everyday life that are ubiquitous but also as a given and therefore taken-for-granted, rendering them difficult to see and discuss as well as are poorly explained through theory (Geertz, 1996; Low, 2009; Aucoin, 2017). Work becomes invisible when it is expected but simultaneously invalidated as non-work (e.g., as leisure) and devalued (e.g., non-monetary), with activities that take place in the personal sphere (e.g., the home) that are often completed by women and affective in nature (e.g., caring or nurturing) being especially susceptible to invisibility (Daniels, 1987). The term unseen will be referred to as what is not perceptible and is often traditionally associated with happenings in private spaces. The term visibility is used in adherence with the ability to be seen, perceived and often happens in public spaces. The concepts of visible and invisible PIM work are not mutually exclusive, especially as there is a blurring of home and work settings. Below we explore these concepts further. The following sections present three initial reflections by the authors on examples of invisibility in their research on PIM.

Scholar 1: The role of PIM in the perception of visibility and invisibility

As the collaborators began to review their own PIM research in response to the prompt, Scholar #1 noted a link between PIM and invisibility via how PIM can enhance perceptions of visibility or invisibility. Below are two examples of their previous research to explore this concept.

Visibility

In work on defining the concept of digital possessions (Cushing 2012; 2013), scholar #1 found that some of the digital items that participants managed in their collections were more significant than other items because they were perceived as representing the individual’s identity to themselves and others. These digital items were perceived as making one’s identity more visible so they were treated with more care, resulting in more PIM, than other digital items that were not as closely linked with providing a sense of identity. In the context of “invisible PIM,” this research can be understood as how the PIM process (managing and maintaining digital possessions) is undertaken to make one’s identity more visible, such as managing personal best times in a running event. In this sense, PIM acts as a byproduct because it is part of the work associated with using digital objects to make one’s identity visible to others and reinforcing that identity back to the individual. If PIM is positioned as a byproduct in the process of increasing visibility, it may also have a role in making something less visible, or invisible. Future research is needed to further explore this concept.

Invisibility

Cushing and Kerrigan (2022) explored the PIM that LGBQ parents must perform to obtain birth certificates and other identity documents from the Irish Government. After voting by referendum in 2015 to legalize same-sex marriage in Ireland, the Irish government developed a “pathway to equality” for same-sex parents who identify as female (same-sex dads are excluded). The resulting policies, outlined by the 2015 Child and Family Relationships Act, did not become law until May 2020 required same-sex parents to perform additional PIM tasks that heterosexual parents did not have to perform. The tasks included the organization, maintenance, and management of additional paperwork and documents including documents to evidence cohabitation, documents and medical records that evidence ART/surrogacy at an Irish clinic; evidence of conception date, evidence of maternity/paternity, marriage certificate (only in the case of two mothers), application to change the lines on a birth certificate from “mother” and “father” to “parent 1 and “parent 2”, parent identity documents, and engagement in the registry office process. Therefore, the Irish government’s “pathway to equality” is paved in PIM because it requires significant organizing, maintaining, and managing of personal information. The study participants who had engaged in this process described it as invisible for several reasons: 1) because it was a process that heterosexual parents did not have to complete to obtain birth certificates for their children and amplified feelings of inequality, and 2) because it
was work that was not understood by mainstream Irish society, which made the parents feel invisible. One participant spoke of how when she tried to explain the process to family and friends they were confused because they thought that gay marriage was “done and dusted”. The participant then explained how the process made her feel invisible because no one knew what she and her family were going through. This research demonstrates the role that PIM can play in reinforcing invisibility through the concept of an invisible burden. Further, it demonstrates how PIM can be used to make inequality feel invisible: the PIM that accompanied the Irish government’s pathway to equality went largely unrecognized and therefore reinforced feelings of marginalization and inequality.

Scholar 2: Invisibility of practices, language, and community

The digital era

The digital era has reshaped the nature, scope, and use of personal information. People collect and store an ever-increasing volume of digital personal information on convenient portable devices and create copious amounts of personal textual and visual digital information on their personal computers. Computer users are accustomed to using various tools involving their interactive social activities. There is a large amount of user-generated content related to peoples’ lives on these personal devices and there is no way for creators to maintain it all. As a result, there are some questions to be answered, such as what skills and practices are rendered invisible by the growing amount of information creators attempt to maintain. This section addresses the skills that have been made invisible due to the increasingly ubiquitous nature of digital personal information as it relates to older adult communities, who struggle with language, and technological practices. PIM skills remain largely invisible to these communities (Reyes, 2016; 2022).

Aging invisibly

Scholar #2 found that with our personal information being primarily digital, there are technological gaps that hinder the ability of older adults for whom English is a second language to have access to personal technologies, let alone have a working knowledge of how to use these PIM tools and platforms. According to Berkowsky et al., 2018), numerous technological applications are available that have the potential to improve the quality of life (QoL) of older adults, with some of these technologies facilitating PIM Practices. However, older adults are less likely to adopt new and emerging technologies and reap the potential benefits. Several unseen contributing factors influence older adults’ decisions about the adoption of modern technology. Self-assessed abilities and computer/Internet skills are among those lacking skill sets, along with the willingness to adopt technologies. Throughout aging adult research, there are invisible factors that limit older adults from managing their digital selves; those are associated with technology readiness, age, and language group.

These populations suffer from the unseen (invisible) PIM skills which are prevalent in adults as they age due to a lack of resources, or from having someone to help them manage their archives. These outstanding issues persist as people age, and as a result, they may find it difficult to retrieve their memories, leading to personal information being at risk of loss. With most personal data now in electronic form, people are losing their information, but not necessarily through oversight. Resources are scarce because they are invisible over time. What skills and practices are rendered invisible when groups of people are rendered socially invisible?

Technological literacy, for the unseen

Technological development contributes to the invisibility of older adults, specifically as advancements are being made to already difficult-to-understand personal information management platform tools. There is a lack of advocacy in the way that PIM tools are being created, and thus there may be a need for an examination of how the labor associated with managing our personal digital lives is to be taken into consideration. Is there an awareness of the labor involved in managing our personal information? How do we consider the barriers for aging adults who lack the skills needed to manage personal information? Are these barriers considered? More importantly, how does current research consider these issues?

Scholar 3: Invisibility of Information Work in Personal Finance

Managing the self through finances

In scholar #3’s recent work on young adult personal finance and financial records management (Ferguson, 2023), there is a prominent theme of PIM as a form of invisible labor that helps people between the ages of 18-25 develop financial maturity and successfully navigate their transitions to financial adulthood and independence. Personal finance is a context that intersects activities from many domains of life, including employment, education, recreation, and family life. Through managing personal finances, young adults described being able to manage different non-financial aspects of their lives by proxy. To what extent is PIM a taken-for-granted technique for self-management and personal records an invisible tool of self-mastery? There is a long tradition within the PIM literature recognizing the task management function of PIM and how digital tools help coordinate and execute concrete actions (Cole, 1982; Malone, 1983; Barreau & Nardi, 1995; Whittaker & Snider, 1996; Bellotti et al., 2002; Bellotti et al., 2003; Bellotti et al., 2004; Bergman & Whittaker, 2016), whereas scholars in personal archiving tend
Managing liminality as articulation work
PIM in personal finance is a form of articulation work that addresses the unexpected and unanticipated that create disruptions in people’s lives, requiring corrective measures to get “things back on track” (Corbin & Strauss 1985, 1988; Star 1991; Dalmer & Huvila, 2019). Young adulthood is characterized as a period of the novel and expanding financial responsibilities and expectations (Butterbaugh, Ross, & Campbell, 2019; Hoge et al., 2017; Xiao et al., 2014). Through financial self-tracking, young adults described feeling more capable of navigating the instability and liminality that characterizes emerging adulthood (Arnett, 1998, 2000, 2006). Young adults described making extensive use of the financial touch using “occasional glimpses of the complex whole rather than a concerted and coherent overview of their entire [financial] situation” to detect anomalous or unexpected financial events using minimal personal financial data gleaned from financial records and information technologies (e.g., account balances) (Kay et al., 2014, p. 526). Thus, PIM in personal finance is also “the work of keeping track” (McKenzie et al., 2014; Dalmer & Huliva, 2019), which young adults used for modifying financial behaviors they deemed irresponsible and immature, and future work could explore the relationship between financial wellbeing and effective PIM.

Social transmission of PIM practices
Lastly, the knowledge translation work parents do to prepare young adults for living independently is also a form of invisible labor in the context of personal financial PIM. Young adults describe relying on parents as role models of records management. Referred to as financial socialization, parents are teachers of personal finance who support the development of a variety of financial management skills and practices (Mary, 2014; Lanz, Sorgente & Danes, 2019; Damian, et al., 2019; Allsop et al., 2020). Therefore, how knowledge is rendered explicit from tacit states and translated as part of the social diffusion of PIM practices as a form of information work still remains largely invisible within PIM literature, begging the question, what are other examples of the social transmission of PIM practices?

CONCLUSION
We found threads of invisibility throughout the initial reflection upon our own PIM research. The overlap rests in the instrumental roles that PIM plays in the management of everyday life that are often invisible and therefore minimally supported. Our reflections on PIM as invisible labor highlight how PIM can be difficult to learn, keep up with and even when you feel that you have a handle on it, and is not always recognized as legitimate work.

Interestingly, we also found a link to personal archiving, or Jones’ (2008) meta-level activity of maintaining personal information over time. As previously stated, there is little research available that explores the relationship and overlap between PIM and personal archiving, but invisibility might be a theme to explore, to unify these two strains of research so there is less siloing of ideas. Another avenue worth further exploration is the overlap between PIM and information behavior research on invisible work, as exemplified by Dalmer & Huvila (2019). Particularly, investigations of health information behavior have touched on the concept of invisibility (Dalmer, 2020). We also found that our research population samples tended to stray from the participants studied in the “office of the future” that Landale (1988) described: the white-collar workers’ habits and behaviors explored in early PIM research. This aligns with our earlier observation that PIM research has grown more humanistic over the years and suggests that defining overlaps with other research areas such as information behavior and personal archiving is needed.

Taken together, these insights suggest that exploring PIM through a lens of invisibility was a fruitful approach. After our auto-ethnographic exercise, we conclude that the concept of invisibility draws from our work in identity, language, aging, and self, further we think that invisibility has several layers. From our experiences, invisibility correlates with PIM skills, activities, and processes that are not discussed or thought of. We started with a theme, not a set of activities, which is how one may traditionally approach PIM research. While this work is still in progress, we believe it can be applied in other PIM research contexts and holds potential to make a theoretical contribution to PIM research.

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Seize the Initiative: In-Process LGBTQ+ Research Findings and Their Impact on Connecting Practices in New Zealand GLAMU Institutions

Day, Alison Victoria University of Wellington, New Zealand | alison.day@vuw.ac.nz

ABSTRACT
LGBTQ+ activism has played a significant role in effecting legislative and social change in New Zealand and overseas, promulgating public attitudinal shifts towards tolerance and inclusion. These societal changes do not however appear to have resulted in the visible representation of LGBTQ+ communities in New Zealand’s GLAMU institutions. Using a survey, this study investigated what has been occurring in GLAMU institutions with respect to LGBTQ+ collecting and donating through a queer theory lens. The findings indicated that broad, inclusive collection policies do not equate to representation when coupled with passive collecting and little connectivity not only with LGBTQ+ communities but between GLAMU institutions. The evident need revealed by the research findings, particularly the facilitation of GLAMU interconnectivity, offered the chance to alter the existing state of affairs. This paper shows how ongoing research can be applied as the opportunity arises to inform current practices and initiate change.

KEYWORDS
LGBTQ+; community; collections; donations; information institutions

INTRODUCTION
In 1986 New Zealand passed the Homosexual Law Reform Act decriminalising homosexuality, while sexuality-based discrimination was made illegal under the 1993 Human Rights Act. Decriminalisation highlighted the attitudinal shifts taking place, not just within society, but among galleries, libraries, archives, museums and universities (GLAMU) which had previously overlooked lesbian, gay, bisexual, transgender and queer/questioning (LGBTQ+) materials. Up until the 1960s most LGBTQ+ personal collections were lost or discarded, while a paradoxical ‘conspiracy of silence’ around the existence of LGBTQ+ communities in New Zealand meant they were largely invisible (Parkinson, 1984).

It was this failure to acknowledge LGBTQ+ existence, along with the persistence of criminal and social stigmas, which spurred communities to document their own history. Downs (2021, p.31) contends that “LGBT people have been the leading and often exclusive archivists of their own history; beginning in the 1970s and continuing until today”, pointing out that it is only recently that mainstream institutions have been collecting and preserving LGBTQ+ history. Change has been slow in New Zealand with homophobia still perceived in 2020 as a pervading issue in art galleries and other major institutions (Te Kani, 2020). These past and current attitudes still require those in LGBTQ+ communities to collect and preserve their stories or risk losing them, underlined in a recent New Zealand media headline proclaiming, “Overlooked by the cultural sector, Aotearoa's [New Zealand] queer communities document themselves” (Chumko, 2021).

Academic attitudes have also influenced collecting strategies as providing resources for researchers is an important part of the work of GLAMU institutions, encouraging acquisitions in those areas of interest (Avery, 2013). LGBTQ+ history and sexual diversity were originally excluded from and overlooked by universities and, by extension academic journals, which meant GLAMU institutions were much less likely to accept proffered donations or actively seek to develop collections in that area (Brickell, 2008; Downs 2021). These attitudes have stifled the development of relationships between LGBTQ+ and GLAMU institutions (Vincent, 2016) and perpetuated LGBTQ+ communities’ ongoing mistrust of mainstream institutions and the state (McKinney, 2015; Kirste, 2007). Lack of connectivity and trust indicates LGBTQ+ donations are more likely to be offered to an LGBTQ+ independent archive than to a GLAMU institution.

This study is part of a broader research project investigating several components of LGBTQ+ collecting and donating in New Zealand, including LGBTQ+ donor relationships, LGBTQ+ independent archives and GLAMU institutional collecting. This paper will consider some of the key findings from a qualitative survey to investigate the state of LGBTQ+ collecting and donating among GLAMU institutions in New Zealand. Furthermore, this paper will showcase, not only the current holdings situation and some of the associated issues, but also the impact of research on practice occurring during the research process, by acting on opportunities as they arise.

LITERATURE REVIEW
Much of the research around LGBTQ+ collecting focuses on the lack of representation in GLAMU institutions with information professionals cast as willing collaborators (Avery, 2013). These views appear to have extended to
sociably inquiry around GLAMU holdings of LGBTQ+ collections with only a few such surveys undertaken. In Canada in 2010 it was found that only 55.9% of surveyed public institutions had LGBTQ+ materials and only 26.5% actively collected these (Avery, 2013). A 2006 survey of holdings in the state of Victoria, Australia, showed an institution-wide failure to represent LGBTQ+ communities and, of the larger institutions that did hold LGBTQ+ documentation, there was an LGBTQ+ silence in existing collections for the nineteenth and early twentieth centuries (Davison, 2006). Discovering the extent of LGBTQ+ holdings in New Zealand would contribute not only to the literature, but also afford a clearer picture of what is occurring in this space and will be explored in this paper.

Within the information science field, most of the literature on LGBTQ+ is predominantly from the United States and Canada with other countries such as the UK and Australia featuring notably less. In New Zealand, most of the very limited scholarship focuses on the establishment of an LGBTQ+ independent archive (Parkinson, 1984; Parkinson & Parkin, 1998). Donors do not feature and this topic has continued to receive little attention. Donations from Māori are limited to one paper (Bloomfield, 2020) while Pacific peoples have not been researched in the New Zealand context. Understanding the context of LGBTQ+ collecting and donating in New Zealand would contribute not only to the literature, but also afford a clearer picture of what is occurring in this space and will be explored in this paper.

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Building connections between GLAMU institutions and marginalised communities, such as LGBTQ+, for donation purposes is important as often LGBTQ+ donors may not appreciate the cultural and historical value of their documents (Kumbier, 2014). One aspect of donor relationships that scholars agree on is the necessity for trust, either with the archivist and/or the institution (Skeem, 2018; Fife, 2019). The most successful connections are achieved by shifting the balance of power and centring the needs of donors (Wexler & Long, 2009) while Krizack (2007) found that employing a collaborative approach when developing connections with potential donors from marginalised communities was the most effective. This paper will consider if/how LGBTQ+ donors are approached in GLAMU institutions and revealing the gaps and issues.

Employing a radical empathy lens in association with an ethics of care paradigm actively considers another person’s perspective in order to establish a deep and caring connection with them, both coming from feminist theory. Radical empathy involves emotional and cognitive empathy while understanding how the person feels provides insights into how that person views the world (Givens, 2021) and both theories can be employed with GLAMU donor relationships. Centring the donor (individual, group, community) in the relationship rather than the donation can engender trust both in the curator and the institution. Both theories were deployed during the data collection and analysis.

**THEORETICAL FRAMEWORK**

Two interdisciplinary theories have scaffolded this research. Queer theory, from queer studies and influenced by Foucault (1978), challenges the rigidity of postmodern constructs of sex and gender identity and advocates for identity fluidity to allow multiple interpretations (Neal, 2019, Sullivan, 2003). Seeking to ‘queer the archive’, means shifting from a heteronormative gaze to a queer perspective thus rendering LGBTQ+ collections and items visible within GLAMU institutions and revealing the gaps and issues.

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**RESEARCH METHOD: QUALITATIVE SURVEY**

A qualitative survey was designed using a queer lens, with the aim of ascertaining what is occurring in the collecting, documenting and donating space for LGBTQ+ in New Zealand. Non-probability sampling was used and institutions were selected from the top 18 New Zealand population centres. A total of 32 GLAMU institutional responses were received from 37 emails containing a survey link, with 5 non-responses. The survey comprised both closed and open questions and was constructed to elicit information regarding whether a queer perspective informed any aspects of institutional collecting. The questions included finding out the extent of an institution’s LGBTQ+ holdings, if LGBTQ+ were part of the collection policy and if any LGBTQ+ collection redescription was being undertaken. An ethics of care and radical empathy lens underpinned the LGBTQ+ donation questions to ascertain the nature of (any) connections with LGBTQ+ individuals/communities/organisations from a donor-centred perspective. An information professional at each institution whose role involved curating archives, heritage and/ or
special collections, responded to the survey. The responses to the open questions were analysed using Braun and Clarke’s (2006, 2022) reflective thematic analysis. Following data familiarisation, initial codes were created which were refined and reviewed during the process of analysis as themes emerged. Data analysis and interpretation were informed by queer, radical empathy and ethics of care theories to elicit if and how these manifested within institutions. As part of the reflexive process, the researcher’s LGBTQ+ positionality was subject to critical reflection regarding how this might affect interpretation from a queer theory perspective.

**FINDINGS**

For this short paper, three interconnected findings from the survey will form part of this discourse: collection policy and practice, institutional collecting approaches, and institutional and community connections.

**Collection Policies and Practice**

All institutions had collection policies in place and the majority featured broad collecting strategies. These are designed to be inclusive with one institution commenting, “Our collection policy currently does not favour or discriminate against particular groups within our community” (I17). Such policies are widely perceived across the GLAMU sector as a significant contributing factor in creating a diverse collection. However, there are caveats as the national museums and libraries collect material considered nationally significant while for regional institutions and universities material needed to be relevant to the locality or the university. Specific collecting plans that targeted marginalised and under-represented groups were only evident at a few institutions, including one that was regionally based.

**Collecting Approaches**

Most institutions are beset by constraints that can impact severely on their collecting abilities. Under-staffing and the resulting lack of time, financial restrictions, processing backlogs, and severe storage problems have meant several regional institutions have recently placed moratoriums on donations. Collecting by New Zealand GLAMU institutions has traditionally been passive, from donations, which many of the participating institutions perceived as an inclusive approach with one stating, “As we currently only collect passively, we collect from all facets of the community” (I11). However, several institutions recognised the limitations of passive collecting, observing that the “majority of donations offered to the collection tend to fit into a certain kind of material...which is already well represented in the collection” (I23). Reliance on donations therefore distinctly shapes collections. Many institutions, particularly those in regional areas, were of the opinion that donations will remain their only collecting approach, as the lack of resourcing and operational constraints prohibited proactive collecting. Within two of the main population centres, a few of the larger institutions have instituted proactive and/or contemporary collecting, either for marginalised communities generally, or particularly for LGBTQ+ and is usually a component of a broader project. Proactive collecting has included recording LGBTQ+ oral histories and employing student interns to work on specific LGBTQ+ tasks. A contemporary collecting initiative at one institution involved establishing an online contemporary transgender collection. Nevertheless, the survey revealed that LGBTQ+ proactivity, set within a New Zealand context, is very limited. The predominant issue is that donations are usually offered by mainstream societal groups, not LGBTQ+, with many institutions affirming that “we have not been approached about accepting donations by any LGBTQ+ communities” (I4). Consequently, LGBTQ+ groups are under-represented (or are not present) in New Zealand GLAMU institutions. Survey respondents expressed awareness of the situation and there is evident goodwill and desire to initiate change and begin to queer the archive. “We would like to collect more proactively by building relationships with local LGBTQ+ communities and basing our collecting practices on their needs” (I4), demonstrating that some respondents are cognisant of the necessity to focus on communities in the relationship, rather than any potential donations.

**Connections**

Another key issue was that the majority of GLAMU institutions did not have connections with LGBTQ+ communities and this was seen as a significant stumbling block. Respondents observed that building relationships with communities is a long-term venture, observing “it’s vital that the community know their records will be safe and treasured with us. But it takes time to build that trust” (I31), with many noting they lacked the necessary resources and staff to sustain relationships. Additionally, many respondents would “like to partner with community members to do some targeted collecting in this area” (P18) as they recognised that only through establishing mutually respectful and supportive connections with LGBTQ+ communities might donations become a possibility.

Additional complications were raised by respondents who were not members of the LGBTQ+ communities themselves, concerned about “not necessarily having the contacts or being confident in what it is appropriate to ask for” (I1). Another connection issue aired by several respondents is the limited relations between the GLAMU institutions. While there are one or two small local groups, nothing exists on a wider, more formal level for discussions and idea sharing in a space where most institutions face similar resource constraints and are looking for innovative ways to work around these.
DISCUSSION: RESEARCH IN PRACTICE

The findings for New Zealand GLAMU institutions clearly accord with other studies in this area (Avery, 2013; Davison, 2006) regarding a lack of LGBTQ+ representation. Conversely, broad and accessible collection policies, intended to be inclusive and diverse, do not reflect practice as they fail to encourage offers of donations from a diverse range of societal groups assumed in the literature (Sauer, 2001; Grgic, 2011). Additionally, the predominant collecting approach in GLAMU institutions is donation-driven and passive which privileges certain societal groups, while others, like LGBTQ+, are under-represented or not visible at all. The survey findings demonstrated the interdependency between passive collecting, broad collecting policies and the under-representation of marginalised groups, including LGBTQ+, indicating there are operational barriers to change in GLAMU institutions. Attitudinal barriers were not evident, with respondents indicating they would like to be more representative but were unsure how to navigate their resource constraints, while the lack of institutional connections meant they were unable to share ideas and obtain advice.

The findings also clearly show it is essential to adopt a person/community-centred, empathic and respectful approach, based on ethics of care and radical empathy theories, when making connections with LGBTQ+ communities. Institutions have recognised they must be proactive in this regard, they need to take the initiative and connect with LGBTQ+, as the findings have indicated that these communities are highly unlikely to come to them. This perspective is supported by the literature, building relationships built on trust, respect and collaboration is essential (Fife, 2019; Krizack, 2007)

Although this research is ongoing, areas of need were immediately identifiable. Connecting respondents together from the institutions surveyed was the first task undertaken and permissions sought and obtained. One curator at a national institution, whose role includes increasing representation of marginalised communities, agreed to be the facilitator and two separate groups, one for the universities and one for the GLAM institutions, were established. The requirements of universities tended to be different from those of GLAM institutions and connecting the universities together in the first instance was seen as beneficial. Two groups have now been formed and meetings are held on Zoom. The researcher is an invited member of both groups with the aim of finding out and supporting what members are doing and would like to do in the marginalised community space. Acting on a suggestion has resulted in collection policies being shared amongst the members of each respective group for future discussion about how these may (or may not) facilitate representation and how this might be navigated. The researcher also drew respondents’ attention to the free SafeSpace Alliance initiative, established by New Zealand artist Shannon Novak, designed to show LGBTQ+ communities that an organisation is a verified safe space. This would offer GLAMU institutions, if they wished, an opportunity to connect with local LGBTQ+ communities for their input. The logo, once granted, can be displayed both physically at the institution and on their website. SafeSpace has already been utilised by several GLAMU institutions.

Developing connections with local LGBTQ+ communities is vitally important to help build trust and confidence in local and national institutions and for them to feel encouraged to become part of the local and national narrative and see themselves represented. It is hoped that connecting members of the New Zealand GLAMU sector together will help facilitate contacts and connections with LGBTQ+ communities. For one institution, becoming aware of the lack of LGBTQ+ representation through survey participation has led to local LGBTQ+ communities being actively sought out for inclusion in consultations regarding future collecting and exhibition strategies, after being originally overlooked. Other GLAMU institutions mentioned that because of raised awareness from completing the survey they have been giving consideration to how LGBTQ+ can feature more visibly in collections and what measures could be implemented to achieve this.

CONCLUSION

This research has shown that queering an archive is not just the task of an institution, it also requires input from the communities in terms of expertise, narratives and materials which, for many GLAMU institutions, is either not occurring or is part of a short-term project only. GLAMU institutions cannot rely on broad collection policies and passive collecting approaches as in practice such policies and approaches exclude rather than include by perpetuating the status quo. For LGBTQ+ collections and communities to make their way to GLAMU institutions, information professionals need to develop connections with LGBTQ+ communities to build trust and develop community-centred relationships based on the concepts of radical empathy and ethics of care. What is clearly evident from the survey is that before this can occur, it is essential to connect respondents in GLAMU institutions with each other to commune and share ideas by providing a forum for productive and meaningful conversations. This researcher is now an invited member of both groups to contribute ongoing research findings to expedite discussions and help make LGBTQ+ (and other marginalised groups) more visible in GLAMU institutions. Research in process can therefore help to inform practice and initiate change as findings eventuate, seizing favourable opportunities as they arise, instead of adopting the traditional approach of waiting until the research is completed, and risk losing the momentum.
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Using Playful Metaphors to Conceptualize Practical Use of ChatGPT: An Autoethnography

Desai, Smit  
University of Illinois at Urbana-Champaign, USA | smitad2@illinois.edu

Twidale, Michael  
University of Illinois at Urbana-Champaign, USA | twidale@illinois.edu

ABSTRACT
In this short paper, we employ a month-long autoethnography to investigate the utilization of ChatGPT through metaphor analysis. We conceptualize three metaphors—unreliable narrator, court jester, and sounding board—that possess the most explanatory capabilities in describing what ChatGPT is, when it can be used, and how it can be helpful. We posit that grounding the use of ChatGPT in metaphors could facilitate discussions and streamline the intricate mechanism of Large Language Models (LLMs). Our study indicates that by proffering playful metaphors as substitutes to apocalyptic and arcane ones, we can enhance the accessibility and comprehensibility of ChatGPT for non-experts and policymakers, thereby potentially contributing to more informed and productive dialogues about the role and potential of LLMs in everyday life.

KEYWORDS
Metaphors; Autoethnography; ChatGPT; Large Language Models (LLMs)

INTRODUCTION
With the release of ChatGPT in November 2022, Large Language Models (LLMs) catapulted into mainstream consciousness. Whenever we encounter a new technology, we draw on metaphors to explain it to ourselves and others. From humber metaphorical roots as “stochastic parrots” (Bender et al., 2021), LLMs are now being compared to “steam engines,” “fire,” and even “God” (Thompson, 2023). Much of this conversation is a mixture of scary doom stories and useful but potentially confusing and contradictory advice from people with expertise in AI for people with less expertise. Unfortunately, this can turn into giant lists of prescriptions and proscriptions that can be perceived as very disempowering—the AI priesthood telling the uninformed laity what they should and should not do. Moreover, these lists are not grounded in the systematic use of ChatGPT for practical purposes. For example, a salient metaphor for ChatGPT is “it’s like autocomplete.” Although technically correct (with caveats), it is not an actionable metaphor as it does not provide an understanding of how to use ChatGPT. Helping people think more productively about LLMs can help conceptualize how ChatGPT could be realistically used to perform tasks.

The inspiration for this short paper came from the first author engaging in a conversation initiated by their barber about ChatGPT. During this conversation, the author tried to explain the underlying mechanism of LLMs but found movie metaphors to be the most effective explanatory tool. Motivated by this, we use a month-long autoethnography to ground the use of ChatGPT in practical scenarios useful for a wider audience. We use metaphor analysis to identify metaphors to make sense of interactions with ChatGPT. In some cases, the metaphors used are explicit (e.g., using ChatGPT as an assistant). But in most cases, the metaphor use is implied and conceptualized during analysis. We use Desai & Twidale (2022)'s work on metaphor analysis as a basis for our paper and apply its understanding to ChatGPT, with the help of three metaphors—a sounding board, an unreliable narrator, and a court jester. We use these metaphors to understand what ChatGPT is, when ChatGPT was employed, and how ChatGPT was utilized.

BACKGROUND
We adopt a constructivist position to discuss metaphors from a cognitive linguist lens—as developed by Lakoff & Johnson (2004)—by introducing “conceptual metaphors.” We conceptualize metaphors as the basis for generating new knowledge by enabling us to talk about one concept in terms of another. Metaphors have been studied in various fields, including sociology, cognitive and clinical psychology, and discourse analysis (Goatly, 2008). Scholars generally agree that the metaphors people use can provide insight into their tacit knowledge, their representations of complex knowledge structures, and their developmental understanding of their role in social structures (Moser, 2000). Discourse analysts examine metaphors to uncover underlying perceptions and to shed light on the ways in which they shape behavior in contexts such as politics, ecology, and economics (Chilton, 1996; Goatly, 2008). In clinical psychology, it is common for practitioners to pay close attention to the metaphors patients use, as these may reveal valuable insights that would otherwise remain latent (Barlow et al., 1977; Billow, 1977).

In Human-Computer Interaction (HCI), metaphors have been used to educate users on the functionalities of information systems (Colburn & Shute, 2008). The most popular example of this is the ‘desktop’ metaphor used for Graphical User Interfaces (GUIs), which is decomposed into secondary metaphors (folders, files, menus, tabs, etc.) (Neale & Carroll, 1997). These metaphors help provide mental models by familiarizing users with unfamiliar concepts using existing knowledge (Heckel, 1994). In some instances, there may be a mismatch between the designer-provided metaphor and the user-interpreted meaning. For example, a trash can symbol to delete files may...
mislead users into thinking that once deleted their files cannot be recovered. Such mismatches necessitate a closer examination of metaphors to keep them relevant and closer to the systems’ changing capabilities.

Our understanding of metaphors for conversational systems is currently limited and often restricted to ‘humanness’ (Doyle et al., 2019). However, humanness is a problematic metaphor as it signifies a level of intelligence that these systems are incapable of (Cowan et al., 2017). This is best signified by referring to conversational systems as ‘agents’ (Lieberman & Selker, 2003) or ‘assistants’ (McMillan & Jaber, 2021). A closer inspection of the literature suggests that users’ mental models are more complex than such simplistic metaphors imply. Desai & Twidale (2022) showed that the use of metaphors for conversational systems is contextually fluid and depends on the performed tasks. In some cases, the same user might (intentionally or unintentionally) use several metaphors to describe different aspects of the system. Moreover, they find that metaphors used by users could explain how they perceive the system and make sense of the interaction they are experiencing.

**METHOD & POSITIONALITY**

In this paper, we use autoethnography, a qualitative research method, to document the lived experiences of the researcher who places themselves in the role of a research participant. Traditionally, an autoethnography “...acknowledges and accommodates subjectivity, emotionality, and the researcher's influence on research, rather than hiding from these matters or assuming they don't exist” (Ellis et al., 2011). In this sense, the researcher’s positionality, emotions, and cultural and life experiences play a major role in the production of new knowledge.

For transparency, we provide a brief background of the autoethnographer—Smit is raised in urban India. He migrated to the U.S. to study at a Midwestern University for a doctorate in Information Science. He has been living in the U.S. for seven years. Smit’s expertise is in usability engineering and conversational AI.

Data collection for this project began on March 6th, 2023 and ended on April 6th, 2023. During this time, Smit journaled his interactions with ChatGPT in a Google Doc daily. The only grounding rule for Smit was to use ChatGPT for research or work-related activities. All other uses were outside the scope of this autoethnography. The journal entries included annotated screenshots and an explanation of the goal and reason for the interaction. Further, the journaled entries were then supplemented by daily retrospective reflections (Duncan, 2004) of the experiences and interpretations to construct meaning and rationale for the behavior.

<table>
<thead>
<tr>
<th>Task domain</th>
<th>Metaphor</th>
<th>Helpful use case</th>
<th>Unhelpful use case</th>
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</table>
| Simple writing tasks | Sounding board    | • Administrative emails (e.g., “write an email to remind the research team to get their memos in before the deadline”)  
• Grammar and tone checker (e.g., “does my review sound rude...”)  
• Bridge cultural gaps in writing (e.g., “Do Americans use the phrase ‘you really sorry’ often?”) | • Original work (e.g., “generate an abstract from these bullet points”)  
• Personal emails (e.g., “Give advice to a young student about choosing a specialization in computer science”) |
| Designing a website | Sounding board    | • Coding (e.g., “write an HTML code to embed an iframe in the header”)          | • Summarization (e.g., “summarize this abstract for a lay audience”) |
| Ideation          | Court jester      | • Example generator (e.g., “popular liars in movies”)  
• AI image prompts (e.g., “create a prompt for an AI image generator based on this project description”) | • Research design (e.g., “how could I design a research study to study the effect of conversational styles on user perception?”) |
| Menial jobs       | Court jester and Sounding board | • Transcript cleaning (e.g., “clean this research transcript between two speakers...”)  
• Proofreading (e.g., “proofread my blog post...”) | • Generate alt-text (e.g., “what would an accessible alt-text for this image...”) |
| Searches          | Unreliable narrator | • Factual/ objective queries (e.g., “define confabulation”) | • Literature review (e.g., “what are influential papers on user perceptions of conversational agents?”) |

Table 1. Summary of use of ChatGPT with conceptualized metaphor and further description of use.
At the end of the journaling period, the Google Doc was shared with Michael for further analysis. Due to the shared research interests of the authors, the focus of the analysis was to identify metaphors that might have been used to explain certain behaviors or interactions with ChatGPT, and how that might be useful for a broader research community and users of ChatGPT. At the beginning of the analysis, Smit reread the journal entries and retrospective reflections and identified nine metaphors that could explain his use of ChatGPT. It is important to note that the use of these metaphors was not conscious during the autoethnography, and they only became apparent during analysis when the uses of ChatGPT and the underlying behavior were conceptualized using metaphors. After discussions with Michael, the number of metaphors was narrowed down to three on the basis of their explanatory capability—a sounding board, an unreliable narrator, and a court jester. A summary of activities conducted during the autoethnography, along with the conceptualized metaphor(s), is included in Table 1.

**METAPHORS FOR CHATGPT**

Overall, the metaphors in this section represent how Smit interacted with ChatGPT in certain use scenarios and how these experiences shaped his mental model. It is important to emphasize that metaphor analysis is messy. It would be easy to pick one metaphor and apply it to all scenarios. But that is usually not the case—especially in interactions with information systems. Even the three metaphors elaborated below fail under scrutiny. However, they provide a useful start to encourage discussions and provoke research questions that might help researchers envision design spaces and identify research opportunities.

**ChatGPT as a sounding board**

ChatGPT should not be viewed as a replacement but rather as a tool to augment one's knowledge. One of Smit's most popular use cases for ChatGPT was confirming existing knowledge on a subject. The added layer of confirmation provided a greater sense of security in one's writing or research. For instance, ChatGPT was useful in checking if a complicated search query would yield expected results in a library database, even if Smit were confident it would. Similarly, ChatGPT can offer a second opinion in trivial scenarios, such as confirming if a review of a research paper sounds rude. In these cases, ChatGPT functions well as a supportive sidekick.

Conversely, it is advisable to use ChatGPT with caution when seeking information on a topic outside one's expertise. Although ChatGPT may offer convincing answers, there is a risk of automation bias. Therefore, verifying the accuracy and credibility of ChatGPT's responses is important, which can be time-consuming. It is premature to suggest that ChatGPT will replace Google search, as a conversation as a medium of information retrieval may be less efficient than a simple search, especially when one has to confirm ChatGPT's results on Google. In such cases, using Google search may be more practical to save time. In this style of use, ChatGPT is like how Sherlock Holmes interacts with Dr. Watson: as a way for the former to show off his superior intellect and as a sounding board for how more ordinary minds might perceive the world. An initial request to ChatGPT to suggest “popular movie sidekicks” led to a suggestion of Robin from the Batman oeuvre (along with other suggestions, including Dr. Watson). This was partially helpful, particularly when contrasting the enthusiastic but naïve Robin with the highly capable Alfred the Butler (butler being a recurrent metaphor used for many conversational agents). However, upon deeper discussion, we chose Dr. Watson as a somewhat better (but still imperfect metaphor). Nevertheless, ChatGPT’s suggestion was a useful starting point, albeit not an ending point.

**ChatGPT as an unreliable narrator**

As many others have noted, ChatGPT is a confabulator that can be amusing in storytelling, imaginative play, or social conversation but not in serious settings. Given the prompt “famous liars in movies,” ChatGPT suggested various creative lies from movies, of which we liked best Keyser Söze from “The Usual Suspects” (and of course, that required us to have seen the movie and remembered the character). Similar to Keyser Söze, ChatGPT is an unreliable narrator skilled in creating plausible responses using limited context or clues. Unlike Keyser Söze, whose abilities were constrained to the objects in the interrogation room, ChatGPT can draw upon the vast expanse of the internet to craft engaging stories. In instances where reliability is important, the results could be full of ‘hallucinations.’ For example, ChatGPT generated hallucinated citations to queries regarding a literature review. While Smit could easily identify the hallucinations as the literature was within his expertise, non-experts could be easily convinced by the results. These hallucinations could include erroneous information about real people, sometimes leading to horrifying outcomes, such as when a ChatGPT article falsely accused a real Professor of sexual harassment in a hallucinated story (Verma & Oremus, 2023).

All this leads to one of the most significant design issues with ChatGPT—its lack of accountability. When caught providing inaccurate information, it often resorts to stating that it is merely an AI language model trained on a dataset and not perfect (although it provides no such disclaimer when giving out information). This shift from portraying itself as an omniscient entity to a *mere* language model can seem absurd and even comical, rendering its apologies worthless. The question arises whether ChatGPT is (or indeed can be) genuinely remorseful or merely attempting to walk away free.
ChatGPT as a court jester
As noted above, sometimes tall tales are entirely appropriate in social conversation, and other times trivial tasks are fine to outsource, even if the quality and accuracy of the results are poor—provided that they are interesting or amusing. For example, using ChatGPT to synthesize a prompt to feed to an AI image generator for a blog post was interesting as well as amusing. Even if the results were imperfect, the interaction was enjoyable and worthwhile. Since conversational interactions are comparatively personal and intimate, perceived enjoyment becomes crucial to a positive experience. In a previous study with conversational agents, Desai & Twidale (2022) discussed participants finding conversational errors funny and the behavior of the agent to be endearing, like a “silly child.” In our analysis, we found this behavior comparable to the eponymous hero of Ace Ventura: Pet Detective. Similar to Ace, ChatGPT was useful at getting the job done in scenarios where the outcome was not important. Its purpose was to make a rather dull task enjoyable. But in cases where the outcome is important—lives or reputations are at stake—and an expert is needed, we call upon Nancy Drew or Sherlock Homes. So, unfortunately, until LLMs reach a higher level of reliability, it is stuck with an Ace Ventura metaphor.

CONCLUSION
In this paper, we used autoethnography to identify three metaphors—sounding board, unreliable narrator, and court jester as manifested by the fictional characters Dr. Watson, Keyser Söze, and Ace Ventura—by implementing metaphor analysis to explain the use of ChatGPT. This can only work if the chosen fictional references are relevant to the participants. However, other characters can be substituted, indeed, by using ChatGPT as we did to suggest alternate movie characters with the desired characteristics. Our claim is that metaphors such as these can help inform decisions about how to use ChatGPT productively and when not to use it.

Discussion and use of metaphors allow for the assessment of interactions that might be helpful—and as warnings of when other interactions might not be. Nevertheless, using fictional human characters from popular culture still carries a risk of anthropomorphism—as current LLMs are unlikely to be as smart as these imaginary entities.

We claim that the discussion of metaphors, both those that are useful and those that are not, is empowering. Such discussion can help make the promise and risks of AI tools, such as Large Language Models, more accessible to a larger audience. They can help demystify these rather alien technologies and help people make informed decisions about when to use them, when not, and especially how to use them safely and effectively.

We believe that many people; non-experts, perhaps some students, and even some non-technical peers and policymakers, would appreciate a framing of the power, potential, and risks of LLMs in terms of a few suitably elaborated metaphors. As in the motivating case of the conversation with a barber, many people outside the academy are intrigued by AI and LLMs. They want to know more. They are genuinely interested. They have a right to know. Surely as information scientists we have a duty of explanation and outreach—indeed to put our research into practice. But such people probably don’t want PowerPoints, or a 15-week lecture course with a detailed syllabus. They probably do not want a dissertation on the mathematical implications of vector models. But they may well like a few metaphors—if it helps them understand LLMs a bit better and gives them a sense of empowered action: a feel for assessing things that work and things that would be unwise or unlikely to be productive.

Metaphors can either inform or disempower action. The metaphor "stochastic parrot" may have explanatory power for those who understand what stochastic is but lacks wider appeal. Comparing LLMs to The Terminator may inspire pessimism and a desire to destroy them, but it does not help much. The metaphor of fire can remind us that LLMs have both beneficial and unintended negative consequences. Although useful in some sense, these metaphors do not provide information on how ChatGPT could be incorporated into everyday life. Instead, metaphors such as a sounding board, an unreliable narrator, and a court jester can inform decision-making and form realistic expectations about LLMs. We are not claiming these are the best metaphors—they emerged from one autoethnography. Our aim is to advocate for the idea of metaphor analysis and use in the explanation of complex new technologies.

A single simple metaphor is not a panacea. We often need a number of different contrasting metaphors, but it seems that people can cope rather well with such a multiplicity (Desai & Twidale, 2022). We speculate that wrapping a complex, potentially disturbing technology and its underlying algorithms and emergent consequences in a metaphorical coat might demystify and make the increased understanding a bit stickier (like Velcro, perhaps?). This can be empirically tested, and we encourage readers to experiment with explaining LLMs using multiple metaphors and see if that increases understanding. Most importantly, we believe that metaphors can help promote discussion, and we hope for a deeper investigation of AI across society as opposed to rather esoteric discussions using complex terminology that are only accessible to intellectual elites.

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Spontaneous Learning Environments: Manipulating Readability & Cohesion in Support of Searching as Learning

Dodson, Samuel
University at Buffalo, USA | smdodson@buffalo.edu

Sinnamon, Luanne
University of British Columbia, Canada | luanne.sinnamon@ubc.ca

Kopak, Rick
University of British Columbia, Canada | r.kopak@ubc.ca

ABSTRACT
In this concept paper, we make the case that variables related to reading and comprehension are relevant to the design of searching as learning environments. We propose that measures of cohesion – the lexical and grammatical connectedness within and between texts – be used as signals in retrieval and ranking algorithms for such environments, as cohesion is an important factor in text comprehension and learning. In illustrating this concept, we introduce a use case for learning-oriented search in which the task is to retrieve a multi-document set that functions as a spontaneous learning environment. For this task, features of the document set as a whole are important in addition to features of individual documents. In this paper, we focus on the goals of achieving a mid-range level of readability and cohesion across a set of texts in order to balance comprehensibility with challenge and stimulation.

KEYWORDS
Searching as Learning, Cohesion, Readability, Interactive Information Retrieval

INTRODUCTION
This concept paper draws upon research on reading and comprehension to propose variables and measures relevant to searching as learning (SAL) in interactive information retrieval (IIR). SAL is a growing research area that focuses on search systems as environments for human learning, as opposed to information access and fact-finding tools (Freund et al., 2014). The premise of our approach is that reading is a primary but under-examined means of interaction between users and text-predominant IIR systems. Reading is the foundation upon which other learning activities are based, including comprehension and sense-making (Britt et al., 2018a). In addition, the experience of reading and the associated cognitive and emotional responses to the content (e.g., interest, pleasure, and motivation) influence the user experience (Arapakis et al., 2017; Sinnamon et al., 2021; van der Sluis et al., 2014). A closer examination of reading as a core IIR activity is warranted – particularly in cases of exploratory search and SAL, as these cases typically involve interaction with multiple documents over extended time periods, with the goal of learning about a given topic or problem space (Freund et al., 2014; Freund et al., 2016). Factors relating to reading have been understudied in IIR. For example, Collins-Thompson (2014) noted that “the ability of a user to understand a document would seem to be a critical aspect of that document’s value, and yet a document’s reading difficulty is a factor that has typically been ignored in designing access to Web content.”

In this paper, we take a cognitive and linguistic approach to reading. We focus on the notion of cohesion – the lexical and grammatical connectedness within and between texts – which is recognized as an essential feature in the assessment of texts for readability and quality (Graesser et al., 2004; McNamara et al., 2014). We base our work on the Construction-Integration (C-I) Model of text comprehension, in which cohesion is fundamental to the inferencing process that enables the reader to construct knowledge (Kintsch, 1998). We argue that greater attention to readability, and specifically cohesion, in the design of searching and learning environments can provide better support for comprehension. We first provide an overview of concepts and relevant research. To illustrate how cohesion measures can be used, we then sketch out a novel use case in which the task is to retrieve a set of topically related documents, which, together, can function as a spontaneous learning environment. Following in the tradition of work that moves away from the assumption of independence in ranking (Clarke et al., 2008; Tague-Sutcliffe, 1992), we assume dependence among a set of results and model it using multi-document (or global) cohesion (Britt et al., 2018b). For purposes of illustration, we use the Coh-Metrix toolkit (Graesser et al., 2004) as a source of readability and cohesion measures. We conclude with some ideas for future expansion of the approach.

READING & COMPREHENSION
When people search using a text-based retrieval system, they engage primarily through reading. Reading can be evaluated using a wide range of outcome measures, including objective measures of comprehension, recall, and speed, or subjective measures, such as self-reported fatigue and satisfaction (Marshall, 2009). In keeping with our SAL perspective, we are primarily concerned with comprehension and associated measures, such as recall and long-term retention. Text comprehension involves the construction of a mental representation of one or more texts. The more robust the reader’s mental representation, the greater their understanding of the text and the conveyed subject matter. Understanding how these mental representations form can inform the design of search environments.

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This process is modeled by Kintsch and his colleagues on the basis of propositions – small units of meaning (Kintsch, 1974; Perrig & Kintsch, 1985). Propositional analysis is used to identify the meaning of a text, and model the mental processes that occur while reading. It involves breaking a text down into propositions upon which the concepts of textbase and situation model are established (Kintsch, 1998; Kintsch & Dijk, 1978). Propositions derived directly from the text are organized into a hierarchical structure called the textbase. The structure derived from propositions at the level of sentences and paragraphs is called the microstructure. The macrostructure is created by applying inferencing rules to the microstructure. Kintsch identified many inferencing rules, including selection, generalization, and construction (Kintsch, 1998). The microstructure and macrostructure form the textbase, which represents the larger meaning, or gist, of the text. In propositional analysis, text comprehension is largely thought of as the process of extracting propositions and arranging them in the textbase, applying inferencing rules as necessary.

The textbase is insufficient to ensure comprehension of most texts. Texts contain propositional gaps that the reader must address by drawing on their prior knowledge. The situation model represents the role of prior knowledge in text comprehension, and depends on the reader-specific characteristics of short- and long-term memory. The reader can update their mental model of a text based on the connections they make between it and their prior knowledge.

The C-I Model of text comprehension has been tested extensively, leading to a consolidated understanding of the variables that influence text comprehension (Kintsch, 1998). Drawing upon the C-I Model, Freund et al. (2014) highlighted several variables for consideration in SAL research. Among reader variables, interest, prior knowledge, and motivation influence comprehension and learning. Predictors of comprehension and learning include the amount of effort the reader invests and the extent to which they can put the information to use, whether conceptually or practically within task or problem spaces. In this process, readability characteristics of documents are vital, as they influence the reader’s ability to construct a coherent textbase and situation model. Search systems designed to support learning need to take into account features of texts that support comprehension. In this paper, we focus on the feature of cohesion, which is an important component of readability.

**COHESION & READABILITY**

Dale and Chall (1949) defined readability as “the sum of all elements in textual material that affect the reader’s understanding, reading speed, and level of interest in the material.” Readability formulae are used to assess the level of difficulty of a text, such that texts can be selected for suitability to different reading levels (Meyer, 2003; Todirascu et al., 2013). Other applications of readability assessment are to determine text quality (Pitler & Nenkova, 2008), assign grades for student writing, and identify candidates for some intervention to improve readability (Smith et al., 2011). However, the association between readability measures, text comprehension, and learning, which is the focus of this paper, has received less attention.

Well-known readability formulae, such as Gunning’s Fog Index and Flesch–Kincaid readability tests, are calculated using a limited set of lexical and syntactic features (Collins-Thompson, 2014; Todirascu et al., 2013). These formulae rely on word and sentence length and ignore “deeper levels of text processing known to be important factors in readability, such as cohesion, syntactic ambiguity, rhetorical organization, and propositional density” (Collins-Thompson, 2014). More sophisticated automated approaches for assessing readability are now possible, which allow global document features, such as cohesion, to be computed and modelled (Collins-Thompson, 2014).

Cohesion is a property of a text that influences readability and comprehension. Cohesion is derived from linguistic mechanisms that create links between propositions (Todirascu et al., 2013). For example, connecting phrases, repeated words and ideas, and signposting are writing techniques that increase cohesion. Cohesive texts are designed such that readers can detect propositional relationships and use them to construct a coherent mental model of semantic meaning (Storrer, 2002). In keeping with the C-I Model, a coherent mental model is a function of the text (textbase) and the reader’s prior knowledge (situation model) (Graesser et al., 2004; Smith et al., 2011). Readers with less knowledge of a subject are more reliant on textual cohesion to understand and learn from texts.

Empirical research on readability shows associations between cohesion, reading speed and recall of semantic content (Kintsch et al., 1975). Myers, Shinjo, and Duffy (1987), and a more recent fMRI study (Mason & Just, 2004), found that the association between text cohesion and recall is not linear. Instead, recall is highest at a midpoint of cohesion, indicating that effort and time invested in generating inferences from moderately cohesive texts leads to a more robust network of connections stored in the reader’s memory, resulting in better recall (Todirascu et al., 2013). A research challenge is to find an appropriate balance of cohesion, such that readers are challenged enough to engage in deep processing of content without becoming frustrated and abandoning the text (Smith et al., 2011).

A thorough overview of approaches to the measurement of readability is provided by Collins-Thompson (2014). An important contribution is made by Coh-Metrix, a toolkit that assesses cohesion using 108 measures in 11 categories including referential cohesion, connectives, syntactic complexity, and word information (Graesser et al., 2004). Coh-Metrix has been validated in empirical work, showing that it can distinguish between low and high cohesion in texts.
calls to expand studies of reading measures across multiple documents (Rouet, 2006). There is a smaller body of
Prior research has primarily focused on cohesion in stand-alone texts or pairs of sentences, although there have been
cohesion) to construct information browsing spaces to support comprehension and learning.
be determined through patterns in interaction logs, we are interested in using the features of the documents (i.e.,
learning environment for a given information need, expressed as a query or problem statement. For purposes of this
example, we assume that the query is topically unambiguous, reducing the need for extrinsic (topical) diversity in
the results (Clarke et al., 2008), but intrinsically diverse, containing multiple sub-topics of interest (Raman et al.,
2014). In this sense, it can be viewed as a special case of whole session relevance (Raman et al., 2014), implemented
in response to a single query and optimized for the task of comprehension and learning. The concept bears some
similarity to the notion of search trails (Hendahawa & Shah, 2017; White & Huang, 2010). While search trails may
be determined through patterns in interaction logs, we are interested in using the features of the documents (i.e.,
cohesion) to construct information browsing spaces to support comprehension and learning.

Prior research has primarily focused on cohesion in stand-alone texts or pairs of sentences, although there have been
calls to expand studies of reading measures across multiple documents (Rouet, 2006). There is a smaller body of
work focused on reading in multi-text environments, which has considered the difficulties readers face in
establishing global coherence across a collection of documents (Braasch et al., 2018; Britt et al., 2018b; Han et al.,
2018; Storrer, 2002). A research challenge is to establish a meaningful measure of cohesion across multiple texts.
Another challenge arises from the research indicating that a mid-level of readability and cohesion is associated with
the best comprehension outcomes. We need an approach that balances the overall readability and cohesion of a
collection of documents, such that neither is too high (low text complexity with high redundancy and connectedness)
nor too low (high text complexity and novelty with sparse connections). A balance of readability and cohesion can
result in a learning space that encourages active and deep processing of the content. Future iterations of this work
could consider tuning the cohesion parameter in relation to user features, such as prior knowledge and reading skill.

To illustrate an approach to these challenges, we envisioned a searcher submitting the query “cryogenics” to a
search system with the goal of retrieving a set of documents optimized for exploration and learning about this topic.
We used Coh-Metrix to assess readability and cohesion across the search results and Poisson disc sampling to filter
and select search results in the mid-range of these measures. Poisson disc sampling is a widely-used method in
computer graphics for selecting points that are not too similar (Bridson, 2007; Dunbar & Humphreys, 2006).

Our approach is outlined in the following steps, represented in Figure 1. We conducted a keyword search with
Google to gather a set of ten documents on the topic. We labelled the documents by their relevance ranking – i.e.,
the search first result was labelled “D1” and the last “D10”. Then, we calculated the overall cohesion of the
collection as follows: We used Coh-Metrix to calculate the metrics for the highest-ranked search result (i.e., D1) and
the between-result metrics for the other nine documents concatenated with D1 (i.e., D1 + D2, D1 + D3, D1 + D4, ..., D1 + D10). This was our answer to the first challenge: measuring cohesion across a set of documents. We combined
the Coh-Metrix score vectors for each search result into a matrix, with a row for each document and a column for
each Coh-Metrix measure. While we treated measures equally, future work could weight the Coh-Metrix measures
by how closely they relate to the preferred characteristics of the spontaneous learning environment. Documents that
are located close to each other in the multidimensional space have similar characteristics across the 108 dimensions.
Poisson disc sampling allows us to filter out documents that are too similar or dissimilar. This was our answer to the
second challenge: balancing the overall readability and cohesion of the search results.

We represented the matrix in a two-dimensional space by reducing the dimensionality of the dataset with principal
component analysis (PCA). PCA yielded two principal components that account for more than half of the variance
in the data set. We interpreted the first principal component as text complexity and the second as cohesion. This
interpretation aligns with the purpose of Coh-Metrix. Then, we plotted each of the search results using the principal
coordinates. Figure 1 allows for the visual comparison of the similarity between any two search results by their
Euclidean distance.
Figure 1. We begin the Poisson disc sampling by choosing D1, the most relevant search result (Step 1). We draw a green ring around D1, which represents the space that is neither too similar nor dissimilar to D1. We will choose the next document from within this ring. The red circle represents the space that is too similar to D1. No more documents will be selected from within this circle. While we use arbitrary radii for the green ring and red circle, future work could personalize these radii to the reader by considering their interest, prior knowledge, or search stage. At Step 1, possible sampling choices are D3, D8, and D9. We choose D3, the highest-ranked search result among the options. Future work could consider random selection, as McKay and colleagues (2020) argue that nondeterministic approaches may be advantageous. The sampling continues recursively (Steps 2–6), until there are no more documents to choose from (Step 6). The resulting spontaneous learning environment is comprised of D1, D2, D3, D6, and D8. The other search results were filtered out for either being too similar (D5, D9, and D10) or dissimilar (D4 and D7).

In summary, the Poisson disc sampling filtered out five of the ten documents. While we have found that the approach yields similar results with other queries, a systematic evaluation is necessary to determine performance across many queries and with more than ten search results. The example is intended to demonstrate the thinking that can occur when applying a theoretically-driven understanding of reading and comprehension to IIR. We see opportunities for future work to extend the approach, and offer a number of specific next steps in this paper.

CONCLUSION & NEXT STEPS

We have made several modest contributions through this preliminary work: to encourage researchers to consider models and measures associated with reading and text comprehension in their work; to highlight the notion of cohesion and Coh-Metrix as a possible candidate for further exploration in SAL research; and to propose future research on the design of spontaneous learning environments as an IIR task. We see exciting opportunities for extending the concept of spontaneous learning environments in connection with recent work on the diversification of search results (Sakai & Zeng, 2019; Wang & Joachims, 2021; Yigit-Sert et al., 2021) and the design of interesting information spaces (Glassey & Azzopardi, 2011; Liu & Jung, 2021; van der Sluis et al., 2014). Interest is a key intrinsic motivational variable in reading and learning. Recent research examines methods to trigger interest states among readers through manipulation or control of textual features, including novelty, complexity and comprehensibility (Glassey & Azzopardi, 2011; Sinnamon et al., 2021; van der Sluis et al., 2014). Other paths forward could take into account the presentation of texts and provision of reading tools in support of reading and comprehension (Freund et al., 2016). The level of background knowledge of the searcher might also be factored into the design, such that novices would be offered learning spaces with overall high readability and cohesion, whereas spontaneous learning environments for experts could be less constrained by readability measures.
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Involving Older Users in Design of Patient Accessible Electronic Health Records: Exploring the Potential of Open-Ended Questions

Eriksson-Backa, Kristina Information studies, Åbo Akademi University, Finland | kristina.eriksson-backa@abo.fi
Enwald, Heidi Information studies, University of Oulu, Finland | heidi.enwald@oulu.fi
Hirvonen, Noora Information studies, University of Oulu, Finland | noora.hirvonen@oulu.fi
Huvila, Isto Department of ALM, Uppsala University, Sweden | isto.huvila@abm.uu.se

ABSTRACT
Despite older adults being one of the most important groups of users of eHealth services, including patient accessible electronic health records, these are claimed to not be designed to suit older users, and to not necessarily fulfill their information needs. User-centered design methods often utilized when developing eHealth services have also been claimed to not work well for older adults. This paper suggests an alternative way of collecting ideas and feedback on eHealth from older adults, by including open-ended questions in the data collection of larger studies on eHealth information behavior. When data are collected by methods like focus group interviews and surveys, older adults can be requested to envision an eHealth service that suits their needs. Results from studies in Finland are presented, and show that current eHealth services do not fulfill all information needs of older adults, as answers to the question in both focus group interviews and surveys contain practical suggestions for additional and more comprehensible information, easier ways of searching for needed information, and alternative channels for communication. Open-ended questions can be a cost-effective and timesaving way to help in the design and development of patient accessible electronic health records and other types of eHealth services.

KEYWORDS
eHealth, focus groups, older adults, service development, surveys

INTRODUCTION
Older adults are generally thought to benefit from eHealth solutions such as patient portals (e.g. Wildenbos et al., 2018), but older age groups might not use eHealth applications if these are not perceived to fulfill the users’ needs or if the users experience difficulties in using them (Vergouw, 2020). In library and information science, the aim of research is generally to come up with solutions to fulfill information needs of users or potential users, be it of existing or planned services, systems or products within these. This has been at the core of the field at least since the early 1980s, when Tom Wilson published his much-cited work on information needs and user studies (Wilson, 1981). Later, Mark Hepworth (Hepworth, 1997) underlined the need to understand the consumers in the context of design and development of electronic information products and services. The focus of research has often been to suggest how knowledge of users’ information behavior can be useful for designing information systems in various contexts ranging from archeology to health. Yet, information behavior researchers have often failed to reach out to systems developers, for various reasons (Huvila et al., 2022). Rytkönen and colleagues (Rytkönen, Kinnunen & Martikainen, 2022), however, found that Finnish software developers working with information systems within social and healthcare were positive towards end-user input, as they considered feedback useful, but cooperation with users was restrained by lack of established methods for cooperation and necessary resources. In addition, the end-users the software developers considered important to work with were mainly health professionals or people in decision-making positions, not laypersons. Comprehensive user-centered design of new systems is, in addition, usually time-consuming, and there is room for other and faster methods to examine users’ needs and preferences. This paper suggests involving older laypersons in innovating eHealth services that suit their needs, and presents findings from a larger study on eHealth information behavior of older adults in Finland.

MOTIVATION
The focus of this paper is on patient accessible electronic health records (PAEHRs). While electronic health records are records and systems maintained by health professionals and official agencies (Comandé, Nocco & Peigné 2015), a PAEHR is a service that is provided by an online system and that grants patients continuous access to their medical health data from either electronic health records or other systems related to health (Essén et al 2018). The value of PAEHRs lies mainly in the possibility to check test results, and for renewal of prescriptions and secure checking appointments are also perceived to be beneficial (Wildenbos et al., 2018). Frustration with technical issues related to access, temporal unavailability of information, or limitations in the available contents, on the other hand, possibly limits use. Limitations in the available content can be an issue especially for those who want to know more about particular aspects of their health or treatment such as, for example, test results (Shah et al., 2015). Timeliness
can be a problem when the content does not become available fast enough. For example, it is often requested that test results are quickly available. Usability issues, such as difficulties with the login process, form additional barriers to use (Shah et al., 2015; Wildenbos et al., 2018).

Older adults are perhaps the most important group of PAEHR users. However, it is claimed that health technologies fail to be designed in a way that meets the expectations of those in older age groups (Wildenbos et al., 2018). Stojmenova et al. (2012) feared that if users are not involved in the design of eHealth services, this might influence how well they accept and adopt these services. In order to involve end-users, user-centered design has been considered crucial for eHealth design, for example, to increase user satisfaction and technology adoption (van Velsen, Ludden, & Grünloh, 2022). Gould and Lewis (1985) describe user-centered design as a situation where designers study users and what they need to do with technology. For this purpose, users need to work with existing prototypes, and the technology should be tested and possibly redesigned several times during the process. Over the years, new approaches have been introduced to address this issue, including activity-centered, community-driven and economic design approaches, and citizen science and participatory action. Researchers who have worked with user-centered design, have also expressed concerns about, for example, sampling bias, limited and biased end-user input, overreliance on end-user input, that end users are only a subset of those who should be heard, and that ethical, societal and political aspects are missed out (van Velsen, Ludden, & Grünloh, 2022). In addition, this approach requires time, effort and resources (e.g., Cornet et al., 2020). Stojmenova et al. (2012), on their hand, claimed that conventional user-centered design did not work well with older adults, due to various factors, such as lack of familiarity with technological terminology. It is, hence, motivated to try out other methods.

AIM
Drawing on earlier research showing the importance of involving end-users in development of eHealth applications, and existing problems in doing so, this paper explores how (potential) users can be involved in development or improvement of PAEHRs in a way that is simpler than the user-centered design approach. We suggest using a method based on asking users open-ended questions on what their ideal eHealth service or application would look like, and which features it would have, as a part of focus group interviews and surveys examining eHealth information behavior more extensively.

METHODS
As part of a larger Finnish research project aiming at connecting health information behavior research and development of health technologies for older adults, two sets of data were collected separately. The methods were in part overlapping with those used in user-centered design; focus group interviews and surveys (Stojmenova, Imperl, Žohar & Dinevski, 2012). Focus groups have been described as a good way to examine needs, wishes and opinions on eHealth (Kip et al., 2022). Suggestions developing during the discussions in the focus groups can be more in-depth, and more varied than those in surveys, as more people with more ideas are involved in the discussion, whereas the answers in surveys are generally the output of one single person, who has to write down the answer that can be quite short and not much elaborated on. Questionnaires are, hence, not suggested to be the sole method for collecting data, but triangulation has been suggested (Kip et al., 2022). On the other hand, the number of survey answers is much larger and can result in more varied suggestions. In contrast to previous mixed-method studies such as that by Papoutsi et al. (2015), where survey results were later discussed in focus groups, these particular studies were conducted separately, and the survey questionnaire was, in fact, developed based on the focus group interviews that were conducted first.

Focus group interviews were conducted with a convenience sample consisting of 24 persons aged 55-73 years divided into six groups, and printed questionnaires were sent by mail to a nation-wide sample of 1,500 Finnish persons aged 55-70 years. This sample was randomly drawn from the population register system of Finland. In total, 373 responses were obtained. In both cases, the participants were asked to discuss or respond to questions surrounding their health information behaviour, with a special focus on the Finnish National Health Archive Kanta and its portal My Kanta, yet not limited to it. Stojmenova et al. (2012) were concerned that older adults are not familiar with eHealth systems and hence cannot express their wants and needs. In this study, some experience of the My Kanta portal was a requirement for inclusion in the focus groups, whereas the survey participants may not have had such experience. On the other hand, occupational healthcare and municipalities in Finland generally have their own PAEHRs that were possibly familiar to most participants in the selected age group. Open-ended questions have been described as “any question where the respondent’s answers are not limited to a set of predefined response options” (Singer & Couper, 2017, p. 117). The following open-ended question was included in both studies: “If there would not be any limits in resources or available technologies when developing a digital health service, what would a best possible service look like and what functions would it have?” In the focus groups, the question was asked at the end of the interview, whereas it in the survey was placed in the middle of the questionnaire, and altogether 160 respondents answered the open-ended question in the questionnaire. Focus group discussions were
recorded and transcribed verbatim, and for both interview transcripts and survey responses, the content analysis was inductive.

RESULTS
The responses provided to the open-ended question in the focus groups showed both similarities with and differences from the answers in the questionnaires. Overall, the suggestions in the focus groups were more in-depth and detailed than many of the written answers in the questionnaires, which were generally shorter than the spoken ones in the focus groups, and some were a mere “I don’t know” or short expressions of being satisfied with the current services. However, most survey answers did contain practical suggestions. As the focus group participants were given the open-ended question at the end of the interviews, they had already previously discussed several additions or improvements, and sometimes struggled to come up with additional new ideas, but the support from other group members helped to stimulate the envisioning, and some features that are not currently available were suggested. The suggestions from both focus groups and survey responses were categorized into five categories: access to service or care; access to information; personalized content; communication channels, and; control of information.

Access to service or care
In the surveys, one of the most often mentioned ideas included 24/7-access to health care. In the group discussions, there were suggestions about possible improvements in access to the service, for example, in case one helps elderly parents who are not able to log in themselves, and also in the surveys there were suggestions for improved alternatives for authentication. Furthermore, the possibility to make appointments was mentioned. In the surveys, some even envisioned a robot that could promptly perform a thorough examination and come up with a solution.

Access to Information
In both the focus groups and surveys, there was a wish that all information from different care providers could be gathered in one place. Sometimes the used services did not fulfill information needs, as some participants wished for additional information on one’s condition, or a vocabulary of medical terminology in order to understand the language of the contents. In addition, a well-functioning search tool that would give access to needed information was mentioned in the surveys.

Personalized Content
In one focus group, the participants discussed adding a health-promoting function, possibly by utilizing artificial intelligence to provide recommendations for eating or exercising to the user based on test results. In similar fashion, survey responses contained suggestions for personalized information, for example, in the form of recommendations for eating. Another focus group discussed reminders for check-ups at certain ages. There were also suggestions for a possibility to personalize the look of the service, for example, making it more pleasing to the eye or easier to read.

Communication Channels
One of the most common ideas in the surveys was the possibility of contact via video connection. Participants also requested channels for interactivity that were more varied than the current ones, including chats. In the focus groups, a section where the users themselves could add some possibly important information was discussed. Another suggestion was the possibility to give feedback or comments on some medication.

Control of Information
Ideas that occurred only in the focus groups were related to having some control of the contents, such as the possibility to remove obsolete information like treatments in youth that are no longer of any use in older age and a possibility to monitor one’s own test results, for example through figures showing test values over time. In addition, information on vaccinations, blood type and allergies, to prevent possible trouble in case one is taken into care and is unable to inform about possible allergies, was mentioned.

DISCUSSION AND CONCLUSIONS
Our results can be directly useful for the design of eHealth services, or further development of existing PAEHRs in terms of the practical suggestions made by the study participants. The answers to the open-ended questions show that variations in information behavior are important to consider; older adults have needs for both more varied information and other communication channels than the PAEHRs they currently use can provide. Users may also need to feel that they have some control over their information. Our results remind of those showing the benefit of secure messaging (Luo, Dozier, & Ikenberg, 2021), frustration with access, or needs to know more about one’s own condition (Shah et al., 2015), but also bring up new suggestions. Open-ended questions elicit variation in the answers. Users’ concerns are not necessarily focused on mere usability issues and testing of existing features, often of a certain service or application that is often the focus in user studies (e.g. Cornet et al., 2020; Gould & Lewis, 1985; Stojmenova, Imperl, Žohar & Dinevski, 2012). By using open-ended questions, respondents are allowed to
innovate freely and propose ideas that go beyond specific services; hence, the answers can also be useful for informing the development of multiple types of services. As it has been found that lack of resources hinder cooperation between end-users and software developers (Rytkönen, Kinnunen & Martikainen, 2022), and user-centered design approaches usually include several phases such as planning, designing, testing and evaluating, requesting longer time spans and hence more resources (Cornet et al., 2020; Gould & Lewis, 1985; Stojmenova, Imperl, Žohar & Dinevski, 2012; van Velsen, Ludden, & Grünloh, 2022), the option of including open-ended questions in larger studies related to eHealth information behavior, can be a cost-effective way to provide developers with useful feedback. The approach can be termed as a form of citizen science (van Velsen, Ludden, & Grünloh, 2022) with a major benefit of not requiring a recruiting of end-users at certain points of time at certain places, or the effort of testing existing services thoroughly multiple times (Cornet et al., 2020; Gould & Lewis, 1985).

There are, however, possible limitations with relying on answers to open-ended questions. Envisioning an ideal service might be challenging, not the least in the middle of an otherwise mostly structured questionnaire, but at its best, it can also be a quite rewarding and interesting task. As questions are generally open-ended in interviews, including focus groups, answers to the intended topic might be given already in other parts of the interviews potentially diminishing the need for a specific question on design or development. On the other hand, the answers in our focus groups were more in-depth and managed to elaborate service features in more detail than many of the answers in the survey. In this sense, collecting data through different methods might be the most useful solution, as also Kip et al. (2022) suggest. Other limitations of this particular study include the small number of participants giving suggestions, with only 160 out of 373 survey participants responding, and of them, many merely answering that they did not know what to suggest. Not obtaining specific answers is also a disadvantage, which, on the other hand, also occurs in user-centered design studies especially with older adults, despite their focus on a specific service (Stojmenova, Imperl, Žohar & Dinevski, 2012). There might also be challenges in reaching out to those who can implement the suggestions. In order to provide software developers with suggestions provided through the open-ended questions, researchers in the library and information science field should, furthermore, strive to approach developers more directly to share their findings, instead of merely presenting or publishing them for an academic audience.

ACKNOWLEDGEMENTS
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REFERENCES


How Information Science Research Can Contribute to the Development of Dementia-Friendly Communities

Faletar, Sanjica
Faculty of Humanities and Social Sciences, University of Osijek, Croatia | sfalelar@ffos.hr

Petr Balog, Kornelija
Faculty of Humanities and Social Sciences, University of Osijek, Croatia | kpetr@ffos.hr

ABSTRACT
Dementia is a progressive and incurable disease which impacts both people who have been diagnosed with some type of neurocognitive disorder but also their family members. Since dementia care has lately started to include not only pharmacological treatment and medical care but also a person-centred and evidence-based (neuro)rehabilitation in the community, library and information science scholars and professionals have started to investigate how they can contribute to development of dementia-friendly communities. The paper discusses how findings from an ongoing multi-phase research have been translated into practice in the city of Osijek, Croatia. Information sciences scholars have collaborated with librarians, civic organizations, neurology and human rights professionals to develop diverse programs in the local community, which aim to raise the quality of life of older citizens, people with dementia and their caregivers through information sharing and raising awareness, supporting their health and wellbeing, and capacity building of librarians.

KEYWORDS:
Research into Practice; dementia; evidence-based rehabilitation; information science; public libraries

INTRODUCTION
Dementia is a progressive, irreversible and incurable disease which impacts both people who have been diagnosed with some type of neurocognitive disorder such as Alzheimer's Disease (AD) but also their caregivers (CGs), most often family members. The continuous and slow decline caused by this disease, is characterized by cognitive deterioration (which starts with minor memory problems and ends with total loss of communication skills), changes in behavior and loss of functional independence (Zvěřová, 2019). Over the years, people with dementia require 24-hours care and are completely dependent on others (Alzheimer’s Disease International, 2016). Since the prevalence of dementia worldwide is expected to explode, due to the growing number of people over 65, and its financial impact on families and governments will inevitably rise, World Health Organization (WHO) has recognized dementia as a global public health problem and invited governments, policy makers and all stakeholders to implement coordinated action across multiple levels (WHO, 2012).

Although librarians have not been traditionally regarded as professionals who support people with dementia, recent inclusion of a person-centred and evidence-based community (neuro)rehabilitation into the dementia care and wider acceptance of social model of disability (which argues that a person is not impaired by their condition but by social, economic, attitudinal, physical and other barriers in the society), has motivated library and information science scholars to join the efforts of healthcare and social care professionals and investigate how they can better serve them through customer service, resources, reading interventions, design and development of more positive and inclusive attitudes toward people with dementia among library staff. She believes that people with dementia can live well i.e. they can have a positive and fulfilling life, enjoy their interests, participate in the social activities, engage in meaningful relationships, and feel sense of achievement and wellbeing. Howarth (2020) further states that people with dementia must be viewed as citizens with disability who have legal right to certain level of service in support of their autonomy and independence, and that cultural heritage institutions have a responsibility and a rationale for servicing those who have been marginalized across time by what they have rather than who they are.

Although there is a growing body of literature reporting on specific and particular library services for people with dementia, including lone and shared reading programs (Baker, Rimkeit & Claridge, 2018; Latchem & Greenhalgh, 2014; Billington, Carroll, Davis et al., 2013), music evenings, old-time movie screenings and reminiscence therapy (Vincent, 2018), Library Cafes (Charbonneau & Rathnam, 2020), and Tales and Travel programs (Dai, Bartlett & Moffatt, 2021), the library sector as a whole and (inter)national library organizations provide only sporadic (and often outdated) guidance on this topic. For example, the International Federation of Library Associations and Institutions’ (IFLA) has published (now outdated) Guidelines for library services to persons with dementia (Mortensen & Nielesen, 2007), and American Library Association (ALA) has published only a short policy document Library Services for Patrons with Alzheimer's/Dementia with tips and links to best practice resources.
studies and analyzed the findings. The project member affiliated with the local dementia association provided participa-
ted in outlining the research questions and developing the research instrument. LIS scholars conducted both know-
who to ask and where to turn for help. Moreover, often their doctors failed to provide them with required infor-
mation, available local services etc. Also, respondents revealed that they felt lost and abandoned, they did not
caring for people with dementia, non-pharmacological therapies, legal and financial information, benefits

the findings, a brochure with local information about dementia was produced and a
to support and help others), and to seek emotional support and advice (Erdelez, Faletar Tanacković & Petr Balog, 2019).

Dementia in Croatia: Facts and figures
Since there is no official register at national level, it has been estimated that there are approximately 300,000 people
affected by AD in Croatia (including 100,000 people with AD and additional 200,000 people who care for them)
(Mimica et al., 2015). Many cases of dementia remain undiagnosed until the final stages of the disease and many
patients are treated with supportive (alternative) medication instead of antide
tiventives (Mimica & Prešečki, 2010). Existing capacities for medical care are underdeveloped, CGs are not provided adequate support and people with
dementia are often exposed to potential human rights violations and loss of dignity (Dološić, Milić Babić & Rušac, 2019) because national dementia strategy has not been adopted yet. Currently the needs of people with dementia in relation to diagnosis, treatment, care and support in Croatia are not met. They and their CGs are in urgent need of
responsive healthcare, legal, social and information system which will help them live a good and dignified life
(Erdelez, Faletar Tanacković & Petr Balog, 2019).

TRANSLATION OF DEMENTIA-RELATED RESEARCH INTO PRACTICE
The paper will discuss how findings from two research and development projects (Information needs of people with Alzheimer’s Disease and their family members & Building dementia-friendly public libraries: Theoretical and practical implications) have been translated into practice in the city of Osijek, Croatia. In their first study, authors (library and information sciences - LIS scholars) have collaborated with neurology, economy, law and human rights professionals to explore the information needs and behavior of people with AD and their CGs. All partners participated in outlining the research questions and developing the research instrument. LIS scholars conducted both studies and analyzed the findings. The project member affiliated with the local dementia association provided contact with respondents. The mixed method study (using interpretative phenomenological analysis of eleven in-person interviews with CGs in the city of Osijek, and qualitative content analysis of initial posts on the Croatian Internet Forum) indicated that CGs face immense physical, psychological, emotional, social and financial challenges and that they require diverse information about disease symptoms and its progression, medication and treatments, caring for people with dementia, non-pharmacological therapies, legal and financial information, benefits information, available local services etc. Also, respondents revealed that they felt lost and abandoned, they did not know who to ask and where to turn for help. Moreover, often their doctors failed to provide them with required information (Erdelez, Faletar Tanacković & Petr Balog, 2019). The analysis of posts on online discussion list confirmed the lack of knowledge about the disease but it also revealed that CGs post not only when they require specific information, but also to share their experience (describe their situation, share practical information in order to support and help others), and to seek emotional support and advice (Erdelez, Faletar Tanacković & Petr Balog, 2019).

Based on these findings, a brochure with local information about dementia was produced and a Memory café was organized in the local public library. Authors organized the event in collaboration with local dementia association. The brochure was written by authors, in collaboration with the project member closely affiliated with the local dementia association. The 16-page brochure includes diverse and easy-to-read information that was reported relevant by respondents in the study (how to recognize symptoms and seek diagnosis, legal instruments such as incapacity, guardianship or legal representation, proxy-decision-making, end-of-life decisions, advance directives, free legal aide, financial benefits and practical support in community, palliative care etc.). It also lists locally available services and presents an accompanying map with contact details for organizations, associations and places in the community (such as hospital, social care services, ombudsman for persons with disabilities, Red Cross, police department) where they can obtain reliable information, advice and psychological support. The brochure has been
Respondents are fairly knowledgeable about dementia and that they do not hold any stigmatizing opinion against people with dementia. However, they feel inadequately skilled to deal with this user group and would like to get additional training about this topic. Although majority of respondents believed that people with dementia should have access to appropriate library services, they do not offer any such services yet. Nevertheless, they do provide dementia-related materials (fiction, non-fiction) for the general public and CGs, and would welcome partnerships in providing targeted programming for people with dementia (Faletar Tanacković, Petr Balog & Erdelez, 2021). An analysis of online survey among library students at University of Osijek and in-person interviews with older adults in the local senior citizen social club indicated that their knowledge about dementia is below average. Senior citizens also expressed a wish to participate in activities which would boost their mental competences.

Findings of these studies have been translated into practice at several levels. First, a two-day educational seminar has been organized primarily for librarians and library students, but it was open to interested citizens as well. Authors outlined the seminar aims and identified the themes to be covered, while project partners suggested potential speakers. At the seminar, the presenters from different disciplines (neurology, medicine, psychology, law and human rights, libraries, museums, publishing), addressed topics such as dementia symptoms and treatment, evidence-based community rehabilitation of people with dementia, non-pharmacological therapies, reading programs for people with dementia, reminiscence therapy, communication with people with dementia, human rights of people with dementia, successful cognitive aging of older adults, socially responsible publishing with emphasis on designing reading materials for people with dementia etc. Representative from a local initiative Dementia Friends Croatia presented their campaign and invited participants to become members. Although this seminar was planned to be held in person only, due to a large number of requests placed by librarians across the country, it was open to in person and remote participants via Zoom. Over a hundred participants from libraries across Croatia but also from other fields (economy, law, medicine, social care, care institutions, family caregivers, Red Cross etc.) attended the seminar. In connection with this seminar, a training-the-trainer bibliotherapy workshop was organized for librarians and library students, by a reading expert with rich experience in reading programs for senior citizens and people with special needs, in order to equip them with the necessary skills to organizes a guided reading activities for senior citizens and people in early stage of dementia.

Based on the participants' positive comments reported in the evaluation of this educational seminar, and their expressed desire to attend similar learning opportunities in future, a further effort has been made to educate local librarians about dementia and the potential contribution libraries can make to this growing medical and social problem. Authors developed a five-hour training program for the National Centre for Professional Development of Librarians, with focus on the following topics: dementia (symptoms, treatment) and living with dementia (challenges faced both by persons with dementia and their family members), social model of disability, dementia-friendly communities, communication with people with dementia, information needs of people with dementia and their family members and CGs, library materials, programs and space for people with dementia (and their family members) and senior citizens in general.
Since it is very difficult to reach local people with dementia (because national dementia register has not been established yet and hospital and long-term facilities are not taking in people with dementia and they mostly stay at home) and librarians do not yet have required dementia training, in collaboration with local dementia organization it has been decided to provide social inclusion, cognitive stimulation, healthy lifestyle and cultural engagement programs not exclusively for persons with dementia but also for senior citizens in general as a means of preventing the early appearance of the disease. In collaboration with reading therapists and other professionals, a one-time guided reading program was organized where a literary motive was used to trigger memories and discussion about personal experience of loss and ageing. Based on the participants’ positive feedback, preparations for another guided reading program are underway. In collaboration with library and psychology students, a number of cognitive and memory boosting workshops have been organized for local senior social club. In addition to sharing information about healthy lifestyle (diet, sleeping, physical exercise etc.), participants have taken part in interactive activities involving reading, writing, memory, music, arts and crafts etc.

In order to reach a wider audience, popular activities such as Memory Walk, dissemination of dementia-related print materials (the earlier mentioned 16-page brochure and some additional materials provided by partners), MiniCog testing and a pop-up counselling have been organized in collaboration with local dementia organization, library student associations, Red Cross and local hospital across the city in accessible public spaces such as city park, river bank and squares. Authors coordinated these activities while all project members participated in brainstorming ideas, provided their expertise and time, and contacted potential outside partners. Apart from scholarly articles reporting research findings authors have also published popular texts about dementia and possible contribution of library services to development of dementia-friendly communities in local and national media (Večernji list, 2021). All these activities, aimed at raising awareness about dementia and removal of social stigma connected to that disease, have been organized regularly for the last couple of years on several occasions such as International Day of Older Persons, World Health Day, Brain Awareness Week, World Alzheimer's Month and Day etc.

CONCLUSION
The paper presents two interdisciplinary dementia-related projects conducted in the city of Osijek, Croatia and discusses how their findings have been applied to local community and library practice. In both research projects, authors (local library information sciences scholars) have collaborated with neurology and human rights professionals, local library, student association, dementia and senior citizens organizations. In most cases, authors initiated and coordinated all described project activities while project partners participated in brainstorming ideas and providing feedback, contributing their expertise and time, and reaching out for outside partners. The project activities provided initial opportunities for information sharing and raising awareness about dementia, supporting health, wellbeing and cultural engagement of senior citizens and people with dementia, and capacity building of seasoned librarians and library students.

The interdisciplinary and multi-level partnership has been successful over the past few years. These efforts have mainly been accredited to the city of Osijek and rest upon individual efforts of researchers. For example, the authors encountered problems connected to inadequate library space designated for people living with dementia and the lack of its promotion, poor motivation and slow uptake of activities for people affected by dementia by local library. Although the sustainability of described activities has not been secured and services for people affected by dementia have not been integrated into local library operations yet, the described research and its application to practice has shown that there are many ways to support people with dementia. Despite their lack of training, libraries as community centres are ideally suited to collaborate with external organizations and provide support to people affected by dementia by engaging them in library activities, which can be very demanding, and by building public understanding about the disease. Authors believe that the described research and practical application of its findings, despite the challenges, represent the first step in development of dementia-friendly libraries in Croatia and that the seed that has been planted will continue to grow until it reaches critical momentum.

LITERATURE:


DataChat: Prototyping a Conversational Agent for Dataset Search and Visualization

Fan, Lizhou  
University of Michigan, USA | lizhouf@umich.edu
Lafia, Sara  
University of Michigan, USA | slafia@umich.edu
Li, Lingyao  
University of Michigan, USA | lingyaol@umich.edu
Yang, Fangyuan  
University of Michigan, USA | yangfy@umich.edu
Hemphill, Libby  
University of Michigan, USA | libbyh@umich.edu

ABSTRACT

Data users need relevant context and research expertise to effectively search for and identify relevant datasets. Leading data providers, such as the Inter-university Consortium for Political and Social Research (ICPSR), offer standardized metadata and search tools to support data search. Metadata standards emphasize the machine-readability of data and its documentation. There are opportunities to enhance dataset search by improving users’ ability to learn about, and make sense of, information about data. Prior research has shown that context and expertise are two main barriers users face in effectively searching for, evaluating, and deciding whether to reuse data. In this paper, we propose a novel chatbot-based search system, DataChat, that leverages a graph database and a large language model to provide novel ways for users to interact with and search for research data. DataChat complements data archives’ and institutional repositories’ ongoing efforts to curate, preserve, and share research data for reuse by making it easier for users to explore and learn about available research data.

KEYWORDS

data reuse, dataset search, knowledge graphs, large language model, research data management

INTRODUCTION

Because of the volume, variety of formats, and complexity of connections embedded in the scholarly knowledge linked to research data, it is often hard for researchers and research data management (RDM) units to organize research data for discovery (Gregory et al. 2020; Koesten et al. 2021). Recent RDM guidelines emphasize the importance of discoverability and reusability of research data to promote sharing and transparency of scientific findings (National Science Foundation n.d.; National Institutes of Health 2023). Data archives promote research data findability by assigning a Digital Object Identifier (DOI) to each dataset they distribute (Mooney 2011). While assigning datasets machine-readable identifiers and producing standardized metadata marked up with schema.org tags allows datasets to be harvested and aggregated by large-scale services like Google Dataset Search (Brickley et al. 2019), machine readability does not directly help users determine the reuse potential and relevance of datasets (York 2022).

In this paper, we introduce DataChat, a prototype chatbot for interactive dataset search that leverages a scholarly knowledge graph (SKG) to expand the information available for users to query and access when search for data. We developed and tested DataChat using metadata from the Inter-university Consortium for Political and Social Research (ICPSR). ICPSR provides access to over 11,000 datasets in public social science studies and a bibliography of 100,000 data-related publications that have used ICPSR’s data.

ICPSR makes a number of linked resources – including datasets, variables, and publications – available for search and discovery (Levenstein and Lyle 2018); however, links between these resources are not made directly visible to users as they search (Lafia et al. 2022; Fan et al. 2022). Users can currently use third-party aggregators (e.g., Google Dataset Search) or ICPSR’s web search system, which is built on a Solr index, to search through study-level metadata, codebooks, variables, and publications (Pienta et al. 2018). Most users initiate their searches through ICPSR’s “Find Data” webpage, which provides a search box, a word cloud of popular search term topics, a list of the most downloaded datasets, and other features (“Find Data” 2023). When users search via ICPSR’s website, they tend to search directly (e.g., by using a study name), orient while searching (e.g., by looking up subject terms while searching), or take scenic approaches (e.g., by navigating to and comparing multiple study datasets) (Lafia et al. 2023). Datasets and publications are directly accessible when their metadata properties match users’ queries; relationships between objects are not directly exposed to users.

By contrast, graph databases and scholarly knowledge graphs (SKGs), organize structured information according to relationships between entity types. SKGs link semantic, directed, and labeled networks of entities (nodes) in academic research by their relations (edges), organizing structured scholarly information from a variety of unstructured sources (Verma et al. 2023; Auer and Kasprzik 2018). To facilitate DataChat, we developed an SKG for ICPSR (ICPSR-SKG) that encodes the same metadata currently available through the ICPSR search system and enables new interactions with research datasets in three main ways. First, the ICPSR-SKG explicitly stores context
about the relationships between entity types (e.g., publications and datasets) that users can access, explore, and query. Second, the SKG renders interactive network visualizations, which support user understanding of large-scale relationships across entity types. Finally, unlike systems that are built on static indexes, the SKG is built on top of a graph database, which supports natural language understanding that leverages the connections within the data.

SKGs support applications, like conversational or collaborative chatbots, that work with users to explore and navigate linked, scholarly information (Meloni et al. 2021). To maximize the usability of the information encoded in SKGs, we use a large-language model (LLM) to convert users’ natural language questions into Cypher queries (an SQL-inspired query language for graphs), which are expressed in a machine-readable database language. LLMs employ billions of parameters and outperform previous natural language processing models (Shen et al. 2023; Zhao et al. 2023; Fan et al. 2023) and are widely applied to chatbot applications (Yu et al. 2021; Day and Shaw 2021; Harmouche et al. 2020). We leverage a specific LLM, GPT-3.5-turbo (OpenAI n.d.), to help users query the ICPSKKG database in the DataChat workflow.

DataChat uses the same underlying metadata currently available in ICPSR’s dataset search to contribute novel: (1) **front-end interactions for users** (i.e., natural language queries and network visualizations); and (2) **back-end relationships in databases** (i.e., semantic triples). As a conversational assistant to dataset users and other stakeholders, DataChat traverses ICPSR-SKG as the knowledge base for answering users’ dataset-related questions. DataChat then presents the resulting textual and visual representations in an interactive user interface, enabling users to explore relationships between research datasets available from ICPSR.

**DATA AND METHODS**

We selected the DataChat technology stack shown in **Figure 1** based on our original design goals of: (1) enhancing metadata context by exposing links between entity types; and (2) increasing users’ proficiency with the search system, regardless of their level of research expertise. The search system is centered around **Datasets**, which have explicit contexts derived from their relationships with other scholarly entities, including research **Publications**.

**Figure 1. DataChat design: (a) schema and (b) workflow for the ICPSR-SKG graph database prototype**

As **Figure 1(a)** indicates, the schema of the ICPSR-SKG prototype includes dataset nodes and other types of nodes linked to them. For scalability and experimentation, we selected the 1,642 ICPSR datasets released from 2017 to 2022. Dataset nodes have seven attributes, including the dataset’s unique identifier (“id”), its formal study title (“name”), its creation “date”, the “url” of its DOI, the total number of users who downloaded any metadata or data of the dataset (“totalUserCount”), the number of users who downloaded datasets (“dataUserCount”), and total number of publications that have cited the dataset (“dataRefCount”). The other six types of nodes are linked to dataset nodes through unique types of relations. While all six types of nodes, including publication, owner, funder, series, location, and term, have the “name” attribute, the publication nodes also have the “url” of DOI and the number of citations (“pubRefCount”). We derived publication information from ICPSR Bibliography (ICPSR 2023).

**Figure 1(b)** illustrates the DataChat system design, incorporating a seamless workflow between an end-user tool based on Streamlit (Snowflake Inc. n.d.), a backend processing system utilizing the OpenAI API (OpenAI 2020), and an internal Neo4j-based ICPSR-SKG retrieving data from ICPSR databases (Neo4j, Inc. n.d.). The interaction process starts with the user input, a natural language question about datasets, on the Streamlit interface, which is then sent to the backend for processing using the OpenAI API of the GPT-3.5-turbo model (OpenAI n.d.). The API processes the prompt to generate a Cypher query, the native query language for Neo4j databases, where the prompt is based on the combination of the user input and engineered input-output pairs, e.g., the natural language input “What are the top 5 most cited datasets not owned by ICPSR?” corresponds to the Cypher query output “MATCH (a:Dataset) WHERE a.owner <> 'ICPSR' RETURN a.name + " LINK: " + a.url AS response ORDER BY a.dataRefCount DESC LIMIT 5”. The ICPSR-SKG Neo4j database then executes the generated Cypher query to retrieve relevant nodes and edges, which are returned to the Streamlit-based
interface as either chat messages or a subgraph of the ICPSR-SKG using the streamlit-agraph, a Streamlit Python package that visualizes interactive network graphs (Klose 2023). The code repository for the DataChat system is available on https://github.com/casmlab/DataChat.

RESULTS: THE DATACHAT DASHBOARD

The DataChat dashboard includes two tabs, the DataChatBot Tab and the DataChatViz Tab. Based on users’ natural language inputs, these two tabs respectively provide suggestions of datasets with links and visualize interactive graphs for users’ exploration. Figure 2 shows the results of the DataChat dashboard for the example input “What are the latest datasets owned by ICPSR that have been cited by publications more than 3 times?” We intentionally used a grammatically ambiguous query to demonstrate the system’s flexibility in query interpretation. The DataChatBot Tab (Figure 2(a)) contains three parts, including a question input frame on the bottom, the conversation panel on the top left, and the generated Cypher query on the top right. Users can modify the input and rerun by pressing the “Enter” button. The resulting messages start at the bottom and scroll up, similar to texting, promoting familiarity and ease of use, as most users are already accustomed to this layout. We also keep the Cypher query available to users for transparency, debugging, learning, and feedback purposes.

The DataChatViz Tab (Figure 2(b)) is a colored graph visualization where colors correspond to object types (Figure 1(a)). In addition to visualizing different node types and names, the graph also highlights the attribute nodes shared by at least two datasets, which are positioned at the center of the graph. For example, the American Health Values Survey and the Massachusetts Health Reform Survey are both owned by HMCA, the Health Management Company of America. Notably, the graph(s) are also interactive – users can highlight and place the nodes and edges for their illustration needs. A video demo of the DataChat dashboard is available on https://youtu.be/y4EaJzV2nA8.

PRELIMINARY EVALUATION

To evaluate the performance of the DataChat prototype, we generated and tested 105 natural language questions about ICPSR datasets. These questions were inspired by a prior study of “genuine information needs” (Papenmeier et al. 2021) for specific social science data stakeholder perspectives from education, funding agencies, and data management units. These questions met a preliminary evaluation of DataChat’s overall ability and versatility. Two authors from our team evaluated the system outputs of the 105 questions and annotated them as “pass” or “not pass”. Questions “passed” if they met the expected information need in the original query (semantics of natural language) and compiled a query that can be executed within the existing schema (syntax); they did “not pass” if they returned incomprehensible results or violated the schema. The evaluators reached a high level of agreement in the first round of annotation ($\alpha = 0.87$) (Krippendorff 2018), and reached the full agreement after discussion. As Table 1 shows, the overall pass rate was 61% (64/105), while the pass rate per stakeholder varied: for education-related (e.g. researchers, educators, and students) queries, the pass rate was 83% which was the highest; for data
management-related (e.g. archivists, librarians, and bibliographers) queries, the pass rate was 74%; for funding-
related (e.g. governments, NGOs, and corporates) queries, the pass rate was 26%, which was the lowest.

<table>
<thead>
<tr>
<th>Pass rate per stakeholder</th>
<th>Input example</th>
<th>Corresponding Cypher query output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education: 29/35 (83%)</td>
<td>What are the most popular datasets about mental health?</td>
<td>MATCH (a:Dataset)-[:HAS_TERM]-&gt;(t:Term) WHERE t.name CONTAINS 'mental health' RETURN a.name + &quot; LINK: &quot; + a.url AS response ORDER BY a.dataUserCount DESC LIMIT 3</td>
</tr>
<tr>
<td>Funding agency: 9/35 (26%)</td>
<td>Which datasets have been funded by the National Institutes of Health or Ford Foundation?</td>
<td>MATCH (a:Dataset)-[:HAS_FUNDER]-&gt;(f:Funder) WHERE f.name IN ['National Institutes of Health', 'Ford Foundation'] RETURN a.name + &quot; LINK: &quot; + a.url AS response ORDER BY a.date DESC LIMIT 3</td>
</tr>
<tr>
<td>Data management unit: 26/35 (74%)</td>
<td>Which datasets include information from countries in the Middle East, such as Saudi Arabia or Iran?</td>
<td>MATCH (a:Dataset)-[:HAS_LOCATION]-&gt;(l:Location) WHERE l.name CONTAINS 'Saudi Arabia' OR l.name CONTAINS 'Iran' OR l.name CONTAINS 'Middle East' RETURN a.name + &quot; LINK: &quot; + a.url AS response ORDER BY a.date DESC LIMIT 3</td>
</tr>
</tbody>
</table>

Table 1. Evaluation of DataChat with stakeholder-specific examples

DISCUSSION AND CONCLUSION
DataChat is a prototype conversational system for exploring dataset knowledge graphs, and is our initial step towards providing users with needed context and bridging gaps in stakeholder expertise through intelligent and user-friendly dataset search. DataChat leverages scholarly knowledge graphs (SKGs), large language models (LLMs), and network visualization to create a novel, interactive data search system. DataChat improves four key aspects of research data search: Connectivity, Efficiency, Visibility, and Interactivity (CEVI). DataChat also provides a comprehensive research and development workflow from knowledge application design to end-user tool development, which is broadly applicable to data and digital curation applications.

Essential capabilities of SKGs to support dataset search, data reuse, and management: CEVI
DataChat’s enhanced Connectivity links ICPSR databases, connects natural language input to ICPSR-SKG, and integrates textual and visual information. These features benefit stakeholders (e.g., archivists, librarians, and bibliographers) by facilitating metadata management and dataset discovery (Djebbar and Belalem 2016; Corrall et al. 2013). The improved Efficiency of DataChat, which replaces multiple search dropdowns with a single natural language input, makes the dataset search process accessible for researchers, educators, and students, regardless of their technical expertise and time constraints. DataChat increases data Visibility through graph visualization, which also highlights different attributes of nodes and the schema of ICPSR-SKG, enabling stakeholders to evaluate research impacts, identify gaps in knowledge, uncover potential collaborators, and gain insights into emerging research trends (Verma et al. 2023; Manghi et al. 2021). Lastly, DataChat visualization’s Interactivity promotes user engagement by allowing users to emphasize specific nodes according to their needs and goals, creating a personalized experience as stakeholders explore research datasets.

LLMs bridge the human-database language gap, while performance varies by stakeholder
DataChat leverages GPT-3.5-turbo, one of the Generative Pre-trained Transformer (GPT) family’s LLMs developed by OpenAI (Eloundou et al. 2023), known for their versatility in dealing with unseen scenarios or tasks which are essential abilities of artificial general intelligence. In general, LLMs support usability in SKG applications because they bridge the gap between natural language and graph database queries, enabling researchers to operate in network terms without prior knowledge about a specific type of database language. The GPT-3.5-turbo model works well for example inputs from education and data management unit stakeholders’ perspectives. However, our evaluation indicated that the Cypher queries generated for stakeholders in the funding agency are not properly querying data from the ICPSR-SKG, possibly because of the complexity and ambiguity of those stakeholders’ interests.

Research outlook
As we develop the DataChat system, we plan to add details about funder-related attributes, fields of research, and topics of publications that cite data. In addition, while the evaluation examples of natural language queries are helpful, they should be more comprehensive. For example, future evaluation will perform user testing to explain why some queries may not result in anticipated search data. Finally, we will enhance the scalability of the visualization interface, which currently supports three to five datasets in focus.
ACKNOWLEDGMENTS
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An Examination of the Real-World Appraisal Practices of Archivists

Faulkner III, James D.  
Kim, Jeonghyun

ABSTRACT
Archives serve as repositories for items of enduring value. Archivists use a process called appraisal to evaluate the value of these items. While various theories and methods have been developed to guide the appraisal and many issues have been identified, little is known about how archivists conduct appraisals or what efforts they undertake to mitigate these issues. As such, this exploratory and qualitative study aims to examine the appraisal practices of archivists in university special collections, the role of the collection policy, and how these policies deal with problematic aspects of appraisal. This study found that university special archivists view appraisal as a complex but systematic process and implement the collection policy's principles and methodologies into their appraisal practices. Moreover, this study revealed that archivists try to establish and maintain effective relationships with donors and communities throughout the entire appraisal process.

KEYWORDS
Archives; Appraisal; Collection policies

INTRODUCTION
The Society of American Archivists (SAA) defines appraisal as "the process of identifying materials offered to an archive that has sufficient value to be accessioned; the process of determining the length of time records should be retained, based on legal requirements and on their current and potential usefulness; and/or the process of determining the market value of an item" (SAA, Appraisal). Archival appraisal has been recognized as a process where numerous factors and events are considered, such as provenance, content, reliability, condition, mission, and cost of preservation (Craig, 2004). For archivists, appraisal is a central tenet within the field. Cox and Samuels (1988) referred to appraisal as "the archivist’s first responsibility." The importance of ethical and professional judgment in the appraisal process has been acknowledged in the Code of Ethics for Archivists (SAA, 2020).

Appraisal has been discussed as a theoretical concept and a practical process that occurs in archival work. Although various theories and methods are available for making appraisal decisions, it is still uncertain how archivists perform their appraisal tasks and what determines “archival value” in the appraisal process. In particular, university special collections are valuable resources for research and scholarship, often housing rare and unique materials that hold significant historical, cultural, or research value (Cullingford, 2016). Given the numerous factors that determine these materials’ value, a more rationalized appraisal approach is necessary. In this context, this study aims to investigate how university special collection archivists make appraisal decisions, the role of the collection policy, and how archivists deal with ethical issues in the field.

LITERATURE REVIEW
The literature on archival appraisal was formulated by two leading archival theorists. Sir Hillary Jenkinson (1922) believed that the record creator was best suited to appraise their records since archives are, by definition, preserved for the creator’s own use. On the other hand, Theodore R. Schellenberg (1956) argued that it is the archivist’s duty to conduct appraisal, as it presents an opportunity to reduce the volume of records. Today, the literature on archival appraisal has broadened significantly, encompassing a range of theories and methodologies, such as macro/functional appraisal, a social theory of appraisal, documentation strategy, sampling, risk management, and pragmatic acquisitions strategies.

Appraisal determines the makeup of archives, but archives are not impartial despite efforts to make them so. Recognizing this fact enables archivists and institutions to identify and address bias. Several studies attempted to tackle such biases. Lee (2017), for instance, encountered the challenge of maintaining both normative and non-normative accounts in the same collection while ensuring that both were treated equally. Inequalities in how memories collections are stored in archives can have serious repercussions. Lee argued that the archival narrative can become the dominant narrative and that archivists can perpetuate the dominant narrative and social norms through their selection processes. The dominance of the archival narrative underscores the importance of equity in collection development.

There are several problems within archival appraisal, and one such issue in the field revolves around archival value. Value can take place within many contexts, such as legal, historical, political, and social values. But how does one define value? Penn (2014) found that "a definition of archival value is problematic, [though] it is possible to reach an approximate concept of archival value that can be understood, if not perfectly defined" (p. 246).
Power dynamics also play a problematic issue in appraisal. For Randall (2007), "Historical examples abound of societies in which the powerful ruled by controlling and manipulating information and records…From ancient times to the present, disquieting use has been made of archival records to establish, document, and perpetuate the influence of power elites" (p. 254).

The practice of appraisal can be subjective. Whether it is the record creator or the archivist appraising, the record is nonetheless subjective. Boom (1987) asserted that "the formation of a documentary heritage is a subjective and therefore socially conditioned process. This fact is, as we saw, rooted in the very essence of human existence; it is a condition that cannot be changed or removed, only confined" (p. 106).

According to the literature, collection development/acquisition policies can help archival collections in several ways. Cox (2017) asserted that policies can prevent haphazard collecting or the randomness of a collection. This counters what he referred to as a "significant challenge to the archivist and collecting is the archivist's impulse to collect" (p. 200). Marshal (2002) agreed with Cox, asserting that "Collecting policies have been advocated as instruments to help archives build stronger, more comprehensive collections by enabling archivists to make better appraisal choices" (p. 232).

METHODS
This study is based on interviews conducted between January and March 2023 with five university special collection archivists. For this study, a university special collection archivist is defined as someone who is recognized by their university and self-identifies as the archivist responsible for the selection, retention, and preservation of university special collections. This individual is in charge of performing appraisal tasks in this capacity. Subjects were recruited via the Society of American Archivists (SAA) email discussion list.

All study participants are full-time archivists currently employed in a special collections unit/department at a college or university. As presented in Table 1, they all received a master’s degree in library science from an ALA-accredited program in North America and are experienced archivists who have been in the field for nine or more years.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Title</th>
<th>Education</th>
<th>Years of experience</th>
<th>Institution*</th>
</tr>
</thead>
<tbody>
<tr>
<td>P001</td>
<td>Head of Special Collections</td>
<td>MLIS</td>
<td>30</td>
<td>Doctoral Universities: Very High Research Activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Four-year, Medium</td>
</tr>
<tr>
<td>P002</td>
<td>Digital Archivist and Special Collections</td>
<td>MLIS</td>
<td>10</td>
<td>Doctoral Universities: High Research Activities</td>
</tr>
<tr>
<td></td>
<td>Librarian</td>
<td></td>
<td></td>
<td>Four-year, Large</td>
</tr>
<tr>
<td>P003</td>
<td>Archivist and Special Collections Librarian</td>
<td>MLIS</td>
<td>9</td>
<td>Master’s Colleges &amp; Universities: Large Programs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Four-year, Medium</td>
</tr>
<tr>
<td>P004</td>
<td>Director of Special Collections</td>
<td>MLIS MA in communication</td>
<td>12</td>
<td>Special Focus Four-Year: Other Special Focus Institutions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Exclusively Graduate/Professional</td>
</tr>
<tr>
<td>P005</td>
<td>Director of University Archivists</td>
<td>MLIS Ph.D. in history</td>
<td>17</td>
<td>Baccalaureate Colleges: Diverse Fields</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Four-year, Very Small</td>
</tr>
</tbody>
</table>

*Note: Based on the Carnegie Classification of Institutions of Higher Education

Semi-structured interviews lasting around 50 minutes were conducted and recorded via Zoom. The primary purpose of the interview was to discuss each participant’s appraisal work and how they appraise materials for their collection. Interviews began by asking participants general questions about their background and professional experience as an archivist, followed by questions about their own practices in identifying and selecting/de-selecting materials, their institutional guidelines or policies for special collections, and challenges they have encountered in the appraisal process. Follow-up questions were asked when they appeared fruitful.

The transcripts were imported into NVivo 12, a qualitative analysis software that facilitates data organization, theme identification, and coding. The analysis incorporated directed content analysis guided by the grounded theory’s constant comparison method, interactive close reading, and examination of texts for conformity and variation from emerging themes (Glaser & Strauss, 1967). Each interview participant was given a pseudonym (e.g., P001).
FINDINGS
Appraisal: Important and Complex Task
When participants were asked how they viewed and defined appraisal, all agreed that appraisal is a key part of archival work because archives can’t preserve everything forever. Being a lone arranger (a.k.a. solo archivist), P003 said,

“Every archive is limited in staff, time, supply, budgets, and space. So, deciding what you're going to keep or what you're going to allow through the doors is really a paramount question.”

This important work is not an easy task. P004 describes appraisal as something that must be done with much consideration. She said, "Appraisal is really difficult. I find it to be really difficult because so much is up to interpretation."

As for the “value” in the appraisal, all participants viewed value or archival value as a vague and arbitrary concept and such value is often not measurable. According to P001:

“It's archival value or has some value, and it's like, well, what does that really mean? Mm-hmm. But whenever you attach items to that, it really brings it clearer.”

Then this participant elaborated on the research value of t-shirts from their campus LGBTQ student club. She explained that material culture can reveal how a group of people represent themselves to the outside world. Like P001, other participants emphasized the importance of “research” value. For example, when materials come to him, P003 asks himself the following questions: “Are they going to get used? Is this something that I think I can market to students and faculty?” P005 also described materials that can be used for future scholarship and research as valuable materials, although the future research potential is a difficult variable to determine. She also said materials with “enduring value,” such as materials that deserve preservation over the long term, need to be prioritized.

When participants were asked how they conduct appraisal, most stated that if the materials fit within the purpose and scope of their collection policy, they would accept the items into the collection. The appraisal decision was also expressed in terms of and degree of value-added material in their collection. P004 described this process with this question: “Is this covering a gap in what I already have?” Most participants said their institutions retain redundant copies that may exist within a collection. When participants described decisions about what to select and why, some used language that contained subjective connotations, such as “interesting” and, even if the materials are within the scope of their collection, they are not selected if they are not “interesting.”

As appraisal is a complex and demanding task, all participants said they researched potential materials as part of the appraisal process. According to P002, conducting research is necessary to make an informed decision about whether the materials would suit the collection. P004 described research as necessary “because collecting priorities change and new areas grow.” P003 said that, on average, she does a few hours of research and often seeks advice from her institution’s history faculty.

Interestingly, none of the participants stated that they used any archival theory in the appraisal process. They did not have a clear conception of archival appraisal theory and method. On not using theory, P002 stated, "I don't know, it's been so long since the class. I don't even know what like the theory is."

Collection Policy for Guiding Appraisal
All participants emphasized the significance of the collection policy in the appraisal process. They explained that the policy establishes the strategic framework used by their institution to evaluate the archival value of materials while also providing a rationale for the institution’s collection purposes, goals, and priorities.

The policies were also noted to offer protection to archivists when declining a collection from potential donors. By referring to the collection policies, archivists can provide a clear rationale for not accepting a collection. P001 and P002 commented on the policy, stating,

"It's just kind of like a really nice piece of insurance to have, because if you say it's not in our collecting policy, and you show them the collecting policy."

"give[s] us a leg to stand on and like a polite out when a donor is trying to give us something that doesn't make sense [to collect] here."

When asked about the possibility of disregarding the policy, three participants indicated that they did not typically ignore it but could make exceptions under certain circumstances. P001, P004, and P005 stated that their policies contained language allowing for exceptions, such as if the items fell within the general mission of the larger library or if they could be used in their institution’s curriculum. P001 explained that they could deviate from the policy if there was a new area of collecting that they were previously unaware of and wanted to begin collecting in that area.
P003 mentioned that they would not turn down an "amazing" or "valuable" (expensive) collection even if it did not align with the collection policy.

All participants interviewed in the study said their institution has a collection policy. The prominence of the collection policy was surprising, given that Wink (2010) could only locate online collection policies for 44 out of 334 (13%) repositories. P002’s institution had a policy that had been in place but not updated for 20 years, prompting them to rewrite it. Notably, the archivists did not develop policies in isolation but consulted with colleagues or referred to other institutions’ policies. P004 consulted a variety of sources during the development of their current policy, stating,

"We looked at our existing one, as well as policies from our institution’s museum[s] and other institutions. I asked some other institutions if they would send me theirs. Then we discussed with our department archivist what was working/what wasn’t and revised the existing policy.”

**Issues in the Appraisal Process**

While the archivists generally abided by the policy administration, faculty and donors often pressured the archivists to accept items outside of the collection scope. All participants described situations in which they felt pressure to take items that were out of scope. P001 expressed that “dealing with the pressure was not worth the friction.” When handling such pressure, P003, an archivist and special collections librarian, said she would go to the director, who would step in and rectify the problem for her. Interestingly, P005, a director of university archives, described pressure from the administration to lie about the reason for not accepting donations from a group associated with the confederacy. She noted that she was pressured to say that the archive did not have enough space for the donation.

We see a power dynamic between archivists and faculty, and archivists apportion patron power according to their status within the university. P003 conceded that if the university’s president shows up with an out-of-scope collection, they would immediately say yes, describing the situation as one in which you do not say no. P002 felt that her position was compromised when she needed to decline a faculty member’s request to acquire newspaper clippings. She said,

“So, it's just very bizarre, so I kind of do feel that pressure. And added to that, I am a tenure track faculty, and I'm on tenure, so it is like, well, I have to play nice with people. Because I am in that like weird and vulnerable position. And there are people here who don't understand our guys. Like her she was a professor in maritime. But I said no.”

Saying “no” can be difficult. Archivists often hesitate to decline a donation, as establishing good relationships with donors is crucial for their careers. Such relationships were described as a “goodwill mission” or “advocacy” by P004. Participants noted that they often take small items to appease donors, stating they did not want to hurt their feelings. They use funding as an excuse for not accepting donations. P002 stated that they tell donors with out-of-scope collections that they do not have the funding or that the donor would need to fund the processing of the collection. Archivists often recommend to donors other places where they can donate. P003 said,

“And I have to explain why they aren't a good fit, but in those cases, yes, I'm going to direct them to say, hey, I'm so glad you thought of us. You know, again, it's about maintaining relationships. It's like, hey, so glad you thought of us, here's why it's not a good fit for us. But these are the places where it might be a better fit. I would say this is basic reference work. It's like helping, connecting people with where they need to go. So, I will always try and go above and beyond to get people. And again, because every donor is different, every collection is different. Every university is different like you just can't. It's not a black and white thing, and I think what is really important is the relationship. You have to be nimble. Nimble is the key word for me.”

P001 and P003 talked about managing the donors’ expectations as part of the process. One expectation was processing time and when the items would be made available. To help alleviate issues, P003 stated that they told potential donors that items may not be processed and made publicly available for six months to a year or more.

**CONCLUSION**

This study illustrates how university special collection archivists make real-world archival decisions. The study reveals the disparity between the theory and practice of archival appraisal in the university’s special collection. It confirms that appraisal is a complex and emotionally demanding task that is not amendable to merely administrative solutions. Archivists often consult a collection policy to make sound appraisal decisions, although there are many instances where exceptions, anomalies, tensions, and paradoxes are noted.

This study is still in the process of collecting data, and the findings that have been obtained are provisional. Conducting additional interviews with university special collection archivists across various institutions could provide a more comprehensive understanding of appraisal practices.
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Trust in Search Engines: Developing a Trust Measure and Applying It in an Experiment

Häußler, Helena  
Hamburg University of Applied Sciences, Germany | helena.haeussler@haw-hamburg.de

ABSTRACT
Nowadays, users trusting search engines appears fundamental, although this claim is built on little research. In face of new developments of search, the question comes up again: to what extent users trust a search engine, how it is justified, and which consequences does it imply. Based on interdisciplinary research on trust, the individual concepts of trust, trustworthiness, and trust-related behavior are outlined and applied to the web search context. To date, there is not an adequate instrument for collecting the ambiguous concept of trust for technical artifacts like search engines. Therefore, a trust measure will be developed with the help of a qualitative laboratory study and validated with an online survey. Afterwards, the measure will be applied in an experiment to the search engines Google and Ecosia and scenarios from the health and finance domain. The expected results indicate the causes and effects of trust in a search engine. In consequence, misplaced and well-founded cases of trust in search engines can be identified and discussed among civil society, researchers, and policymakers.

KEYWORDS
Trust, search engines, information-searching behavior, user study, trustworthiness

INTRODUCTION
Trust is a fundamental condition for a functioning society as it emerges according to social relations between individuals, organizations, and systems. Thereby, trust fulfills an essential function as it saves time and effort during interaction and allows individuals to proceed with their tasks and purposes instead of controlling the connected parties. Technical artefacts like search engines can also be regarded as trusted parties since people frequently interact with them. To date, the research on trust in search engines has focused on relevance assessments (Pan et al., 2007), search behavior (Hargittai et al., 2010) and search engine literacy (Schulteï ß & Lewandowski, 2021). However, less attention has been paid to the conceptual foundation of trust. Therefore, this PhD project aims at providing a solid concept of trust in a search engine, its antecedents, and consequences. Based on the concept, an adequate measure will be developed and applied to allow for an unambiguous collection and interpretation of trust attitudes and associated search behavior. The results should help identify and discuss well-founded and misplaced trust cases.

LITERATURE REVIEW
In this abstract, the general concept of trust will be outlined and applied to the specific case of search engines.

Trust concept
Due to the research interest of diverse disciplines, many trust definitions and conceptions exist. However, consensus exists that at least two actors participate and are connected (PytlikZillig & Kimbrough, 2016). Trust emanates from one actor, called the trustor, and is directed to another actor, such as an individual, an organization or a (technical) system and is therefore referred to as the trustee. The relationship between the actors is often implied via a dependency of the trustor on the trustee (Mayer et al., 1995). Furthermore, there is agreement that some element of subjectively perceived risk plays a role for the trustor. The subjective risk results from potential adverse effects for the trustor and uncertainty about whether the effects will occur in fact (PytlikZillig & Kimbrough, 2016). From this, it can be inferred that the trustor has goals and interests they want to pursue and achieve. Thus, Rousseau et al. (1998) see the source of subjective risk in the “[u]ncertainty regarding whether the other intends to and will act appropriately.” (p. 395). Despite the subjective risk, the trustor forms a positive, confident expectation regarding the trustee’s behavior in the sense of the trustee (to achieve its goals) (Corritore et al., 2003). Especially in situations characterized by uncertainty and lack of knowledge, trusting allows the trustor to act as if conceivable adverse outcomes in a situation would not happen and effectively pursue their goals (Lewis & Weigert, 1985; Luhmann, 1968/2014).

As PytlikZillig and Kimbrough (2016) explain, there are different views about antecedents for trust. A positive evaluation of the trustee or the relationship often forms the basis for forming positive expectations about the trustee's behavior (Castaldo et al., 2010). This positive appraisal can be called trustworthiness and is determined by ability, benevolence, and integrity (Mayer et al., 1995). Central to the authors’ definition is the reference to a domain since the capabilities of the same trustee may differ depending on the domain. Consequently, trust is also contextualized. Moreover, trustworthiness is built upon the trustor’s subjective knowledge, experiences and impressions. In consequence, the evaluation may be based on false claims and differ betweentrustors.
Many authors agree that trust in the trustee only manifests itself in concrete action or behavior of the trustor (PytlíkZillig & Kimbrough, 2016). Whether this should be an integral part of a definition of trust is debatable. In process models, behavior is instead considered a particular aspect connected to other trust-related constructs (e.g., McKnight & Chervany, 2001). McKnight and Chervany (2001) determine such trust-related behavior as reduced control of the trustee, allowing the trustee to influence the actions of the trustor, sharing sensitive information, and cooperating.

**Trust in Search Engines**

In the context of web search, trust becomes relevant in situations that a person cannot resolve independently. For example, in case of current symptoms of illness that the person cannot assess due to a lack of medical knowledge. Therefore, the person depends on others, e.g., search engines. Many people regularly turn to search engines for health issues (Eurostat, 2022). Therefore, the connection between the actors is established when the person consults a search engine. Trust emanates from the user (trustor) and is directed towards the search engine (trustee). In terms of web search, the user's goal is to obtain information that can be used to solve the situation or problem, like treating the symptoms. In addition, there is an expectation of finding the results on the first search results page (SERP) or high up in the search results ranking (Mager, 2009; Rieger, 2009). The subjective risk is whether the search engine appropriately recognizes the information need and serves the need with relevant search results, e.g., explanations of disease symptoms. When the information need is unmet, the negative consequences are increased time and cognitive effort to switch search engines (White & Dumais, 2009) or additional consultation with other information sources/persons. Thus, the benefit of resource savings that trust in the search engine brings to users would be lost.

Search engines cannot be understood solely as a technical system but as an interplay of technical and social factors (Mager, 2012). The interaction becomes apparent, for example, when emergency numbers are displayed on the SERP in case of searches for suicide-related terms: this is not a deliberate decision of the algorithms but of the operators as part of their self-imposed corporate social responsibility (Scherr et al., 2019). Due to the lack of agency of the ranking algorithm, there should be a differentiation between the antecedents of trust. Concerning the search engine operator, trustworthiness can be described as the ability and motivation to fulfill the user's need following shared values (UI Haque et al., 2023). However, concerning the ranking algorithm, adapting the trustworthiness factors is appropriate (McKnight et al., 2011). The ranking algorithm would be evaluated similarly according to its functions and support to assist the user while working properly without errors.

Trust becomes evident in actions when the user reduces control and allows the search engine to influence their actions. For example, as Pan et al. (2007) report, users trusting Google follow the search engine's relevance ranking rather than their own. In addition, Hargittai et al. (2010) suggest that lacking verification of sources in search results points to trust. However, reduced control and permitted influence may apply to further interaction on the SERP and the use of information. Consequently, trust-related behavior in web search has yet to be investigated.

Differences in the understanding of trust between research disciplines continue in the operationalization. The most widespread methods are quantitative surveys, which measure trust as a self-report, and experiments, which are intended to measure trust based on specific behavior (Kohn et al., 2021). Criticisms of the validation of surveys or the design of experimental trust games highlight particular challenges (McEvily & Tortoriello, 2011). Existing methods often do not consider all aspects of the underlying definitions, and frequently used single-item indicators cannot cover the ambiguous trust concept. Since trust can be experienced as a subjective phenomenon without being attributed from the outside, a self-report should be included but supplemented with a behavioral measurement to improve external validity.

Unfortunately, no (established) measurement instrument for trust exists to date that considers the mentioned prerequisites and could be applied to search engines. Therefore, a significant goal of the planned research project is developing such a trust measure.

**RESEARCH QUESTIONS**

Derived from the identified research gaps, which are particularly evident in the operationalization of trust in search engines, we will first ask:

1. How to measure trust in search engines?

Furthermore, to analyze search engines as trustees within the framework of trust as well as its antecedents and consequences, it will be asked:

2. To what extent does the trustworthiness of the search engine operator affect trust in the search engine?
3. To what extent does the reliability of the search engine algorithm affect trust in the search engine?
4. How does trust in the search engine affect user behavior?
RESEARCH DESIGN
In order to address the research questions, three subsequent studies will be conducted. To account for the contextual nature of trust, the scope of the studies will be limited to two search engines and two domains. Google and Ecosia are chosen for representing contrary search engine operator and algorithm aspects. Moreover, tasks from the health and finance domain are suitable since both offer circumstances for trust and pose profound implications if users act on that trust.

Developing a Trust Measure
A mixed-methods approach will initially be used: a qualitative laboratory study with semi-structured interviews will serve as a preliminary study, which will be deepened and validated by a quantitative survey (Döring, 2023). First, a laboratory study is conducted to address several search tasks from the domains of health and finance. The sampling follows a qualitative sampling plan, according to which a total of 32 persons of different levels of search engine literacy (low, high) and according to the used search engine (Google, Ecosia) are invited to participate. Thus, the screening survey collects information on the participants’ sociodemographic characteristics, usage behavior of search engines, domain knowledge and search engine literacy. The latter consists of knowledge questions on search engines and marking tasks related to SERPs (Häußler et al., 2022). In the laboratory, the participants select in total four search tasks according to perceived difficulty (simple, difficult) and both domains. They can work on the task for a maximum of ten minutes, using either Google or Ecosia, and finish the task with a brief written answer. The search processes are video-recorded and reviewed with the participants as part of a stimulated-recall interview (Oh & Wildemuth, 2009). These transcribed interviews, video recordings and qualitative answers for each task are analyzed deductively and inductively with qualitative text analysis (Kuckartz, 2014). Finally, question items are formulated for the trust indicators derived from the material. According to the present concept of trust, a formative measurement model is suitable which considers that heterogeneous indicators must be present (Döring, 2023). Based on the video recordings of the task completion, search behavior is described and classified for the operationalization of trust-related behavior.

Unlike trust, items already exist to survey trustworthiness and reliance (Thatcher et al., 2011; Ul Haque et al., 2023), which will be adapted to the corresponding search engines. A quantitative survey will be conducted to evaluate the reliability and validity of the reformulated and newly created items. In this case, a casual sample of students will be formed, as the aim is not representativeness but testing exploratory findings (Döring, 2023). The participants will answer the questions randomized for either Google or Ecosia but for health and finance domains. This procedure means that contextual information about the domain and possible search scenarios are given first, before the trust items, and the trustworthiness of Alphabet/Ecosia and the reliability of the search engine algorithm will be displayed randomly.
On the one hand, the resulting values can be used to determine the internal consistency (Cronbach's alpha). On the other hand, the measurement accuracy can be tested with an exploratory factor analysis, i.e., how well individual items load on the superordinate factor (indicator). It will also be examined how the collected indicators can be combined to form an index. Since the indicators do not compensate for each other, an unweighted, multiplicative summary is assumed (Döring, 2023).

**Online Experiment**

Finally, the developed measurement instrument will be used in an experiment to investigate the causal relations of trust in a search engine with the antecedents and consequences of trust. The independent variables are the trustworthiness of the search engine operator and reliability of the search engine algorithm on the one hand and trust in the search engine on the other. Both trust in the search engine and trust-based behavior are collected as dependent variables. This results in the design for a 2x2x2x2-multifactorial experiment, which is partly varied between the experimental groups (between subjects) and partly within all experimental groups (within subjects) (Kelly, 2009). Between-subjects variation of the domain (health, finance) and search engine (Google, Ecosia) is twofold. The variables allow us to assess, on the one hand, the context, which affects the overall trust situation, and on the other hand, the trusting as a whole, to which different values can also be expected. The reliability of the search engine algorithm is varied by functionality and reliability according to relevance ranking and reversed relevance ranking. The trustworthiness of the search engine provider is manipulated based on the display of contextual advertisements and the absence of advertisements because the benevolence towards the user can be doubted based on the apparent self-interests of the search engine operators. In total, there will be sixteen experimental conditions and four experimental groups. The sampling should include a broad sample of people who know Google or Ecosia from their user experience. The optimal sample size will be calculated by estimating the effect size from the survey and the standard values for significance level and test strength (Döring, 2023). The procedure of the experiment is initially planned as follows.

After clarifying the prerequisites for participation in the experiment with introductory questions on usage experience, the participants are randomly assigned to one of the four experimental groups (Google - Health, Google - Finance, Ecosia - Health, Ecosia - Finance). Randomized, four tasks are presented to each, specifying an uncertain situation and formulating an open-ended question, which is supposed to motivate the information search and finally ends with a decision or action of the participant. For each task, the subjects receive a SERP with ten snippets according to the respective experimental condition (relevance ranking without advertising, relevance ranking with advertising, reversed ranking without advertising, and reversed ranking with advertising). Since relevance is not the subject of the study, the SERPs consist of equal parts of relevant snippets that contain information to answer the question, and less relevant snippets, which include a thematic reference, but no information to answer the question (Abualsaud & Smucker, 2022). Likewise, the advertisement should be context-specific, e.g., by connecting the search terms to a retailer’s assortment. Within their positioned blocks on the SERP, the snippets are randomized. Participants can click on the results, but they only lead to a simple text page so that possible trust in the source of information is eliminated as much as possible. Interaction on the SERP and task completion are measured as dependent variables, such as clicks on snippets, completion time and decision-making strength (Fischer, 2016). In a post-experiment questionnaire, domain knowledge, trustworthiness and trust in the search engine are queried related to the respective context of the domain, as well as search engine literacy and sociodemographic characteristics.

**RELEVANCE & CONTRIBUTIONS**

Trust in search engines is often overlooked, and the focus is on trust in search results. However, trust in the proper functioning of search engines is a prerequisite to retrieving and assessing search results. Additionally, information is increasingly provided directly on the SERPs, leading to reduced clicks on search results (Bink et al., 2022) and ascribing the source of information to search engines. Therefore, it is relevant to address search engines as trustees and investigate their trust relations with users.

The PhD project intends to make conceptual and methodological contributions. The profound conceptualization of trust allows distinguishing trust, on the one hand, from similar concepts like credibility or habit and, on the other hand, from trustworthiness as antecedent and trust-related behavior as a consequence of trust. The socio-technical notion of search engines will consequently be applied to the empirical realization. Further, the methodological contribution consists of developing and validating a measure of trust in search engines. The measure can be re-used by other researchers in information science who wish to consider trust in search engines in their research. The current developments of large language models applied to search engines cater for many upcoming research questions and emphasize the question of trust in search engines (Capra & Arguello, 2023).

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Information in Crisis Mode? A Conceptual Analysis of the Information Crisis Discourse

Hicks, Alison  
University College, London (UCL), UK | a.hicks@ucl.ac.uk
Noone, Rebecca  
University College, London (UCL), UK | r.noone@ucl.ac.uk

ABSTRACT
The concept of ‘information crisis’ is playing an increasingly prominent role within information studies literature and practice. Yet, the term is rarely defined and its meaning often remains both inconsistent and ambiguous. This opacity calls for a greater grounding of the term if it is to become a key concept in the field, including how it operates and what it enforces. This short paper draws upon information studies literature to present a conceptual analysis of the concept of ‘information crisis.’ From this analysis, we argue that an ‘information crisis’ framing is typically used to either establish the status quo, through centring challenges to established information ecosystems, or maintain the status quo, by outlining the operations needed to renew or protect these landscapes. These findings illustrate how ‘information crisis’ can obscure the very contexts of inequality and injustice through which crisis operates and delimits the possibility of changing/disrupting the status quo.

KEYWORDS
Information crisis, conceptual analysis, technosolutionism, information literacy.

INTRODUCTION
‘Information crisis’ has not yet been named the word or even the person of the year, but it is becoming an increasingly visible term within Information Studies. Most recently coming to prominence within work exploring the COVID-19 pandemic (Xie et al., 2020), ‘information crisis’ and its cognate, the crisis of information, features within scholarly work, (e.g., Haider & Sundin, 2021), PhD programmes (University of Borås, 2022) and library outreach strategies (Diaz, 2017) as well as various forms of policymaking (Beckett & Livingstone, 2018; Toby & Notess, 2020). Yet, for all this attention, ‘information crisis’ maintains what Camargo and Simon (2022, p.2) refer to as a “fuzzy ontology,” wherein inconsistent and ambiguous meaning is “thrown around with little justification” (Pabst, 2022, p.1). The opacity of this discourse calls for a greater grounding of the term, including how it is deployed and the implications for its use within information research.

This short paper addresses the ontological fuzziness of ‘information crisis’ through presenting a conceptual analysis of how an ‘information crisis’ term has been used within information studies literature to date. Within this framing we focus on the discourses of ‘information crisis’ rather than the operations of information in disaster situations more generally (e.g., Culnan, 2019). From this perspective, we argue that an ‘information crisis’ framing must include cultural considerations, such as how the term operates and what it enforces, alongside empirical investigation if it is to become a guiding concept within information studies. In adopting this approach, this paper builds upon recent meta-analytical work from information studies (Polkinghorne & Given, 2020), media studies (Kuo & Marwick, 2021; Simon & Camargo, 2021) and cultural studies (Nelson, 2021) that examines how terms and concepts become uncritically adopted within both academic research and popular discourse. Like these authors, we consider how the language of ‘information crisis’ often maintains and reproduces particular social states and values, including historic inequity and privilege. Ultimately, the goal of this paper is to add necessary complexity to the framing of ‘information crisis’ through reference to the ideological work that the language of crisis does. We ask: Is ‘information crisis’ a rallying cry for information research? If so, what is it for and who does it serve?

THE RISE AND USE OF INFORMATION CRISIS
References to ‘information crisis’ feature prominently if irregularly within information studies literature with the term being used for varying purposes and scenarios. One of the most common ways in which the term has been used relates to information in or about crisis, whether this is personal or large-scale disaster. Thus, authors position certain health and wellbeing crises as ‘information crisis’ due to the work that information does to both generate and mediate the sudden intensity of challenging personal situations such as domestic violence or illness (e.g., Given et al., 2016; Poole, 2022; Westbrook, 2009). On the other end of the scale, the ‘information crisis’ has also been co-opted in reference to major disasters, including natural and economic crises. Featuring most prominently in crisis informatics literature, which explicitly explores crisis from an ICT perspective, this usage similarly links crisis with complex information environments, with the management of information before, during and after a disaster seen to “have a direct influence on how well the crisis is managed” (Hagar, 2011; also see Gruzdz et al., 2014; Erdelez et al., 2016; Rodriguez et al., 2015; Ballestra & Cavaleri, 2016). Most recently, the COVID-19 pandemic has sparked renewed interest in ‘information crisis’ (Xie et al., 2020) with authors additionally linking the term to the need for information resilient societies (e.g., Radford et al., 2022; Nicol et al., 2022) and other information coping behaviours (e.g., Bossaller et al., 2022; Koltay, 2022).

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Another common way in which the term has been used is to refer to information as crisis, where information is seen to cause crisis rather than to mediate it. The dawn of the computer age, for example, led authors to designate the production of "mountains of data" (Gal & Mylopoulos, 1998) as an 'information crisis', noting that most organisations lack the ability to "effectively value, govern and trust their enterprise information" (Gartner, 2014). Similar concern was raised about the growth of scholarly research (e.g., Garfield, 1999; Worthington, 1984). Conversely, 'information crisis' is also seen to be precipitated by too little data, which is perceived to open a gap "between the 'information havens' and the rest" (Owen, 1997). Since about 2016, however, the 'information crisis' has been most associated with the circulation of and access to the wrong type of information, namely 'fake news' and misinformation. Within this framing, democracy itself is seen to be challenged by changing information flows, including the growth in alternate media providers (Beckett & Livingstone, 2018) and increasingly volatile information environments (Haider & Sundin, 2021). Blamed on progressively more personalised AI systems, which fragment shared context and meaning (Haider & Sundin, 2021, p.4), the attack on the fabric of society is also attributed to organisations that operate outside of ethical and institutional accountability structures (Beckett & Livingstone, 2018, p.9). This 'information crisis' is consequently seen to be constituted by the instability of established, public-facing knowledge systems.

**QUESTIONING INFORMATION CRISIS**

'Information crisis' has been used to characterise the varying roles that information plays during very sudden, traumatic, or overwhelming events. However, our analysis demonstrates that use of the term often obscures underlying narratives and assumptions, including related to what is upheld and what is promoted through the employment of popular or catchy phrasing. Within this paper, themes related to the usage of 'information crisis' have been characterised as establishing the status quo and maintaining the status quo.

**Establishing the status quo**

To begin, 'information crisis' often presumes a temporality of newness, or of a worsening condition based on discourses of 'unprecedented,' 'intensified' or 'profound' changes to an information landscape, often in relation to misinformation, information overload, algorithmic bias, and data extraction. While these are elements of information that are worthy of study, the crisis narrative often carries with it the assumption that the nature of the 'information crisis' is its infiltration into what is presumed to be a previously healthy information ecosystem. For example, the dominant narrative of misinformation posits that a current crisis of fragmented "truth" due to technologically enabled polarisation presupposes that, prior to the advent of social platforms, the public agreed upon "facts" and "knowledge" (Kuo & Marwick, 2021). Looking at this example, we see how an 'information crisis' is always already imbricated in what Kuo and Marwick (2021) identify as the power structures and ideological inequalities that have driven the spread of false information. As such, the presented emergency of an 'information crisis', often paired with the presumed unprecedented nature of this crisis (Ellcessor, 2022), can seem to forget the structures of information that have long been at the helm of crisis. For example, Noble's landmark research (2018) calls us to see how racist and misogynist misinformation has long been rooted in information systems and how that is recirculated through Google Search algorithms. Indeed, 'information crises' like misinformation or information access often avoids discussion of the colonial, racist, classist, and hetero-patriarchal assumptions that often undergird popular framings of what true or objective information was without adequately recognising how these systems and structures of data collection and data classification often inform and institutionalise dominant knowledge structures in the field (Bowker & Star, 1999). As such, this temporality – that crisis is a new phenomenon – enforces a status quo-thinking that presumes a pre-crisis objective and trustworthy information ecosystem.

The status quo is further established through references to the threat that the 'information crisis' creates for traditional information practices. A frequently mentioned cause of the 'information crisis' is the perception that large parts of the population are unable to access the forms of information that are needed to meet social, community and workplace goals, whether this is because they have become overwhelmed or seduced by increasingly sensational informational content. Yet, in positioning people as either inefficient or manipulable, this framing sets out both a correct way to address stated issues and the correct forms of information that will help people do so. Furthermore, it is often a very specific status quo that is being enforced; the emphasis on "ideal informational conditions" (Lenoir & Anderson, 2021), for example, conjures a rational model of human action wherein decision-making is predicated on the use of all available information (Wilson, 1995) and individuals are perceived to form self-disciplined "cognizing subjects" who exert control over their emotions (Tuominen, 1997, p.358). From this understanding, the 'information crisis' narrative invokes the "magic bullet" or "hypodermic needle" theory of media effects, wherein people are assumed to be both mesmerised by and incapable of resisting questionable messaging (Marwick, Clancy & Furl, 2022). Sidelineing the broader "matrix of reading practices" in which people engage (Cover et al., 2022, p.12), placing the blame for crisis upon questionable media choices also fails to consider how radicalisation, which is often positioned as an outcome of 'information crisis', forms "a gradual process facilitated by on and offline relationships, emotion and affect, individual factors, message framing, and technical affordances" rather than message content.
(Marwick et al., 2022, p.50). The expectation that people will make correct political choices once they have the ‘right’ information also associates ‘information crisis’ with technocratic models of human action in which information ecosystems form “free information markets” that citizens navigate as responsible, goal-driven agents (Lenoir & Anderson, 2023). Disregarding how ignorance is often actively and socially cultivated, including through “neoliberal transactional approaches to media consumption and the affective sensationalism of the instantaneity of content” (Cover et al., 2022, p.13), this narrative paints a very regulated picture of how dangers should be mediated.

**Maintaining the status quo**

Beyond drawing attention to threatened information ecosystems, we also note how the status quo is enforced or maintained through the presentation of solutions to the ‘information crisis’, including the use of technology. Within the ‘information crisis’ discourse, technology plays a dual role as both catalyst to crisis and the reason behind the crisis, including through the spread of fake news and misinformation or the loss of privacy (Cover et al., 2022; Kuo & Marwick, 2021). At the same time, technology is often also positioned as the means to fix the crisis, an approach that critical scholars see as a form of techno-solutionism (Floege & Costello, 2022; Milan, 2020; Benjamin, 2019). For example, platforms take on the role of ‘fixing’ fake news by promising new developments in optimised machine learning to find and sort through online misinformation (Cover et al., 2022; Palomo & Sedano, 2021). Thinking alongside Cover et al. (2022) and Ellcessor (2022), we posit that framing technology as solution presumes that crisis and its constitutive complexities can be easily remedied, thus enforcing a dialectical relationship between emergency and normalcy. In other words, technologies mediate a restoration of the prior state of affairs imagined to be “normal” (Ellcessor, 2022; Ong & Cabañas, 2019). Returning to the example of platform content moderation, the AI moderation systems as used within the misinformation crisis “is perceived to address not only the symptoms of fake news but also the communicative, cultural and economic conditions that enable it” (Cover et al., 2002). Yet, even as the speediness of the technological fix reflects the presumed immediacy of the crisis, these techno-solutions often operate through their own forms of bias and unfair labour practices (Roberts, 2019; Gillespie, 2018). As such, we see how the language of crisis, like Ellcessor’s analysis of emergency, is itself productive of meaning “about what is valuable, what is tragic, and how we ought to respond” (2022, p.3). The exceptionalism of “crisis” becomes part of how technological solutions are used in these contexts, often in ways that continue to centre ‘normality’.

The status quo is further upheld through the pinpointing of information literacy and in particular, the need for more and better forms of information literacy instruction as another key solution to the ‘information crisis’ (e.g., Rodriguez et al., 2015; Ballestra & Cavaleri, 2016). Within this framing, the ‘information crisis’ is seen to be solvable if people were only better equipped to mediate rumours, manipulation, or information overload. However, in equating the solution to ‘information crisis’ with the application of corrective, individual competencies, which is typically the approach to information literacy that is being promoted within literature, this framing preserves the status quo by providing the means through which established research processes and methods of inquiry are protected. In addition, and as before, it is a very specific form of the status quo that is being endorsed; the belief that education in “correct scientific inferences” forms the best way to “mitigate the public’s inherent tendencies to irrational thought” (Sproule, 1989, p.234) is an elitist assumption that centres “domination of the mass audience” (Sproule, 1989, p.242) rather than broader forms of meaning-making. The emphasis on decontextualised skills that will “autonomously” solve the crisis situation with little accounting for the conditions that shaped these issues in the first place, does little to dispel this storyline (Street, 2003). Saddling information literacy with the responsibility for fixing the crisis situation further impedes a broader consideration of who benefits from upholding the status quo, including large institutions “with a strong stake in the existing social and political order,” such as the Aspen Foundation (Lenoir & Anderson, 2023) and information literacy scholars and librarians looking to legitimate threatened professional expertise (O’Connor, 2009). The tendency for crisis situations to be used to impose problematic technocratic and market-based modes of management (e.g., Long, 2021) further illustrates the dangers of failing to question the underlying shape of proposed information literacy solutions.

**DISCUSSION AND CONCLUSION**

Throughout this short paper we analyse ‘information crisis’ as a cultural artefact that is rarely defined or interrogated in information studies literature and often modelled through assumptions about the cause of and solutions to its “fuzzy ontology” (Camargo & Simon, 2022, p.2). We argue that in the current information studies discourse, ‘information crisis’ both establishes and maintains a status quo defined by hegemonic orderings of race, gender, rationalism, and class. However, the remedies that are often offered in the name of addressing the ‘information crisis’ – technologies that promise to govern, moderate, or provide access, and the individual-focussed skills training of information literacy– assume a time previous to ‘information crisis’ in which the information ecosystem was convivial and just. Moreover, the normative renderings of ‘information crisis’ serve to flatten the differential impacts of ‘information crisis’ that are informed by constructions of race, gender, and class (Ndione et al., 2021; Noble, 2018). Using the lens of ‘information crisis’ to study information societies and structures results in an obscuring, enabling, or overdetermining of crisis itself and the histories it erases, the rationality it presumes, the
normative skill set it calls for and the techno-solutionism it facilitates. Drawing from Cover at al.’s (2022) Foucauldian analysis of disinformation, this analysis makes us wonder how information studies is disciplined by the reification of ‘information crisis’ and how we become part of the architecture of techno-solutionism that tacitly justifies it.

Greater work to understand the histories and contexts of crisis, including who is included and excluded from crisis modelling and which communities are overdetermined as vulnerable and at-risk while having long-standing practices of critical negotiation and mutual aid undermined, are ways that will help expand and extend ‘information crisis’ beyond normative assumptions. Care should also be taken to explore how crisis can be used as a lens to apprehend change rather than merely to portend threat and uncertainty; Stuart Hall (1979), for example, argued that crisis can be formative rather than being understood exclusively as a rupture that destroys the past (Cover at al., 2022). The emphasis on change further illustrates the need to shift the focus of ‘information crisis’ responses from merely bouncing back, which further references a reified status quo, to learning how we go on, an approach that acknowledges the need to reconcile the impact of disruption. We are also challenged to think beyond knee-jerk fears about changing information practices to focus, instead, on how we work within information flows that open “liminal spaces of unknowability about contemporary cultural, social and political relationships” (Cover at al., 2022, p.219).

An aspect of crisis that is not always represented within narratives, this uncertainty warrants a reflexive consideration of the role that information plays in these ruptures as well as the cultural formations within which these ideas are grounded. In identifying dual registers of establishing and maintaining the status quo as well as the cultural formations of which this is grounded, we hope to provide some food for thought for how information studies moves forward as well as how we critically engage with an understanding of remedying, curing, or tooling solutions.

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Information Barriers Caused by Marginalization and Norms: Experiences of Transgender and Non-Binary People

Huttunen, Aira  University of Oulu, Finland | aira.huttunen@oulu.fi

ABSTRACT
Marginalization and stigma can shape the information practices of vulnerable groups. Using examples from previous research, this short paper examines how norms and marginalization can serve as information barriers in societal and medical settings for transgender and non-binary people. The results indicate the presence of several information barriers that are related to marginalization and gender norms in both social and medical settings. Marginalization can result in covert information seeking, and gender norms can affect embodied information practices, such as information sharing. Medical authorities hold authority that can impose barriers on information sharing and lead to gender norms being adhered to in medical settings. The results highlight various practical implications for information and healthcare providers.

KEYWORDS
Embodiment, information practices, marginalized populations, norms, transgender people.

INTRODUCTION
Marginalization can shape access to information through stigmatization. Studies have demonstrated that both identities and information can be stigmatized (Lingel & boyd, 2013; Kitzie, 2017b). For example, social media sites and different platforms frequently remove queer content because non-normative sexualities and genders are inherently politicized and stigmatized (Floegel, 2022). In healthcare settings, stigma can entail the absence of marginalized identities, the provision of undesired information, or the commoditization of marginalized identities (e.g., Kitzie et al., 2021). Focusing on experiences of transgender and non-binary individuals, this article elucidates how stigma, marginalization, and norms can impose information barriers. In this research, the concept of transgender is understood as a broad umbrella category that encompasses diverse gender experiences and identities that fall across, between, or beyond stable categories of “man” and “woman” (Enke, 2013; Hines, 2010). This research combines theoretical perspectives from the fields of library and information science (LIS) and gender studies, particularly transgender and queer studies, which focus on bodily experiences and gender norms and normativity. By combining these two perspectives, this article elaborates upon the current knowledge regarding marginalized communities’ information practices.

The theoretical aim of this study is to contribute to the emerging concept of embodied information practices (Olsson, 2016; Olsson & Lloyd, 2017), which focus on discursive, affective, and embodied practices from an information practices perspective. In this study, information practices are understood as information-related social actions that are typically connected to interactions with other people (Savolainen, 2008) and corporeal modalities of information within the development of knowing (Lloyd, 2010). The focus on information practices specifically concerns how information activities are woven into social practices (Cox, 2012).

This article integrates findings from studies published as part of a doctoral dissertation (Huttunen, 2022; Huttunen et al. 2020; 2019; Huttunen & Kortelainen, 2021; Pohjanen & Kortelainen, 2016) and two separate studies (Huttunen, 2023; Vähä-Savo & Huttunen, 2023). Based on exemplars from the author’s previous qualitative analysis of these studies, this article’s objective is to offer an understanding of information practices regarding transgender and non-binary people living in Finland in a specific historical and societal context. This article addresses the following research questions: What types of information barriers do transgender and non-binary individuals encounter in societal and medical contexts? What kinds of norms do they encounter while seeking and sharing information?

RELATED WORK
Transgender and non-binary people are largely marginalized and stigmatized in Western societies. Previous studies have demonstrated that transgender and non-binary people can face significant discrimination, violence, and harassment in various social contexts, such as in educational settings (Pomerleau, 2012), public places (Namaste, 2000), and healthcare (Cruz, 2014; Kosenko et al., 2013; Linander et al., 2017). Marginalization and stigma can shape individuals’ information practices. Individuals with marginalized identities may adopt protective and defensive information practices, which can include seeking information from a distance (Veinot, 2010; Wong & Wong, 2006), using sources where information can be sought anonymously (Hamer, 2003; Kitzie, 2019; Mehra & Braquet, 2011), avoiding potential risks (Kitzie et al., 2020), destroying and hiding information (Namuleme, 2013), or protecting the community by minimizing the availability of information (Lingel & boyd, 2013).
Transgender and non-binary individuals commonly exhibit several types of information needs related to accepting transgender identities, coming out to family and friends, searching for support groups and counselling services and seeking information on other people’s experiences (Adams & Pierce, 2006; Miller, 2016; Taylor, 2002). For transgender and non-binary people, public media or libraries are generally not helpful information sources, and the limited and negative media representation of transgender and non-binary people can negatively affect their impressions of these experiences and their frequency (Capuzzo, 2015; Floegel & Costello, 2019; Jardine, 2013). As these sources tend not to serve the information needs of these groups, such groups may seek alternative information sources, such as online spaces and social media. Online platforms, such as Twitter, YouTube, Instagram, and Tumblr, can offer safe places for transgender and non-binary people to build communities where they can be accepted, validated, and empowered and where they can share information and experiences (Cannon et al., 2017; Haimson et al., 2021; Hawkins & Haimson, 2018; Karami et al., 2018; Kitzie, 2017a).

Previous studies have revealed that many transgender and non-binary people have a range of questions concerning access to gender-affirming care and experiences with treatments, such as surgical and hormonal treatments (Augustaitis et al., 2021; Karami et al., 2018). However, not all transgender and non-binary people desire or need medical treatments. Previous studies have uncovered several barriers they may face while seeking information from healthcare providers, including healthcare providers’ lack of information, stereotypical understandings of the transgender experience, and the gatekeeping of treatments (Irmi, 2017; Linander et al., 2017; Sørlie, 2019). Because of these barriers, transgender and non-binary people may experience mistrust from healthcare providers (Hawkins, 2017; Wagner et al., 2022). In their systematic review, Kearns et al. (2021) found that healthcare providers can be ill-equipped to treat transgender individuals; transgender patients can experience dread, fear, and avoidance while navigating health services; they may feel obligated to prove their gender identity; their preferred pronouns and names may not be used; and healthcare can be refused due to a transgender patient’s gender identity.

Medical professionals wield enormous power over the range of possible ways in which gender-variant individuals can express their gendered identities (Irving, 2013). The concepts of the “wrong-body model,” and “transnormativity” represents the idea of transgender as a fixed identity and regards a transgender person as a man or woman “trapped in the wrong body” (Bettcher, 2014; Johnson, 2016). The wrong-body model is predicated on a binary understanding of gender and does not account for non-binary people’s experiences. It was developed in the context of sexology, medicine, and psychiatry, and it has affected how transgender embodiment has typically been understood, not only in medicine but also in the media and on a societal level (Bettcher, 2014).

METHODS
As described above, this article synthesizes findings from studies published as part of a doctoral dissertation (Huttunen, 2022; Huttunen et al. 2020; 2019; Huttunen & Kortelainen, 2021; Pohjanen & Kortelainen, 2016) and two separate studies (Huttunen, 2023; Vähä-Savo & Huttunen, 2023). These studies, drawing from interpretive phenomenology, have sought a novel understanding of the embodied information practices of transgender and non-binary people. From the beginning, this research has been oriented around the principle of listening to the experiences of transgender and non-binary people and amplifying their viewpoints. The data were collected via semi-structured interviews with a total of 37 transgender and non-binary individuals living in Finland. Of the interviews, 12 were executed in 2013 and 25 in 2016. The interview protocol is discussed in greater detail by Huttunen (2022).

RESULTS AND DISCUSSION
This paper focuses on information barriers and norms that transgender and non-binary people generally encounter. This article introduces three examples of that topic. It first presents findings concerning transnormativity across society. Second, it presents findings regarding embodiment and gender norms. Third, it elucidates the findings concerning norms in medical settings.
Transnormativity in society
Since representations of transgender and non-binary identities commonly invoke negative stereotypes, interviewees expressed that stigma and marginalization had shaped their ability to acquire relevant information to support their identities. Interviewees reported that particularly during childhood and adolescence, relevant information was difficult to obtain; for example, schools, the media, and the church did not provide sufficient information or offer adequate support; instead, they were more likely to intensify stigma and covert information seeking regarding the topic. Only the youngest of the interviewees (aged 15) had gained helpful information about transgender people at school, although it was provided after he had already sought information elsewhere. However, some of the interviewees stated that they had encountered information about transgender people in school, but this was represented as a rare phenomenon: “Well, it may have been presented or I may have interpreted it somehow vaguely or as an extremely rare experience, or in such a way like, like this could not concern me, kind of.” Moreover, several interviewees indicated that information about LGBTQ+ people was not shared in schools in small, rural, or religious towns. Living in a small town was regarded as a barrier to information seeking, as small towns may not provide opportunities to access peer support groups and meet other transgender and non-binary people, and the political and religious atmosphere may affect people’s attitudes.

Media representations of transgender people were frequently found to be deficient or even misleading. Negative media representations sometimes caused information avoidance. Moreover, with few exceptions, interviewees also found that the rare transgender-inclusive media representations did not help transgender viewers gain an understanding of their own experiences. Non-binary interviewees believed that there was no media representation that would reflect their experiences. Several of the interviewees reported having the impression that they could not be transgender unless they had experienced the feeling of being in the wrong body since childhood. This is consistent with previous research suggesting that transnormativity in media portrayals can make information seeking more difficult for people whose experiences do not align with the wrong-body model. (see also Hines, 2007; Johnston, 2016).

Norms and embodied experiences
Because of the lack of information, interviewees indicated that it was difficult to gain relevant information to understand their embodied experiences, particularly during adolescence. For some, body dysphoria was a clear signal of a transgender experience, which was not necessarily understood to be caused by gender; rather, the experience appeared to be difficult to define without information about the subject. Some interviewees connected their eating disorders with body dysphoria, but since they had not had information concerning body dysphoria, it had taken time to disentangle these experiences from each other. Even for the interviewees with weaker body dysphoria, the bodily changes they had experienced during puberty had still caused discomfort and confusion. Moreover, their need for information was also caused by the misalignment between how they were regarded by other people and how they viewed themselves; one respondent described this as “some kind of friction between their own experience and the message that comes from the outside.”

Gender norms shaped transgender and non-binary individuals’ embodied information sharing. Bodily information sharing in relation to gender occurs through walking, talking, and moving in ways that represent feminine or masculine gender expression (or something between or neither) and gender norms (see also Butler, 1990). The interviewees embodied their knowledge (Olsson, 2010) in many gendered ways, including through clothing and style. Style and clothing can be conceptualised as acts of information creation and sharing, and they are typically based on certain norms (Guzik, 2018), in this case gender norms: “Nowadays I am far more confident than I was before, and it has for sure affected my identity expression positively, for example. Or, like, whatever my gender, I have quite a feminine style of clothes, and I don’t see a problem with that. But when I was like 16, then I was thinking like, oh no, could I be trans, well, I cannot be because I had pink clothes when I was six.” The interviewee above describes how he has gained confidence to present his gender as he desires; however, when he was younger, he felt uncertain about whether his affinity for a feminine style would mean that he cannot be transgender.

For some of the interviewees, expressing their gender as they desired had caused conflicts and harassment and sometimes a need to conceal their gender identity from their family members or other people. Moreover, others’ reactions sometimes provoked negative emotions such as shame and guilt, especially in adolescence (see also Hines, 2007). Some of the interviewees regulated their own embodied information creation and sharing because they feared violence and marginalization. The fear of violence affected the interviewees’ gender expression and limited the places they went and thus their ability to create and share embodied knowledge.

Norms in medical settings
Gender norms were also prevalent in medical settings where respondents sought gender-affirming care. In Finland, gender-affirming care operates in the context of the public healthcare system. To access care, one needs a referral from a general practitioner to a gender identity clinic. There are two gender identity clinics in Finland, and a series
of evaluations with a nurse, social worker, doctor, and psychiatrist is necessary before a diagnosis can be made. After a diagnosis, one can seek somatic treatments, including hormonal and surgical treatments. Several of the interviewees described barriers to information sharing in gender identity clinics that were related to the fact that medical authorities control access to care. Many interviewees who had faced communicational barriers at gender identity clinics stated that the issue was not a lack of information; rather, information sharing was not possible because of the decision-making power of these clinics: “There is this pressure because you go there to be evaluated before they decide whether you get a diagnosis, so every time, you have to be afraid that you might say something wrong. So, it is not possible to openly talk about your issues there because of the fear of not getting the diagnosis.”

Interviewees also described the pressure to adhere to gender norms in gender identity clinics in order to be perceived as a “true” transgender individual: “I had to know a certain kind of ‘transnarrative’ to be able to show it in the right way in those transition examinations, and it helped that I had read about other people’s experiences to be able to point out and adduce certain things.” In the excerpt above, the interviewee explains that they had to repeat the wrong-body narrative in trans-specific healthcare to gain treatment (see also Bettcher, 2014; Hines, 2007; Namaste, 2000).

The norms interviewees described can be also understood in relation to the concept of respectability. Respectability was found to encompass three areas while seeking gender-affirming care: respectability as a transgender person, citizen, and patient. Being a respectable transgender person meant conforming to expectations of binary and stable identity, binary sexuality, and the appropriate level of suffering; being a respectable citizen was related to social relations, education, and overall life management. Conversely, being a respectable patient was related to cooperation. Achieving cooperation was the responsibility of the subjects, who had to adapt to the practices, speech, and behavior desired in the clinic. Interviewees felt that they had to behave in a humble manner and that they could not challenge or question the views or practices of experts. Moreover, interviewees felt that being respectable requires both the proper way of describing themselves and the appropriate way of presenting themselves externally and physically. Although interviewees wished that they could speak openly in clinics, they reported that the encounters felt like interrogations and performance sessions as opposed to opportunities for information and assistance.

CONCLUSION
The results demonstrate how norms and marginalization shape information practices and impose information barriers on transgender and non-binary individuals in several ways. In this article, barriers were divided into societal, embodied, and medical. As transgender people are typically portrayed negatively across society, individuals with stigmatized identities must be covert in their information seeking (Namuleme, 2013). Moreover, gender norms are connected to embodied information practices. One novel finding of this research is that information needs were sometimes described as arising from discomfort with one’s own body and from the experience that one’s body is not what it should be. Without information, these experiences were difficult to verbalize. Embodied information practices were also related to information sharing on an embodied level, which can be regulated through gender norms. Norms related to gender are not private but are strictly regulated by other people (Foucault, 1976/1998). Using the concept of respectability, this research describes the various norms based upon which transgender and non-binary people are evaluated while seeking gender-affirming care.

This research contributes to theoretical discussions regarding marginalized communities’ information practices. It does so by describing how gender norms can erect barriers related to encountering, seeking, and sharing information in societal and medical contexts. Moreover, the results describe how gender norms are connected to embodied information sharing, thus contributing to research regarding embodied information practices. In addition to contributing to theory, the outcomes of the research are expected to provide new knowledge to support and inform organizations, information providers, and healthcare providers working with transgender and non-binary people. For knowledge organizations, the results indicate a need to prioritize information regarding marginalized communities to better serve these communities. Information providers should consider how to avoid stereotypical representations that further marginalize vulnerable communities. Healthcare providers should consider that we are immersed in norms that are not commonly accounted for or discussed. The norms can affect patient-provider interactions and place vulnerable groups at risk of not gaining the treatment they need.

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Practices of the "Library as Place" in Norway

Kawamoto, Marika Yamanashi Eiwa College, Japan | marika@yamanashi-eiwa.ac.jp
Koizumi, Masanori University of Tsukuba, Japan | koizumi@slis.tsukuba.ac.jp

ABSTRACT
In modern society, though public libraries must be equal and neutral "places" to address social problems such as the crisis of democracy and social isolation, it is unclear how the roles and functions of "Library as Place" appear in modern library management policies or practices. This study aimed to clarify the characteristics of public library policies in Norway and Oslo and the practices of the Oslo public library from the perspective of the "Library as Place." Using Kawamoto and Koizumi’s (2023) model, a qualitative content analysis and case analysis were conducted of the roles and functions of "Libraries as Place" in Oslo, Norway, identifying the access to materials and information that libraries have traditionally afforded alongside the implementation of distinctive functions such as Cultural activities, Cutting edge, Improving life skills, and Meeting place as concrete practices. These functions contribute to public libraries becoming places in the heart of the community whose services are accessible to all.

KEYWORDS
The “Library as Place,” Library Policies, Practices, Norway, Qualitative Content Analysis

INTRODUCTION
The concept of “Library as Place,” which illustrates the physical significance of libraries from various perspectives, was established in opposition to the development of digital libraries (Lancaster, 1982; Birdsall, 1994). Over time, the idea of the hybrid library where physical and digital place complement each other has become mainstream, and “place” has been understood in more broad contexts. In modern society, it is essential to recognize public libraries as a “place” and grasp their unique facilities as one solution to social problems (Wiegand, 2003; Buschman & Leckie, 2007), as they constitute a neutral and equal environment helping maintain and develop a democratic society, hosting information and events on social problems and supporting public interaction for the socially isolated.

This study examines the characteristics of public library policies in Norway and Oslo and practices of the Oslo public library (Deichman) with the “Library as Place” concept. Deichman was studied because 1) Norway has aggressively enacted public library policies under the library reform plan in 2006 and the amended public library law of 2014, 2) the amended public library law reflects the view of modern libraries regarding places and management, 3) Deichman showed a positive attitude to providing “place” by opening the new award-winning large-scale central library Bjørvika in 2020. Deichman consists of the central library Bjørvika, the other 21 branches, and the demo library. Koizumi and Larsen (2022) clarified the actual conditions of local public libraries after changes in the law regarding policies, library management, and users. This study seeks to describe policies and practices in library management from the “Library as Place” concept in order to relate the roles and functions of the “Library as Place” to policies and practices in the libraries for policymakers and library managers.

METHOD
This study conducted a qualitative content analysis (QCA) and a case analysis. The QCA examined the Norwegian national strategy, “A space for democracy and self-cultivation: National strategy for libraries 2020–2023” (2020–23 strategy), and Oslo’s library management plan, “Bibliotekplan for Oslo kommun 2019–2022” (2019–22 Oslo plan). The Norwegian was translated into English by Google translate. The “Library as Place” model by Kawamoto and Koizumi (2023) was used as an analysis framework.
This model organized the roles and functions of the “Library as Place” in public libraries into 3 symbolic infrastructures, 11 categories, and 30 sub-categories. This study used the sub-categories and symbolic infrastructures to clarify how the “Library as Place” concretely appears as policies and practices in Norwegian and Oslo.

First, QCA was conducted on the target literature to clarify government and municipality strategies of the “Library as Place.” Concretely, the authors 1) defined the “Library as Place” and created a coding manual, 2) conducted deductive coding by independent two coders using the MAXQDA, 3) discussed the coding results (including inter-coder reliability check) and reviewed the coding manual, 4) conducted re-coding to form a consensus between coders, and 5) confirmed the inter-coder reliability, yielding 894 codings. Inter-coder reliability was 84.97%, and Cohen’s $\kappa = .84$, which was acceptable as per Lombard et al. (2002): “.80 or greater is acceptable in most situations” (p. 600). The coding procedure followed “Deductive Category Assignment” (Mayring, 2014). The analysis unit was the sentence level, and multiple codes could be assigned for applicable multiple concepts in one sentence. Next, the roles and functions of the “Library as Place” in library management were investigated through the case analysis (Yin, 2018) by 1) collecting Deichman webpages, 2) reading the descriptions carefully of all services and events of the central and branch libraries, installation of facilities and equipment, and explanation of Deichman’s missions and history, and 3) extracting cases of the 30 sub-categories and three symbolic infrastructures. These results were intensively discussed to clarify the “Library as Place” of public libraries in Oslo, Norway.

RESULTS

The 10 most frequent of the 894 codings are shown in Table 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Code: Sub-categories</th>
<th>(Categories)</th>
<th>Number of codings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Access</td>
<td>(Empowerment)</td>
<td>105</td>
</tr>
<tr>
<td>2</td>
<td>Cultural activities</td>
<td>(Culture &amp; History)</td>
<td>66</td>
</tr>
<tr>
<td>3</td>
<td>Assistance</td>
<td>(Empowerment)</td>
<td>58</td>
</tr>
<tr>
<td>4</td>
<td>Cutting edge</td>
<td>(Novelty)</td>
<td>51</td>
</tr>
<tr>
<td>5</td>
<td>Places for everyone</td>
<td>(Equality)</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Improving life skills</td>
<td>(Empowerment)</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Meeting place</td>
<td>(Sociability)</td>
<td>46</td>
</tr>
</tbody>
</table>
Table 1. The 10 most frequent codes

<table>
<thead>
<tr>
<th>No.</th>
<th>Code: Sub-categories</th>
<th>(Categories)</th>
<th>Number of codings</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Familiarity</td>
<td>(Friendliness)</td>
<td>42</td>
</tr>
<tr>
<td>9</td>
<td>Impartial service provision</td>
<td>(Equality)</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>Education</td>
<td>(Intelligence)</td>
<td>39</td>
</tr>
</tbody>
</table>

The most frequent codes were Access (105 codings), Cultural activities (66 codings), and Assistance (58 codings), after which the codes did not differ widely in frequency. In terms of the model in Figure 1, roles and functions related to all three symbols (Wisdom, Heritage, and Community) appeared. For example, Access, Assistance, and Improving life skills fall under Empowerment category, and they support to Community; Cultural activities under Culture & History category, and supports to Heritage; and Cutting edge under Novelty category, and support to Wisdom.

As these roles and functions were repeatedly mentioned in the strategy and plan, they can be considered priorities of the Norwegian government and Oslo city council for public libraries. Above all, the emphasis on Access embodies the function of providing information and materials to users, a traditional role expected even in the 21st century.

Due to limitations of space, this paper will describe both strategizing and practices, focusing on distinctive roles and functions in Norway and Oslo, discussing four codings: Cultural activities, Cutting edge, Improving life skills, and Meeting place.

**Cultural activities**

The 2020–23 national strategy quoted Article 1 of the Norwegian Public Libraries Act: “public libraries shall promote enlightenment, education and other cultural activities, through active dissemination and by providing free access to books and other media to everyone living in the country,” and referenced the white paper “The Power of Culture”: “libraries are part of the core infrastructure in society that is needed to achieve several of the cultural policy goals set out.” The Norwegian government thus positioned public libraries as infrastructure for cultural activities. The 2019–22 Oslo plan set the goal: “The library will strengthen events and programs for knowledge, learning and culture,” emphasizing the cultural functions of public libraries to reflect the law and national strategy even at municipal level.

Accordingly, Deichman supports users’ cultural activities in various ways. The central library Bjørvika affords users an environment to gain and experience culture: “Art and temporary exhibitions have moved into the library and are made available to everyone. (…) The exhibitions run through the entire library and invite both young and old to experience art on their own terms” (Art and exhibitions, Deichman HP). In addition, more than 7,700 events for all ages are held per year, such as the popular “Knit and Listen,” where participants listen to poems and short stories while knitting, regularly held at branches such as Bjerke, Bøler, and Torshov.

**Cutting edge**

As the 2020–23 national strategy stated: “The library strategy should also be viewed in the context of the government’s strategy for the digitalization of the public sector, which highlights the libraries’ role in boosting the population’s digital skills,” public libraries should promote a digital society. In addition to helping people improve their digital skills, libraries should expand their digital holdings. The 2019–22 Oslo plan stipulated: “The library shall continue investing in digitizing all aspects of the library’s services,” explaining that “The city council will continue the development of digital solutions within the library area. (…) This applies both to internal work processes, self-service of lending and submission functions in all local libraries, and measures specifically aimed at users,” suggesting the implementation of digital solutions in both operations and services at the municipal level.

Deichman provides digital content such as e-books, audiobooks, podcasts, Atex access to Norwegian newspaper and magazine archives, and online events, and access to new technologies such as 3D printers, recording studios, and DJ stations. The library states on its webpage: “We want you to become comfortable with new technology and familiarize yourself with the opportunities this gives you” (The folk workshop, Deichman HP).

**Improving life skills**

The title of the 2020–23 national strategy was “a space for democracy and self-cultivation,” stating, “ever since the first public book collections were established in Norway almost 200 years ago, the library has served as an institution for self-cultivation.” Libraries are emphasized as places for users to acquire various skills. Specifically, Oslo works to enhance the language skills of the many immigrants. Referring to the “Reading seeds” of the Reading Promotion Program, a collaboration between libraries and kindergartens in the 2019–22 Oslo plan, the city council pointed to “a particular focus on kindergartens with children whose mother tongue is not Norwegian.”
Deichman offers other events, such as Language café and Norwegian training with the Red Cross, where non-native speakers can practice speaking Norwegian at several locations, including Bjørvika, Furuset, and Grünerløkka. Some libraries have invited JobbX to support job training and hold events for job-seekers to learn how to write job applications and offer tours on how to use the library as the foundation for adults’ continued self-cultivation.

**Meeting place**
The amended Norwegian Public Library Act, that came into effect in 2014, added this sentence to Article 1, “The public libraries shall be an independent meeting place and arena for public discussion and debate,” cited in both the 2020–23 national strategy and the 2019–22 Oslo plan, which is thus an important role required of Norwegian public libraries. Meeting places are described in the national strategy as follows: “As a meeting place, libraries play a key role in integration and training, and as a service institution in the municipality.” In the 2019–22 Oslo Plan, the first goal is “The library must be a barrier-free meeting place that stimulates residents to actively participate in society.”

Deichman explains, “Our libraries are meeting places where you can experience or arrange everything from concerts and cartoon festivals to language courses and political debates” (About us, Deichman HP), and operates as a meeting place. Although open to all, the events are designed for people to meet and connect with each other easily. For example, some branch libraries hold “Knitting hit” events in which people with similar interests can chat freely. Others include “Mom meetings” for mothers and “Social events for men,” where only men gather for conversation, so that people with similar backgrounds and affiliations can interact with each other.

**DISCUSSION & CONCLUSION**
The results indicate that the roles and functions of “Libraries as Place” in Oslo, Norway, are based on the access to materials and information that libraries have traditionally afforded, while anticipating the development of services. Access has become increasingly crucial in digital spaces due to the advancements in digital information resources. Deichman, too, recognizes this significance and provides a wide range of e-books and audiobooks on its website. This service proves exceptionally convenient for individuals who possess electronic devices, eliminating the need to physically visit the library. Nevertheless, physical libraries serve an important role by facilitating access to digital information resources for those lacking personal devices or internet connectivity. The concept of “library as a place” ensures that both physical and digital information resources in Norway remain accessible to everyone, thus enabling universal access despite the growing diversity of media.

Distinctive functions such as Cultural activities, Cutting edge, Improving life skills, and Meeting place are emphasized and implemented by Deichman for public libraries to become hearts of the community whose services are accessible to all, as fundamental in maintaining and developing a democratic society, and the code “Place for everyone” appears frequently in the strategy and plan documents. The variety of cultural and recreational events attracts and provides enjoyment and learning for all people, including children and youth. The emphasis on being a barrier-free meeting place creates an atmosphere where immigrants and others can easily visit the libraries and libraries can support their lives by teaching language and other necessary skills. The concrete activities that fulfill each function on the practical side will help implement the abstract roles specified in policy.

Regarding Cutting edge, Norwegian public libraries were expected to create digital as well as physical spaces. As some of the e-books and podcasts Deichman provides are available from home, the “digital place” the library provides fulfills the function of providing the contents. In addition, the number of online events has been increasing as libraries experienced a period of closure due to COVID-19. Libraries as digital places are progressing from content delivery to providing interaction through events and may develop further in the future.

Although few descriptions relate to other codes, Deichman’s practices revealed a variety of programs. For example, “Creative activities” include events such as a cartoon course and workshops for creating musical robots and for fixing or repurposing old clothes. Practices under the “Public sphere” function include a guided discussion after the screening of a film about queer struggles and a lecture by the author of a book on social fragmentation.

This study clarified how Norwegian public libraries perform the roles and functions of “Library as Place” in both policy and practice. Policy goals embodied the roles and functions of Wisdom, Heritage, and Community, while Deichman had instituted practices to achieve each goal set by the government and the municipality, developing beyond activities related to books and physical places to be a place for everyone, the foundation of democracy. A detailed analysis of the evolution of libraries as innovative and unconventional spaces, as well as an exploration of the concept of “library as place” in various other countries, are subjects for future research.

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Development and Validation of a Data Literacy Assessment Scale

Kim, Jeonghyun  University of North Texas, USA | Jeonghyun.Kim@unt.edu
Hong, Lingzi  University of North Texas, USA | Lingzi.Hong@unt.edu
Evans, Sarah  University of North Texas, USA | Sarah.Evans@unt.edu
Oyler-Rice, Erin  University of North Texas, USA | ErinRice-Olyer@my.unt.edu
Ali, Irhamni  University of North Texas, USA | FnuIrhamni@my.unt.edu

ABSTRACT
The recognition of data literacy as an important learning outcome in higher education has led to a call for assessment tools to measure students’ data literacy. Although there has been a growing interest in the conceptualization of data literacy, the literature lacks a measuring instrument to operationalize data literacy. This study developed and validated a three-factor, 24-item data literacy assessment tool using a sample of 573 students from four community colleges in the United States. The data literacy scale developed in this study has respectable reliability and construct validity, supported by a concept analysis of data literacy, a comparative analysis of data literacy competency frameworks, an expert panel review, exploratory factor analysis, and confirmatory factor analysis.

KEYWORDS
Data literacy; Data literacy assessment; Scale development; Community college students

INTRODUCTION
Data literacy, which is defined here as the ability to access, comprehend, critically evaluate, manage, analyze, present, and use data ethically, is an essential skill in the 21st century as it is critical for our personal and professional lives. There is a need for a data-literate workforce, however, this need is not currently being met. New data-related jobs are emerging, while existent jobs not traditionally associated with information technology increasingly require the ability to access, interpret, and produce data sets. For students entering the workforce, the best place to begin developing solid foundational knowledge and skills in data literacy is through post-secondary education. Community colleges, which are the most diverse institutions within the nation’s higher education offerings, have a chance to foster general data literacy in their broader undergraduate populations.

This study was conducted as part of a larger project that intends to explore the current perspectives of community college students, faculty, and librarians regarding data literacy. This study sets out to address the following question: What are the key dimensions of data literacy as a set of knowledge and skills needed by individuals, particularly community college students? To answer this question, this study developed a valid and reliable scale for assessing data literacy.

LITERATURE REVIEW
Data Literacy Competency
Data literacy is a complex construct that integrates cognitive skills and individual dispositions. Gummer and Mandinach (2015) argued that the nature of data literacy, including its knowledge, skills, value, identity, and epistemology, cannot be characterized solely by what an individual knows. Nevertheless, efforts have been made to develop data literacy competency frameworks to enhance our understanding of the required knowledge and skills for data literacy.

Although those frameworks have some commonalities, each framework has a different focus, context, and target audience. Grillenberger and Romeike (2018) focused on computer science education and included four process and content competencies to create a matrix. This framework, with its stated competencies, is one of the narrower ones based on data management and data science. Sternkopf and Mueller (2018) developed a framework of 12 competencies and four proficiency levels for use by non-governmental organizations. Another research by Data To The People (2020) created a “databilities” framework with an online assessment to determine proficiency for 15 competencies targeting business and industry. This framework relies heavily on the Risdale et al. (2015) research, which conducted an extensive environmental scan on data literacy, with the goal of informing data literacy education, and included 22 competencies with examples of the knowledge and tasks mapped to each (Bonikowska et al., 2019). Finally, Carlson and Johnston (2014) used a framework of 12 competencies that mirror the data life cycle to explore the proficiencies and needs of graduate students and faculty. They concluded that this information can be used in understanding the environments, challenges, and needs of the people who work with data as an integral part of developing educational programs about data.
Data Literacy Assessment

There is a rapidly growing need for data literacy skills to navigate the information age effectively, which corresponds with an equal need to measure students’ learning outcomes and the effectiveness of educational tools. Cui et al. (2023) stated that beyond the teaching of data literacy, there is the added importance of the “availability of effective assessment tools to measure skill development and progress to provide valuable feedback for teaching and learning” (p. 2).

Assessments traditionally have fallen into two categories: 1) self-reflective assessment, including surveys, questionnaires, scales, and interviews based on self-evaluation, and 2) objective assessment, such as conventional tests with multiple choice and constructed response questions. Self-reflective assessment can be used as assessments of needs in data literacy knowledge and assessments of learning outcomes in curricula, workshops, and courses. Objective assessment is mandated in public education or for observations of students/teachers engaged in data literacy activities (Bonikowska et al., 2019).

Although various assessments have been developed and experimented with, most were intended to examine the effectiveness of data literacy interventions; insufficient scales have been developed specifically to measure students’ data literacy, with almost none targeting students in community colleges.

METHODOLOGY

Scale Development

The development of this study's data literacy assessment scale followed established guidelines (e.g., Carpenter, 2018). To create a reliable and valid instrument to measure data literacy self-efficacy, this study included three phases to generate, revise, and administer scale items.

Phase one is a concept analysis of data literacy and a comparative analysis of data literacy competency. A concept analysis is a methodology to clarify meanings, classify, compare, delineate, and refine concepts providing validity for developing measurement instruments (Pett et al., 2003). A comprehensive and extensive literature review was conducted to identify key attributes of the concept of data literacy (Kim, Hong, & Evans, 2020). Also, a comparative analysis of seven data literacy competency frameworks was conducted to identify a set of common core competency dimensions (Kim & Berka, 2021).

After generating the initial scale items, an expert panel was recruited to review the items, including their wording, response format, instrument direction, and overall quality, to minimize ambiguities and misunderstandings. In phase two, the four panel members were recruited based on their literacy, data science, data curation, and instrument design expertise. The recommendations given by experts were considered to decide which items should be added, removed, or modified. As a result, the final scale items were constructed by ten dimensions identified from a comparative analysis of data literacy competency frameworks: those dimensions include data awareness, data collection, data cleaning, data analysis/analytics, data visualization, data storytelling, data quality evaluation, data organization, data storage, and data ethics. For each dimension, three to five items were developed to ensure adequate construct representation. A five-point Likert scale was used to assess the scale.

This paper describes phase three of the study, the deployment of the final scale items in a survey questionnaire to community college students at different colleges.

Data Collection

The survey questionnaire includes general questions regarding attitudes toward the importance of data, the final assessment scale of 33 items, and demographic questions, including age, gender, major, and educational goal. Survey data was collected electronically through the Qualtrics platform in three rounds of deployment of the survey: a pilot round ($n = 2$), a round of full deployment ($n = 226$), and a confirmatory round ($n = 513$). For the full deployment, one small and two medium-sized suburban community colleges were selected as research sites. For the confirmatory round, one large community college with an enrollment of more than 28,000 credit students was chosen to generate higher survey response rates.

Data Analysis

For the collected data, multivariate outliers were identified and eliminated based on a Mahalanobis distance significance value of $p < .001$. No univariate outliers were found. After removing those survey participants who completed the questionnaire within 150 seconds, data from $n = 135$ and $n = 438$ were used for exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), respectively. Although there is much debate about an ideal sample size for EFA and CFA, Kline (1994) suggested sampling at least 100 subjects for EFA, and Hoogland and Boomsma (1998) argued that a sample size greater than 200 is generally safe for CFA. Our sample size fulfills this requirement.
Using SPSS 29, EFA was employed to investigate the underlying structure of 33 items of scale with a Principal Axis Factoring and Promax rotation method. Then a CFA was performed in AMOS 27 to test if the hypothesized model extracted from EFA would replicate with the confirmatory dataset. The model’s validity was assessed using the Chi-square test of model fit, Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) (Hu & Bentler, 1999). The scale’s reliability was assessed using Cronbach’s alpha, Spearman-Brown correlation, and Guttman’s coefficients. The study findings were analyzed at a confidence interval of 95% and a significance level of \( p < .05 \).

RESULTS
Profile of Survey Respondents
The demographic profiles of the samples collected from both the full deployment round and the confirmatory round are similar. Half of the survey participants were in the 20-24 years old category. Of the participants, 46.1% were female, and 42.9% were male. A little more than half of the survey participants self-reported as White. Of the participants, 71% indicated that they are full-time students and 87% reported they are employed full-time or part-time. A little less than 40% indicated a high school degree as their highest academic credential.

Exploratory Factor Analysis
Before EFA, we performed Bartlett’s test of sphericity to investigate the factorability of the data and the Kaiser-Meyer-Olkin (KMO) test to measure the sampling adequacy. Results indicated a significant test statistic for Bartlett’s test of sphericity, \( \chi^2 (528) = 6478.431, p < .001 \), and a KMO value of 0.9, meaning that the data were suitable for structure detection.

After iteratively performing EFA, items with factor loadings of less than 0.35 and/or similar cross-loadings with differences of less than 0.50 were removed. The number of factors to be retained was determined based on eigenvalues greater than 1.0 (Hair et al., 2019). As presented in Table 1, EFA resulted in a scale of 26 items representing three distinct factors, with eigenvalues greater than 1.0 that explained 71.07% of the variance in the data. Factor 1 (16 items) appears to measure the ability to process data for application and use. Factor 2 (6 items) appears to measure the ability to define data for need and determine where and how to find data. Factor 3 (4 items) appears to measure the ability to judge the ethical aspect of data. Thus, the three subscales of the data literacy scale have been named: Data Identification, Data Processing, and Ethical Data Reasoning.

The subscales and scales have good reliability results. The reliability of each factor and the entire item set was calculated using Cronbach's alpha. The Cronbach's alpha coefficient for these three factors was 0.983, 0.930, and 0.946, respectively. The Cronbach alpha reliability coefficient of 26 items was found to be 0.957. A reliability coefficient score for all items is accepted as perfect or high (Nunnally & Bernstein, 1994). Such a high reliability coefficient score in this study may be because of the high number of items.

Confirmatory Factor Analysis
To validate the factor structure that was extracted through the EFA, a CFA of 26 items was performed on the data collected in the third round of the survey. Convergent and discriminant validity and internal reliability of the factor loadings were evaluated. The TLI and AGFI of the initial model did not meet the recommended cut-offs. The modification indices indicated an additional covariance path between the error terms of two items that would most significantly improve the model fit. Those two items – “1.3. Explaining the real and potential value of data” and “2.1. Collecting primary data through experiments, survey, interviews, etc.” – were removed. After rerunning the second model, the model fit values that met the acceptable criteria were received. The fit indices for the final 24-item measurement model under the three latent factors were: \( \chi^2 = 480.804; df = 249; p < .001 \); Comparative Fit Index (CFI) = 0.918; Tucker-Lewis Index (TLI) = 0.909; Goodness of Fit Index (GFI) = 0.914; Adjusted Goodness of Fit Index (AGFI) = 0.896; and Root Mean Square Error Approximation (RMSEA) = 0.046. Both the CFI and TLI values were higher than 0.90 and the AGFI value was close to the recommended level of 0.90. The RMSEA value was lower than 0.05.

All items and item-total correlation coefficients are greater than 0.50, and corrected item-total correlation coefficients are greater than 0.4. The correlation coefficients among the three factors were statistically significant. Collectively, these results suggest that a three-factor model of the data literacy scale fits well with the observed data and exhibits adequate construct validity.
### Table 1. Data Literacy Scale Items and Respective Factor Loadings/Cronbach Alpha

*Note: The item statements in this table are shortened versions of the item statements included in the instrument*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Item*</th>
<th>Factor Weights</th>
<th>α</th>
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</thead>
<tbody>
<tr>
<td><strong>Factor 1: Data Processing</strong></td>
<td>3.1 Identifying data errors and inconsistencies</td>
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<td>.930</td>
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<tr>
<td></td>
<td>1.1 Summarizing data using descriptive statistics</td>
<td>.702</td>
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<tr>
<td></td>
<td>4.2 Using inferential statistics to draw meaningful inferences</td>
<td>.765</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.3 Employing predictive analytics to make predictions and decisions</td>
<td>.626</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.4 Applying data mining to explore patterns and trends of data</td>
<td>.776</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.5 Communicating analysis/analytics results in written and spoken forms</td>
<td>.714</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.2 Creating data visualizations using charts, tables, and graphics</td>
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</tr>
<tr>
<td></td>
<td>6.1 Presenting data insights tailored to a specific audience</td>
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<tr>
<td></td>
<td>6.2 Using a storyboarding technique for a data presentation</td>
<td>.934</td>
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<tr>
<td></td>
<td>6.3 Using a narrative structure to create compelling data presentations</td>
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<tr>
<td></td>
<td>7.1 Assessing data sources to ensure they meet the defined need</td>
<td>.796</td>
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<td></td>
<td>7.2 Determining whether data meets the quality for a given purpose</td>
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<td></td>
<td>7.3 Evaluating data critically for the right type and quantity</td>
<td>.866</td>
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<tr>
<td></td>
<td>8.1 Categorizing/classifying data to make it more accessible for use</td>
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<tr>
<td></td>
<td>8.2 Organizing and distributing data among files</td>
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<tr>
<td></td>
<td>9.2 Identifying various data backup methods and strategies</td>
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<td><strong>Factor 2: Data Identification</strong></td>
<td>1.1 Defining what data is</td>
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<td></td>
<td>1.2 Describing what different types/formats of data are</td>
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<td></td>
<td>1.3 Explaining the real and potential value of data</td>
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<tr>
<td></td>
<td>2.1 Collecting primary data through experiment, survey, etc.</td>
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<tr>
<td></td>
<td>2.2 Locating secondary data from print/electronic sources</td>
<td>.481</td>
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</tr>
<tr>
<td></td>
<td>2.3 Accessing and locating secondary data</td>
<td>.596</td>
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</tr>
<tr>
<td><strong>Factor 3: Ethical Data Reasoning</strong></td>
<td>10.1 Locating laws/regulations/guidelines for data security/privacy</td>
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<td></td>
<td>10.2 Utilizing de-identification techniques to protect personal data</td>
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<td>10.3 Determining data ownership and use rights</td>
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<td></td>
<td>10.4 Identifying current best practices in data citation</td>
<td>.852</td>
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</table>

### CONCLUSION

Data Literacy is an essential skill in the 21st century. This study offers an assessment tool to measure data literacy competencies of community college students, which can help faculty and librarians at these institutions to create effective courses and programs that meet the needs of students. This study sets out to fill the gaps in the literature in developing and validating a data literary scale through collecting data from four community colleges in the United States. The developed and tested Likert data literacy scale differs from ones in literature by gaining a deeper understanding of the skill sets needed to be data literate due to the expertise involved in creating the survey questions and the analysis of the survey questions.

The EFA and CFA measurement models found that the scale item formats are of sufficient length and should prove to be helpful in measuring self-efficacy for data literacy. The survey tool is a new development for measurement of data literacy and has been found to be reliable; this makes it useful for developing targeted data literacy programs in community colleges. However, the findings should be interpreted with caution because the research sample might not be representative of community college students in the United States. The usefulness of this scale is highlighted by its potential ability to be adapted to other audiences, such as students of different ages and levels of education. The increase in data will improve the usefulness of the data literacy scale by gathering more results to test the reliability and validity of the questions in order to create the most efficacious assessment tool.

### ACKNOWLEDGMENTS

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REFERENCES


Trend of Collaboration in STEM Education in Informal Learning Institutions Based on IMLS-funded Projects

Kim, Soo Hyeon  Indiana University at Indianapolis, USA | skim541@iu.edu
Yoon, Ayoung  Indiana University at Indianapolis, USA | ayyoon@iupui.edu
Seo, JooYoung  University of Illinois Urbana-Champaign, USA | jseo1005@illinois.edu

ABSTRACT
There is limited systematic research on understanding the trends of STEM education in libraries. While reviews of STEM education from various funding agencies exist, these reviews encompass STEM education across formal and informal settings, which may not provide specific implications that center around libraries. This paper examines the trend of collaboration among libraries and other collaborating organizations involved in STEM education funded by the Institute of Museum and Library Services (IMLS). Through content analysis and geocode analysis of 128 projects that are funded by IMLS in 2012–2022, this study shows the diverse engagement of different types of informal learning institutions in STEM education over time. Findings also demonstrate that while few informal learning institutions represented the leading and collaborating organizations in IMLS STEM education initially, leading and collaborating organizations diversified with a higher level of collaboration.

KEYWORDS
STEM education; IMLS funding; Trend; Collaboration; Geocode analysis

INTRODUCTION AND BACKGROUND
In recent years, there has been a growing focus on informal and lifelong learning in science, technology, engineering, and math (STEM). As an informal learning place, libraries increasingly offer STEM programming to people of diverse backgrounds to lower the barriers to STEM education (Shtivelband et al., 2017). With this growing trend of STEM programming at libraries, it is timely to systematically review STEM education at libraries. Previous research on library STEM education has focused on defining the characteristics of STEM programs, the impact on participants, and their contributions to bridging the digital divide (Baek, 2013; Brook & Winslow, 2018). However, there has been limited systematic research on understanding the trends of STEM programs in libraries.

While our ultimate goal is to understand the trend of library STEM education, in this short paper, we aim to examine the distribution and networks among libraries and other collaborating organizations involved in STEM education. The nature of STEM education can vary based on geographic locations, library/museum size, resources, priorities, and community needs. Therefore, investigating the distribution of STEM education and the organizations involved will provide insight into where investments are being made, who is leading these efforts, and what kind of community impact is being made. For this study, we focus on STEM education projects that are funded by the Institute of Museum and Library Services (IMLS), the federal funding agency that most supports relevant research in the context of libraries. While reviews of STEM education from other funding agencies exist (e.g., NSF), these reviews encompass STEM education across formal and informal settings, which may not provide specific implications for researchers and library professionals who wish to understand the trend of STEM education that centers around libraries. As such, our two specific research questions are:

1. What are the types and geographical distribution of leading institutions and collaborating organizations that have received IMLS grants to conduct projects related to STEM education in 2012–2022?
2. What types of organizations have been participating in IMLS projects that focus on STEM education? Is there any changes in terms of organizational types that most frequently participate?

METHODOLOGY
The study aimed to investigate the trend of collaboration within the scope of IMLS-funded projects that focused on STEM education. As such, the study collected data from the IMLS website to identify grant-awarded projects related to STEM education from 2012 to 2022. The combination of terminologies “STEM” and “library” was used in our keyword search. 455 projects were identified and exported to Excel, with the project description available on the IMLS website. Two researchers manually reviewed 455 grant projects and included: (1) projects that supported the development of programming that focused on one or a combination of disciplines within STEM, and (2) projects that supported capacity building of information professionals to facilitate STEM programming within information institutions. We broadly defined STEM to include STEAM projects and projects relating to data literacy or computational thinking. When there was uncertainty about whether the project fits the category of STEM education, two researchers discussed it until a full consensus was met. 128 projects remained after the first stage of filtering.

Once we finalized our study sample, we analyzed the types of organizations that lead STEM projects (e.g., Principal Investigator (PI)) as well as collaborating organizations and the geographical distribution of those organizations.
Collaborating organizations are partner organizations or personnel collaborating with the PI and Co-PIs. We developed a protocol to extract and categorize information. The categories were: (1) project description, (2) project code, (3) project start year, (4) information related to PI, co-PI, and collaborating organization (organization, name, state, city), (5) type of PI/Co-PI institution (i.e., public library, university, community organization, government, museum, science center, tribal organization, others), and (7) type of collaborating organization (i.e., public library, school library, university and research library, state library, school, university, professional association, community organization, government, museum, science center, tribal, others). When cultural institutions curated science artifacts, we coded the type as a science center and the rest as museums. An example of government was the Department of Education. An example of a community organization was Food Banks.

We trained two research assistants to follow the protocol that included instructions and examples on how to code. Multiple training sessions were held until there was 80% agreement between the two assistants’ coding results. Assistants each coded half of the data. Then, they coded the other half of the dataset to confirm the coding results. We also had a data validator to conduct a final check/audit on coding of all 128 projects. For coding, we used full or preliminary proposals when available (n=20) or project descriptions only (n=108) when proposals were not available. During this process, any coding results with questions or disagreement were marked and discussed with two authors of this paper until a full consensus was reached (Smagorinsky, 2008). After the initial round of coding, the research team observed that 109 out of 128 projects did not have information related to Co-PI. Thus, we decided to focus our analysis on understanding the distribution of PI and collaborating organizations.

To analyze the network and trends of collaboration, we conducted geocode analysis. We first identified the longitude and latitude coordinates of the PIs based on their city and state information. For this work, we employed a statistical computing R environment (Version 4.2.3; R Core Team, 2023), tidygeocoder R package (Cambon et al., 2021), and free OpenStreetMap geo service. Next, we built an interactive geomap to visualize the locations of each PI institution. The map was developed using the R package leaflet (Cheng et al., 2023) and shiny (Chang et al., 2022). In our geomap, PIs and collaborating organizations were represented by a circle in different colors. The map was interactive, and users could click on each circle to see the city name and project code information. A slider bar control was added to investigate the trend of collaboration over time. To demystify the steps of geocode analysis, we have published the interactive geomap on the web (https://jooyoungseo.shinyapps.io/imls_stem_geomap/).

While our study contributes to understanding the trend of collaboration, this study has its limitations. The study relied heavily on project descriptions available on the IMLS website, which did not include details about some other project participants, such as Co-PIs. Thus, our geographical distribution analysis of STEM projects only considers the leading institutions of PIs, excluding institutions of Co-PIs. Further, our geomaps did not provide links between PIs and collaborating organizations to analyze how the location of PI institutions influenced the location of collaborating organizations. Future analysis based on full proposals of all projects related to STEM education with geocode analysis that includes networks between the project team and collaborating organizations are needed to provide a complete landscape and trend of collaboration and networks.

RESULTS
Type and Geographical Distribution of Principal Investigators
The most dominant type of PI institutions that conducted IMLS-funded STEM education projects was university (n=31), followed by public libraries (n=27), science centers (n=26), museums (n=13), tribal organizations (n=13), community organizations (n=8), professional associations (n=1), government organizations (n=2), and others (n=7) (Figure 1). The university was the dominant type in 2013–2016; the public library was the dominant type in 2017–2018; science centers were visible specifically in 2012 and 2022. Tribal organizations began to appear in 2014 and increased in number in 2018. Community organizations, government organizations, professional associations, and other types were less frequently noticeable.

Figure 1. Distribution of Principal Investigator’s Institution by Type in STEM Education from IMLS
The distribution of geographic locations of PIs showed that PIs were frequently from California (n=11), New York (n=11), Florida (n=9), Oklahoma (n=8), and Pennsylvania (n=7) (Table 1). Several PI institutions in California and New York were museums, such as Lawrence Hall of Science, Habitot Children’s Museum, and New York Hall of Science. Other types of institutions, such as New York Botanical Garden, were also included. In Florida, public library systems were the highest in number for PI institutions (n=4), followed by universities (i.e., U of Florida, Florida State University) and museums. Oklahoma had the highest number (n=5) of tribal organizations (e.g., Ponca tribe, the Wyandotte Nation in Oklahoma) and Pennsylvania had the highest number of universities (n=3).

<table>
<thead>
<tr>
<th>Year</th>
<th>Northeast</th>
<th>Midwest</th>
<th>South</th>
<th>West</th>
<th>Other</th>
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<tr>
<td>2022</td>
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</tbody>
</table>

Table 1. Distribution of Principal Investigators in US States from 2012–2022

When the total accumulation was considered, the distribution of PI by region was similar, except for Midwest and Others: South (n=37), West (n=36), Northeast (n=33), Midwest (n=19), Others (n=3). States included in the others category are AS (American Samoa), GU (Guam), and PR (Puerto Rico). PIs from the Northeast region dominated in 2012, South in 2022, and West in 2018. PIs in other regions increased in 2020 (Figure 2).

![Figure 2. The Trend of Principal Investigators per United States Regions in STEM Education from IMLS](image)

**Type and Geographical Distribution of Collaborating Organizations**

The most dominant type of collaborating organization was the public libraries and other types (Figure 3). Other types included botanic garden, housing department, sheriff’s office, radio station, jail, and faith-based organization. The dominant type changed over time. Notably, there was a drastic increase in public libraries in 2018, other organizations in 2019, professional associations in 2020, state libraries in 2021, and K-12 schools in 2022. Government organizations were included repeatedly during 2018–2020. Community organizations were steadily included as collaborating organizations starting in 2013, except during 2018-2021. Universities were continuously included as collaborating organizations, but their frequency varied over time. Science centers, museums, State libraries, and governments were included as collaborating organizations, but less frequently at inconsistent basis.

![Figure 3. Distribution of Collaborating Organizations by Type in 2012–2022](image)

The total number of collaborating organization types increased steadily from four types in 2012 to nine types in 2020. Over time, the type of professional associations diversified from AASL, ALA, and PLA in 2013-2014 to the Association for Rural and Small Libraries (ARSL), National Summer Learning Association (NSLA), Chief Officers of State Library Agencies (COSLA), PEER Associates, and National Afterschool Association in 2017-2019. After
2020, more diverse types of professional associations dedicated to specific ethnic groups were included, such as the Asian/Pacific American Librarians Association (APALA), National Association to Promote Library and Information Services to Latinos and the Spanish Speaking (REFORMA), and American Indian Library Association (AILA). Organizations specifically focusing on STEM and lifelong learning, such as the National Recreation and Park Association (NRPA) and National Summer Learning Association (NSLA), were also included.

Collaborating organizations were frequently recruited in Arizona (n=24), New York (n=16), Georgia (n=15), Ohio (n=13), Illinois (n=12), California (n=11), Pennsylvania (n=10), Maryland, Oklahoma, and Oregon (n=8) (Table 2). The total count of collaborating organizations in 2012–2022 in five US regions were: West (n=71), South (n=66), Northeast (n=52), Midwest (n=36), and others (n=1). Collaborating organizations from the Northeast region were the dominant type in 2013–2017. However, collaborating organizations from the West became the most prevalent type from 2018, except for 2019, which had more collaborating organizations from the South (Figure 4).

<table>
<thead>
<tr>
<th>Year</th>
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<th>West</th>
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</table>

Table 2. Distribution of Collaborating Organizations in US States by Regions from 2012–2022

![Figure 4](Figure 4.png)

**DISCUSSION AND CONCLUSION**

This paper reported on the overall trend of the distribution of STEM programs and collaboration between leading and collaborating organizations in IMLS-funded projects. While our initial search focused on STEM and library, our findings showed diverse engagement of different informal learning institutions and collaborating organizations (i.e., libraries, museums, science centers, tribal organizations, and community organizations) in STEM education over time in IMLS-funded projects. Our analysis found that specific types of institutions were prominent as leading PI institutions in different geographic regions. In California and New York, museums and other institutions were prevalent, whereas Oklahoma had a high number of tribal organizations and Florida had a high number of public library systems. This finding may have been influenced by factors such as the emphasis on STEM education within these institutions and the quality of existing infrastructure to pursue and prepare for grant funding. Nonetheless, further research is necessary to fully understand the underlying causes of these patterns.

Findings also showed that while universities and public libraries were the leading institutions in IMLS STEM education in the beginning, the type of leading institutions diversified from 2018 with the inclusion of tribal organizations and community organizations. This pattern of diversity in the types of leading institutions was also noticeable within the collaborating organizations. A higher level of collaboration was indicated through the increasing types of collaborating organizations over time. This may indicate practitioners’ and researchers’ growing recognition of the importance of diverse collaboration in STEM education to broaden STEM participation. Given that IMLS strategic plan for 2022–2026 has changed to explicitly embrace diversity, equity, and inclusion as one of the core objectives (IMLS, 2022), the growth of diverse collaboration may also result from a possible funding emphasis (i.e., collaborative research viewed more favorably by IMLS). We anticipate that collaboration among IMLS-funded STEM education projects is expected to grow, however future research is needed to understand the full landscape of collaboration and analyze what factors may have contributed to the change in collaboration networks and its impact. As mentioned, this is only a snapshot of the STEM education trend. We have collected other data about the IMLS-funded STEM projects (e.g., topics, target populations, disciplinary focus, and project goals), and currently continue the analysis to provide a complete picture of the trend.
ACKNOWLEDGMENTS
We thank Rina Sim, Lauren Harris, and Drusilla Corliss for collaborating on the data analysis.

REFERENCES
Exploring the Relationship between Sci-Hub and Medical Literature

Kjellström, Zakayo  
Umeå Universitet, Sweden | zakayo.kjellstrom@umu.se

ABSTRACT
This short paper presents an analysis of the distribution of downloads in medical literature, with the aim of understanding the specific conditions unique to the medical research field that necessitate the use of black open access sources such as Sci-Hub. The dataset used in this analysis was obtained by scraping the official Sci-Hub domains during the summer of 2022, and it provides valuable insights into user behavior and interaction with the website. The results demonstrate that a significant portion of the downloads from Sci-Hub during the period were related to medical journals, indicating the acute needs and time-sensitive nature of medical research. The data further highlights that most of the downloaded papers were related to medicine or medical subjects, underscoring the importance of easy and immediate access to the latest research and literature. The study emphasizes the pressing need for universal access to essential health-care information and the importance of continued efforts to democratize access to medical literature. The use of black open access sources like Sci-Hub serves as a reminder of the urgency to find alternative solutions that ensure medical professionals have the necessary resources to provide the best possible care for their patients.

KEYWORDS
Sci-hub; Medical Literature; Information Searching; User Behavior; Black Open Access

INTRODUCTION
In 2004, Godlee et al., published the evocatively article “Can we achieve health information for all by 2015?” posing both questions and solutions to the possibilities of a lingering crisis for health information distribution, calling upon the World Healthcare Organization to fund universal access to essential health-care information (Godlee et al., 2004). Since then, similar calls for a program of universal access have been voiced (Royston et al., 2020; Yamey, 2009). The implementation of open access has certainly expedited the process of universal access, but the process has been slow, considering the inception of the movement more than 20 years ago with the BBB (Suber, 2012). Certain glimpses of the possibilities offered by universal access were given during the Covid 19 pandemic, where openness of the medical literature was essential, and provided what authors called “a light in the dark” in terms of dissemination of medical literature (Capocasa, et al., 2022).

The issue of access is somewhat unique for medical professionals as their work often is placed in the intersection between service and research. As such their research output essentially dwarf every other field, in every region of the world (White, 2019). Furthermore, their demand for information is often related to work that is time-sensitive, such as patient care. An older systematic review showed that most of the information related questions posed by doctors directly related to patient care (Davies, 2007). Additionally, several studies have shown that one of the key barriers to information searching is time (Davies, 2007; Bryant, 2004; Case, 2004.). According to Davies (2007), doctors' top information requirements are treatment or therapy, diagnosis, and drug therapy/information. Health care providers and patients have a critical need for medical information (Daei et al, 2021), but doctors must double-check and validate information from the web and be advised by information professionals on how to evaluate websites (Davies, 2007). Bryant (2004) found that the top perceived interest of doctors when searching for information were clinical care, keeping up-to-date, information for patients, pharmacological information, gaps in knowledge, curiosity, and uncertainty. The purpose of this study is to create understanding of how the distribution of downloads in medical literature suggest that the specific characteristics of medical research: time constraints, significant publication volume, and acute needs creates specific conditions which makes the use of black open access sources, such as Sci-Hub essential for the profession. The term black open access describes unlawful avenues of access to academic literature, i.e., piracy (Björk, 2017). Another term is shadow libraries, which are platforms dedicated to facilitating the mediation of pirated literature (Karaganis, 2018). Unlike previous download studies on the use of Sci-Hub (Bohannon, 2016; Greshake, 2017; Nazarovets, 2018), this study uses a novel dataset created using the official Sci-Hub domains to understand how usage of the shadow library was during a specific time-period. By observing how users actively use the site, an understanding of what journals users download from, what subjects are of interest, and which keywords are most frequently reported in the papers downloaded.

The issue of access, and the information requirements of healthcare professionals have been similar throughout the 2000s. Time seems to continually be a topic of concern for healthcare professionals seeking information, both in terms of stress factors associated with the profession, but also due to the time-sensitive nature of clinical and diagnostic work (Clarke et al., 2016; Daei et al., 2021). Open access has made a lot of progress, but even though biomedical, clinical medicine, and health studies are at the forefront of open access only as much as 50% remain
accessible to all (in certain fields) (Piwowar et al., 2018). With so much out of reach, one of the responses have been to turn to pirated sources, or “Black Open Access” (Björk, 2017). The use of shadow libraries spreads far beyond the medical professions, with user spread all around the world (Bohannon, 2016). Nevertheless, one study, based on data put forth by Sci-Hub, showed that 22% of all downloads from the site over a six-month period were related to medical journals, this has also been confirmed by other inquiries into the website (Till et al., 2018; Bendezú-Quispe et al., 2016)

Methodology
The dataset which acts as the basis for the analysis in this paper was retrieved and compiled during the June and August 2022. It was created by scraping (a technique used to extract data from a website by way of bots) the websites Sci-Hub.st and Sci-Hub.se “latest read” section, these sites were chosen as they were the two of three so-called “Original” mirrors of the notorious and lauded website (Elbakyan, n.d). Two different methods were used to scrape the domains, one using the Python library BeautifulSoup which parses HTML code, and works automatically by refreshing the webpage, and another that involved a Linux script to automatically take screenshots of the HTML stream. The results from both methods were merged, and duplicates were removed, resulting in a dataset consisting of 2539520 download events that provides insights into user interaction with the website.

Since only two of the Sci-Hub mirrors featuring the ‘latest reads’ section, Sci-Hub.se and Sci-Hub.ru, focus was on scraping these two domains. Initially, the intention was to scrape only one domain, but both domains are protected by Cloudflare for content delivery services and Distributed Denial-of-Services (DDOS) mitigation, which made it necessary to scrape them both to mitigate banning from the server. DDOS is an orchestrated attack on a website, most commonly by overloading the servers with queries, Cloudflare acts as an intermediary in the case of such an attack. It is worth noting that the latest read stream is the same on both domains and presumably includes downloads from the third official mirror (which does not have a latest read section), although this cannot be confirmed. To bypass the website's protection, a periodic interval of a few minutes was set for data scraping. Therefore, the final dataset only includes snapshots of the user patterns taken every five minutes during the data collection period. Because of the protection on the sites, there were gaps in the data collection process. This is important since scraping of this kind is typically performed using APIs rather than accessing the contents of the website through incessant repetition. The dataset obtained from Sci-Hub includes information on title, DOI, and time of download, providing a partial understanding of user interaction with the website. To gain a more comprehensive understanding of user behavior, we enriched the dataset with metadata for each article. Since manually querying each of the 1180106 DOIs collected from Sci-Hub over the summer is time-consuming, we used the Crossref API to obtain the full metadata of each download. This allowed for a more in-depth analysis of the dataset in terms of content and user interests. Regarding the data collection and creation methods, it is important to note that these methods and datasets are part of a larger study on user behavior on Sci-Hub. This short paper also aims to show how the dataset can be used to analyze different subjects, in addition to the previous stated aim at analyzing the context of medicine and the use of pirated sources. The dataset obtained from Sci-Hub can be used to understand the usage patterns of medically interested users, which can help identify the special relationship between Sci-Hub and medicine.

Sci-hub and Medicine
As figure 1 shows, the most downloaded from journal is PLoS ONE. This proves to be an interesting example of how Sci-Hub is used. Not just in terms of medical professionals, but users overall. PLoS surprising dominance within the dataset is not just related to its overall size but to the fact that all the content published in the PLoS journals is open access. The fact that PLoS ONE occurs so frequently in the dataset harkens back to an article by Toby Green aptly titled: “We’ve failed: Pirate black open access is trumping green, and gold and we must change our approach”, detailing the challenges of Open Access in the face of alternatives such as Sci-Hub (Green, 2017). Furthermore, it lends weight to the hypothesis that the use of Sci-Hub is most likely just an accepted avenue amongst others as suggested by Segado-Boj et al., (2022). Understandably, a significant amount of the articles downloaded had been published in Nature and Science as due to their prominence in many scientific fields.

Figure 1. Distribution of downloads from the top ten most frequently accessed journals in the dataset.
Both journals also publish significant portions of medical literature. Both journals were also found at the high end in a study performed on the latest dataset released by Sci-Hub in 2017 (Greshake, 2017). However, the most interesting aspect of the chart, for this paper, is the substantial share of downloads from The Lancet. At first glance, this might not be perceived as an especially outstanding occurrence, however, what must be considered is that the dataset was generated based on user requests, meaning that at least 11% of the downloads during the period were performed by a user interested in medical literature.

Figure 2 gives a clearer indication of how important the website is for, presumably, medical professionals. As can be seen, of the ten most downloaded subjects, six are directly related to medicine or medical subjects. Overall, of the ten most downloaded subjects, 60% are medical subjects. Some of the other subjects could be argued as adjacent fields, such as cell biology, but as the share of medical subjects is so significant it is not needed to show how closely connected the use of Sci-hub is to the medical profession. The top 30 keywords, seen in figure 3, further accentuate the tight connection.

![Figure 2. Distribution of subjects in the dataset, subjects were retrieved from journals metadata.](image)

![Figure 3. Histogram of the 30 most frequently occurring keywords in the dataset. Keywords are those input by the article’s authors.](image)

As evident from the dataset, a vast majority of the papers downloaded during the period of collection relate to medicine in some fashion. Either as the overarching subject category or as part of medical fields. All the reasons given at the beginning of this article may begin to explain it, but there is something additional at play here. Boudry et al. studies the field of ophthalmology, and their findings suggest that Sci-Hub isn’t only a simple way to access pay-walled medical literature, but essential for the continued international research (Boudry et al., 2019). The considerations found in this paper also corresponds with others, by drawing example from circumstances and use of Sci-hub in specific nations (Bendezú-Quispe et al., 2016; Corrales-Reyes, 2017). But how is this viewed from Sci-Hub? Whilst browsing the website, one can find the subdomain Sci-Hub.st/medicine (domains frequently change, at the time of writing 23/3-2023, this was one of the active ones). On this page, Elbakyan, who is the sole administrator of Sci-hub has highlighted several important points on the intricate relationship between Sci-Hub and medical research. She discusses partly the points already laid forth in the introduction, such as the importance of medical information for saving lives and the high cost of access for medical journals, but more importantly she points to the...
importance of Sci-Hub in a way that can be interpreted as a liberatory and prefigurative avenue in democratizing access to medical literature. For example, she cites a repository created by “internet archivists” to find freely accessible research papers on Covid-19, using Sci-Hub as the source (Elbakyan, n.d). The repository in question was compiled by a user on the internet forum Reddit named the “Archivist” who creates archives of copyrighted content and makes them available through their website. What this points to is a generally unexplored topic in the previous literature: namely the importance of Sci-Hub, or black open access as a whole, as an infrastructural component in the search for literature.

The strong connection between Sci-Hub and the medical community becomes even more apparent when examining the testimonial section on the Sci-Hub.st/medicine website. If the high frequency of a particular medical category on Sci-Hub was not enough to demonstrate the reliance of medical professionals on Sci-Hub, we can further confirm this reliance by reviewing the testimonials provided, depicted in figure 4.

![Figure 4. Collage of testimonials from medical professionals found on the Sci-Hub website. All references to names, countries and institutions have been redacted.](image)

The collage depicts a personal aspect of the correlation between the usage of Sci-Hub and medical professionals, which is further supported by the comments made by Elbakyan. This relationship is evident not only in the dataset but also in the testimonials sent to Sci-hub. From the testimonials, there are several reasons for why the use of Sci-hub is so prevalent in the medical profession, such as the ability to offer swifter treatment, being able to access a larger swathe of the medical literature, and most importantly giving access to research to medical professionals in low resource nations.

CONCLUSION

In addition to providing important insights into the usage patterns of Sci-Hub by the medical community, this study sheds light on the challenges faced by medical professionals in accessing vital information in a timely and efficient manner. The time-sensitive nature of medical research, coupled with the significant publication volume, creates a unique set of conditions that necessitate easy and immediate access to the latest relevant publications.

While open access has helped alleviate some of the barriers to access, the fact remains that a significant portion of biomedical, clinical medicine, and health studies are still not accessible to all. This is part of the reason which led to the rise of black open access sources, such as Sci-Hub, which have become an essential resource for medical professionals. The analysis of the dataset obtained through web scraping demonstrates the widespread reliance on Sci-Hub by medical professionals, highlighting its critical importance in providing access to vital information that would otherwise be inaccessible.

This study gives a unique perspective on the relationship between Sci-hub and the medical profession. This was achieved means of exploratory statistics to identify patterns and trends in a (something) dataset that were qualitatively contextualized through the study of a selection of testimonials provided by healthcare professionals to the site. Moreover, these testimonials not only shed light on the experiences of healthcare professionals, but also point to the real-world impact of Sci-Hub on medical professionals' ability to provide treatment to patients, especially in low resource nations. This underscores the importance of further studying sites such as Sci-hub in various context, which this short paper also sets out to initiate. Not just by relating to specific subjects but using different methods to achieve information about the intricacies of Sci-hub and shadow libraries like it.
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Teenagers and Videoconference Fatigue: A Preliminary Analysis from an Affordance-based Approach

Lee, Chei Sian
Nanyang Technological University, Singapore | leecs@ntu.edu.sg

Li, Benjamin Junting
Nanyang Technological University, Singapore | benjyli@ntu.edu.sg

Wu, Qian
Nanyang Technological University, Singapore | qian003@e.ntu.edu.sg

ABSTRACT
The Covid-19 pandemic has led to the widespread use of videoconference (VC) technologies, particularly in education and this trend is projected to continue. Prolonged VC usage can lead to “videoconference fatigue” (VCF). While research on factors contributing to VCF has been conducted among university students, there is limited research on younger students (especially teenagers). To fill this gap, this study adopts an affordance-based approach to identify VC affordances (resources and constraints) contributing to VCF in teenagers. Specifically, the objectives are to examine if (a) VC affordances (visibility, information, and availability), and (b) demographic profiles (age and gender) have effects on VCF among teenagers. A large-scale survey was conducted and responses from 491 teenagers were analyzed using Hierarchical Regression Analysis. Results indicate that the three identified VC affordances contribute to VCF in teenagers. In addition, teenage girls and older teenagers are more prone to VCF.

KEYWORDS
Videoconference, Videoconference Fatigue, Teenagers, Affordance, Online Learning

INTRODUCTION
The Covid-19 pandemic has led to the widespread adoption of videoconference (VC) technologies (Beauford, 2023). According to Fortune Business Insights (2021), the global videoconferencing market was valued at approximately USD 6.28 billion in 2021. It is projected to reach 14.58 billion by 2029, underscoring the prevalence of its role in work and school. Specifically, VC has become an integral part of mainstream education due to the rise of hybrid and online learning, with teachers and students embracing this technology (Kharbach, 2022). Additionally, this trend has been aided by the availability of many VC platforms such as Zoom, Skype, Microsoft Teams, and Google Meet.

While VC software has its benefits, it has its challenges which include the absence of non-verbal cues (AI-Samarraie, 2019; Lawson et al., 2010) and prolonged VC usage can lead to fatigue, exhaustion and burnout (Doty et al., 2022; Riedl, 2022). Some termed this as “Zoom fatigue” (Bailenson, 2021; Massner, 2021), while others used a more general term known as “videoconference fatigue” (VCF) (B. J. Li & Yee, 2022). Following Li & Yee (2022), we use the term VCF, defined as non-pathological tiredness arising from videoconferencing which manifests in physical, cognitive, emotional and social ways suggesting the multifaceted nature of the problem. Notably, while VC platforms facilitate remote education, communication and collaboration, we need to be mindful of the resources afforded by VC software that can impose constraints and potentially lead to VCF.

VCF emerged due to the COVID-19 pandemic because of the sudden shift to online learning and increased reliance on VC technologies to facilitate online classes (Bailenson, 2021). While schools may have resumed in-person classes, VC continues to be a common mode of communication for students (Cray, 2021). It is essential to continue to address VCF and improve remote communication effectiveness while minimising the negative impacts of VC. Specifically, studies highlighted that VCF affects students’ well-being (Okabe-Miyamoto et al., 2022; Petchamé et al., 2022). Notably, these studies focused mainly on university students (de Oliveira Kubrusly Sobral et al., 2022; Massner, 2021; Moraliast et al., 2022), and research on younger students (especially teenagers) is urgently needed.

Despite the widespread usage of VC in schools, we are still unclear about the affordances of VC and their effects on VCF among teenagers. It is vital to study VCF among them because VC has become integral to their educational systems and social lives. In addition, familiarity with VC technologies can give teenagers an advantage in the job market as the technology is used for virtual job interviews, networking events and other professional interaction and development opportunities (Julsrud et al., 2014; Sears et al., 2013). Hence, understanding how VC affordances lead to VCF can help to mitigate VCF and contribute to future academic and career success in teenagers.

In terms of affordance-based research, Sundar et al. (2015) suggested that affordances manifest in the form of distinctive technological attributes that shape the nature of communication. Hence, we focus on the features of VC technology that are critical for online learning and interaction among teenagers. Specifically, VC technologies support knowledge delivery and in-class communication by providing visual, audio, and other interactive affordances (Wu et al., 2022). We identify three types of affordances of VC technologies embedded in the common features found in most VC technologies. They are visibility-related affordances (enable users to see and be seen by...
others) during VC, information-related affordances (help with information processing and understanding), and availability-related affordances (provide user’s availability and contact information). It is also important to note that VCF can impact individuals of all ages and genders, and the extent of the impact may vary based on individual circumstances and other factors. Regarding gender, workplace research has shown that female workers tend to experience more emotional exhaustion and stress related to VC use than males, which could potentially contribute to VCF (B. J. Li et al., 2022). Age is also another factor. In particular, younger users (e.g. teenagers) may find it more challenging to communicate effectively through VC, leading to additional cognitive and emotional load (Yan et al., 2021). These factors can potentially contribute to VCF.

The objectives of the present paper are hence two-fold. The first objective is to investigate VC affordances by focusing on visibility, information and availability-related affordances and their effects on VCF among teenagers. The secondary objective is to examine if teenagers’ demographic profiles (e.g. age and gender) also affect VCF. An affordance-based approach is pertinent to this inquiry as it can shed light on the resources critical for teenagers to achieve their learning and communicating goals while being mindful of constraints that may contribute to VCF. Hence, this study attempts to answer the following research questions: What VC affordances contribute to VCF in teenagers? Do demographic factors have effects on VCF among teenagers?

RELATED WORK
An affordance-based approach

The term “affordances” was defined by Gibson (1986) in ecological psychology as action possibilities in relation to the properties of a given environment. Subsequently, Norman (1988) emphasized that affordances should be perceivable in the context of product design. In terms of communication, Sundar et al. (2015) suggested that affordances are technological attributes that manifest particular features to shape the nature of communication (Sundar et al., 2015). Taken together, the affordances of VC can be perceivable and they provide resources to enhance communicators’ competence and ability and enable effective and successful communication (Lee et al., 2014). However, they may also impose constraints and affect communication outcomes negatively (Clark & Brennan, 1991; Lee et al., 2007) and here we focus on VCF.

This study focuses on three types of affordances. The camera function on VC facilitates visibility-related affordances, which enable a user to see self and other users’ behaviors (Treem & Leonardi, 2013). Information-related affordances enable users to organize, control, process and manage information (Väljataga et al., 2010; Zhou et al., 2018) and audio, video, and chat features of VC technologies facilitate this. Availability-related affordances enable users to get immediate responses or updates from other users (Gibbs et al., 2013; Lee, 2010) due to the users’ status availability and contact information shown on the platform. While these affordances provide critical resources, they may also impose constraints on the users during a VC session. For instance, visibility-related requires visual attention which can be demanding especially for long VC sessions (Li et al., 2022). Information-related affordances introduce additional cognitive load and users may feel stress to internalize the different types of information exchanged during the VC session (e.g., audio, video, chat, hyperlinks, presentation slides). The availability-related affordances may introduce undue pressure to be present and engaged during a VC session.

Videoconference fatigue

As schools shut down worldwide due to the pandemic, lessons moved online with the use of VC platforms as a primary mode of communication to facilitate classes (C. Li & Lalani, 2020). Along with this increased adoption, many reports of VCF soon began to surface as usage of the technology peaked. Correspondingly, researchers have developed the Zoom Exhaustion & Fatigue (ZEF) scale to measure VCF (Fauville et al., 2021). The instrument comprises 15 items spanning five dimensions of fatigue, namely general, social, emotional, visual and motivational fatigue. Studies utilizing the ZEF scale have found moderate to high levels of VCF among students, which suggests that it is a prevalent issue in educational settings (e.g., Montag et al., 2022).

Researchers and educators have expressed concerns towards VCF among students especially teenagers and have sought to explore the underlying factors and consequences. Pingkiany et al. (2021) suggested that the intense duration and frequency of VC are potential causes of VCF among students, especially since the technology is used every day in their virtual classes, instructor consultations and group discussions. Others found that students who used videoconferencing for educational purposes experienced difficulty in learning and reported greater emotional, cognitive and/or physical problems compared to face-to-face classes (Massner, 2021).

METHOD
Data collection

A survey was conducted between July and October 2022 with 626 teenagers from four secondary schools in Singapore. Administrators from the schools facilitated the data collection. Participation from the teenagers was voluntary and no monetary compensation was provided. As the teenagers were below 21 years of age, consent was
provided by their parents before participation. The racial distribution of the sample mirrored the multi-racial demographic of the Singapore population. The study was approved by the authors’ Institutional Review Board.

The survey comprised of scales measuring VCF, VC affordances, and demographic characteristics. First, VC affordances were measured as follows: (1) 3 items for visibility-related affordance, (2) 3 items for information-related affordance (3) 3 items for availability-related affordance. The three constructs were respectively measured by five-point Likert scales and the means (M) and standard deviations (SD) were shown in Table 1. To examine the validity, the confirmation factor analysis (CFA) was conducted and the average variance extracted (AVE) values ranged from .53 to .70, reaching the recommended value (i.e., .50) for acceptable convergent validity. Further, the correlations among the three constructs were smaller than the square root of the AVE on the diagonal, suggesting that the discriminant validity was acceptable. The construct reliability of the three constructs was acceptable with values ranging from .77 to .88. Second, the measure for VCF was adapted from Fauville et al. (2021). Due to time constraints set by the school which resulted in a shorter survey length, we used an abridged version of the original scale by using three items measured on a five-point Likert scale (i.e., “How tired/exhausted/mentally drained do you feel after videoconferencing?”). The construct reliability was .92. Finally, the gender and age of participants were collected. In particular, the participants’ gender was measured by a multiple-choice question with three choices—female, male, and others. Participants were further asked to indicate the length of a typical VC session they attended by answering a multiple-choice question.

**Data analyses**

To investigate the effects of VC affordances on VCF, a hierarchical linear regression was conducted. The first block focused on demographic factors (i.e., gender and age). Here, gender was computed into a dummy variable with 1 = female and 0 = others. Next, the second block was VC affordances (i.e., V-Affordance, I-Affordance and A-Affordance). To ensure the absence of multicollinearity among all independent variables, this research further examined the variance inflation factor (VIF) of the variables. The VIF values were all smaller than 10 (i.e., ranging from 1.01 to 1.29), indicating the absence of multicollinearity (Pituch & Stevens, 2016).

<table>
<thead>
<tr>
<th>Construct &amp; Items</th>
<th>Standardized Loadings</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visibility-related affordances (V-Affordances)</strong></td>
<td></td>
<td>3.00</td>
<td>1.07</td>
</tr>
<tr>
<td>Whenever I have my camera on, I am anxious knowing that others are watching me</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whenever I have my camera on, I feel constrained when I see myself on the screen</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whenever I have my camera on, I feel anxious when I see myself on the screen</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Information-related affordances (I-Affordances)</strong></td>
<td></td>
<td>2.93</td>
<td>0.93</td>
</tr>
<tr>
<td>I am often distracted by the excessive amount of information in videoconferencing.</td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I find that I am overwhelmed by the amount of information that I process from videoconferencing.</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I find it difficult to process all the information during videoconferencing.</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Availability-related affordances (A-Affordances)</strong></td>
<td></td>
<td>3.30</td>
<td>0.87</td>
</tr>
<tr>
<td>Sometimes I don’t want to be contacted through videoconferencing</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel pressured that I have to be available on videoconferencing</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am pressured to respond to videoconferencing requests</td>
<td>0.73</td>
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**Table 1. VC Affordances Constructs Measurements (N = 626)**

**RESULTS**

**Profiles of participants**

After omitting participants with missing ages and gender, we had 491 participants and 61.5% were females. The age range of the participants was 14 years to 20 years old as adults in Singapore are 21 years old and above. The average age of participants was 16.7 years old (SD =1.19). Around 63.5% of participants indicated that a typical VC session was more than one hour while 26.3% reported that the length was between 45 minutes to one hour (see Figure 1).
Hierarchical linear regression results
The results (see table 2) indicate that the VC affordances were all significant in predicting teenagers’ VCF ($p < .001$). A-Affordances were the most significant in increasing teenagers’ VCF followed by I-Affordances and V-Affordances. Both gender ($p < .05$) and age ($p < .05$) significantly predicted VCF. The results suggested that teenage girls and older teenagers experienced higher VCF. Our model accounted for 34% variances.

<table>
<thead>
<tr>
<th>Dependent variables = videoconference fatigue (VCF)</th>
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<tbody>
<tr>
<td>Independent variables</td>
</tr>
<tr>
<td>First block: Demographic factors</td>
</tr>
<tr>
<td>Gender (Female = 1, Others = 0)</td>
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<tr>
<td>Age</td>
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<tr>
<td>Adjust R²</td>
</tr>
<tr>
<td>R</td>
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<tr>
<td>Second block: Videoconferencing Affordances</td>
</tr>
<tr>
<td>V-Affordance</td>
</tr>
<tr>
<td>I-Affordance</td>
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<tr>
<td>A-Affordance</td>
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<tr>
<td>Change in Adjust R²</td>
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<tr>
<td>Final Adjust R²</td>
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<td>R²</td>
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*** $p<.001$, *$p<.05$.  

Table 2. Hierarchical Linear Regression Results (N = 491)

DISCUSSION, IMPLICATION AND CONCLUSION
This preliminary exploratory study has identified three types of VC affordances (visibility, information and availability) that contribute to VCF in teenagers. Recognizing and addressing these issues help teenagers feel more comfortable and confident using VC. First, to our knowledge, this is the first study that draws on an affordance perspective to investigate VCF among teenagers. Specifically, an affordance view on VC provides a theoretical foundation to understand the resources and constraints of VC. The availability and visibility-related affordances expect users to respond in real-time in VC can be stressful for teenagers, if they are not accustomed to speaking or being seen on camera especially in a class setting. Additionally, VC presents challenges for information processing due to the limitations of the VC technology (e.g. time lag) and the potential distractions that can arise in the VC information environment (B. J. Li & Yee, 2022). Instructors must be aware of these challenges and avoid cognitively demanding VC class activities. We also found that teenage girls are more prone to VCF. A plausible explanation is that females generally feel more pressure to perform and participate during VC sessions, leading to stress and fatigue (Fauville et al., 2021).

There are practical implications. For educators and policymakers, this study can help them understand the resources and constraints of VC from the perspective of VCF in teenagers and tailor class VC activities for their students based on our findings. The affordances identified in this study can provide guidance to raise awareness of how VC can be used to reduce VCF. In terms of research implication, this study has taken an important first step to expand our knowledge on VC in teenagers using an affordance-based approach. Specifically, instead of focusing on any particular feature or technology, an affordance view on VC use provides a theoretical foundation to understand teenagers’ perceived resources that VC can offer. This helps to provide a more holistic view of the technology and a context for future VC research. There are some limitations in the present study that warrants future research. First, the participants were based in Singapore, and teenagers in other countries may have different VC exposure and as such may perceive VC affordances differently. Future studies should address the generalizability of this study to other areas and cultural groups. Given the multifaceted nature of VCF, a survey may be limited in its ability to capture the full complexity of VCF. While this study serves as a good starting point to understand VCF among teenagers, controlled experiments may need to be conducted to assess the contributing factors of VCF more accurately.

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A Preliminary Investigation of the Effects of Open Review on Citation Impact

Liang, Tiantian
Central University of Finance and Economics, China | 2020312168@email.cufe.edu.cn
Zhong, Zhuosheng
Central University of Finance and Economics, China | 2020312162@email.cufe.edu.cn
Zuo, Zhiya
City University of Hong Kong, HKSAR China | zhiyazuo@cityu.edu.hk
Li, Hui
Central University of Finance and Economics, China | lihui@cufe.edu.cn
Wang, Xi
Central University of Finance and Economics, China | xiwang@cufe.edu.cn

ABSTRACT
This study investigates the impact of open review on citation counts of academic articles. By collecting articles published in the material science area of Nature Communications from 2014 to 2018, we exploit the adoption of voluntary open review in 2016 to examine how article citation counts are associated with open review using propensity score matching and regression analysis. OLS regression results show that open review comes at the expense of fewer citations received by articles. Specifically, open-reviewed articles received 44% fewer citations than their non-open-reviewed counterparts. An additional mediation analysis reveals that this decrease in citations may be partially attributed to the lengthening of the review cycle of articles that were open reviewed—open-reviewed articles experienced 16% longer review cycles; every 16% extension of the review cycle led to 5.8% fewer citations. Results remained qualitatively similar when we restricted the citation windows to three years since publication. Contrary to previous findings concerning the positive effects on articles’ citation impact, our preliminary results call for additional efforts in identifying the costs and benefits associated with open review.

KEYWORDS
Open Review, Citation Analysis, Review Cycle, Propensity Score Matching, Mediation Analysis

INTRODUCTION
In contrast to the traditional anonymous peer review process, open review refers to the process and results of peer review being made public (Patel, 2014). In recent years, scholars have devoted considerable attention towards the adoption of transparent review processes as a means of overcoming the limitations of traditional anonymous peer review, including obscured reviewer identities (Jandrić, 2021), inadequate communication between peers, and ambiguous or inconsistent review quality (Munafò et al., 2017). While conducive to the cultivation of review practices, the consequences of open review to research articles remain a subject of inquiry.

In this study, we exploit the adoption of a voluntary open review system by Nature Communications in 2016 to investigate the effects of open review on research articles concerning their citation impact. We collected academic articles on material science along with their open review option (opted-in or out), review cycle information (manuscript received and acceptance date), and citation counts. Upon obtaining a balanced data set through propensity score matching, we employed regression analysis to investigate the correlation between open review and citation counts. Our results suggest that open-reviewed articles exhibited significantly lower citation counts compared to others, which differs from prior findings (Zong et al., 2020). An additional mediation analysis revealed that opting in open review would significantly slow down the review process, which, in turn, decreased citations.

Types of Open Review
Open review is one form of the academic publishing process that, compared to traditional blind peer review, publicly displays the review procedure and outcome of a paper to readers (Ross-Hellauer, 2017). Open review can be classified into seven categories (Ross-Hellauer, 2017), including open identity (both the author and the reviewer’s identities are transparent to each other), open report (review reports are published along with the related article), open participation (involves a broader community contributing to the review process), open interaction (allows direct discussion between authors and reviewers or reviewers themselves), open pre-review manuscripts (enable manuscripts to be made available before any formal peer review process, such as uploading pre-prints on arXiv), open final version commentary (involves commentary or reviews on the final “recorded version” publication), and open platform (a.k.a. “decoupled review” where reviews are facilitated by different organizational entities). These categories provide a basic concept of understanding different levels of openness in the open review process. In this study, we focus on open report, which was implemented by Nature Communication in 2016.

Consequences of Open Review
Open review is expected to enhance research quality in various ways (McKiernan et al., 2016). Open review increases fairness and transparency by providing readers and peers with a better understanding of the review process and its outcomes (Maria Hodges, 2020; Ross-Hellauer et al., 2017), thereby minimizing the possibility of personal opinions or biases interfering (Thelwall et al., 2021). Additionally, such a process also promotes higher-quality...
research by encouraging communication and discussion between reviewers and authors (Wolfram et al., 2020). Furthermore, open review enables readers to better comprehend groundbreaking research findings and ideas (Kriegeskorte, 2012).

However, open review manifests potential drawbacks. Firstly, authors may experience additional pressure and discomfort as they must publicly address the limitations of their work in front of their peers, leading to an increased level of scrutiny and inquiry (https://plos.org/resource/open-peer-review/). Secondly, open review may result in an increased workload for reviewers (Walsh et al., 2000), who may spend more time and effort reviewing and discussing the paper while responding to comments and questions from the audiences. Before a wide adoption of open review policies in academic publishing, it is incumbent upon scholars to carefully consider the aforementioned potential drawbacks.

In summary, researchers are dialectical about the benefits and drawbacks of open review mechanisms. Bornmann et al. (2010) have reported more citation counts of accepted manuscripts published in the open peer-reviewed journal Atmospheric Chemistry and Physics and rejected ones published in other journals. In accordance with this, we utilize citation counts as an outcome measure to further explore and evaluate the citation impact of open review.

METHOD

Data

Starting from January 2016, Nature Communication launched a voluntary open peer review scheme (Nature Communication, 2022). Authors who submitted manuscripts from January 2016 could choose whether they would like to publish the peer review history (e.g., reviewer comments and author response letters) upon their paper acceptance. This manifested an ideal empirical context for us to test the effect of open review on citation impact at the article level.

Our dataset comprises two primary components. We first collected article metadata from the Nature Communications journal website including DOI, submission date, acceptance date, publication date, funding acknowledgement, and whether such papers were subjected to open review. To eliminate heterogeneity in the sample data, we restricted our data collection from one single academic area, namely material science. Furthermore, we focused on data spanning a timeframe of three years before and after the inception (the year of 2016) of the open review mechanism in Nature Communications from 2014 to 2019. We then retrieved citation and author data from Scopus through DOI matching. Articles whose DOIs failed to match were removed from the sample. In total, we collected 4743 articles, 1388 of which were open peer reviewed.

The control variables are characteristics of the articles, including the abstract length (Hafeez et al., 2019), the number of authors (Lawani, 1986), whether there was funding or not (Patience et al., 2017), author seniority (based on the citations of the authors’ other articles in the submitted article received year) (Siler et al., 2022). In addition, we controlled for article topics since the varying levels of attention that researchers accord to distinct sub-fields within the same domain may play a role in determining the impact of articles (Nielsen & Andersen, 2021). The outcome variable of this study is the number of citations received collected from Elsevier Scopus using Scopus APIs (https://dev.elsevier.com/). The descriptive statistics are shown in Table 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
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<th>Max</th>
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<td>0</td>
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</table>

Table 1. Descriptive statistics

Latent Dirichlet Allocation

We divided the articles into three different sub-categories by implementing Latent Dirichlet allocation (LDA) (Blei et al., 2003). LDA is a probabilistic generative model used in information retrieval, which enables the discovery of hidden topics from a large corpus of text, by identifying common themes across a set of documents or articles. The distribution probability associated with these sub-fields of each article was calculated and incorporated as a covariate during the subsequent matching process.

Propensity Score Matching

Propensity score matching (PSM) is a statistical method widely used in observational studies to reduce selection bias and confounding by creating matched pairs of treated and control groups (Rosenbaum & Rubin, 1983). This matching process entails identifying individuals with akin propensity scores in both the treatment and control groups, resulting in comparable covariate distributions.
We employed PSM to mitigate the heterogeneity among our sample data. Based on the comparison of outcomes derived from various matching methods, we determined that nearest neighbor matching was the optimal technique, as compared to kernel matching and radius matching.

Prior to matching, covariates displayed imbalances exceeding 5%. Following the matching procedure, covariate imbalance was significantly decreased, suggesting that the matched control group can be used as a valid comparison for the treatment group. Overall, we obtained 2,776 academic articles, consisting of 1,388 observations in both the treatment (open reviewed) and control (non-open reviewed) groups.

RESULTS
Regression Analysis
With an OLS regression model, we identified the correlation between open review and log10-transformed citation counts (Table 2). Surprisingly, the significant coefficient (-0.6429, \( p < 0.001 \)) indicates that the open-reviewed articles exhibited significantly lower citation counts. Specifically, an article that was open reviewed received \( e^{-0.6429} - 1 \) \( \times 100\% \approx 47\% \) less citations than one that was not open reviewed. This differs from prior findings that open-reviewed articles attract more citations, views, and downloads (Ross-Hellauer, 2017; Zong et al., 2020).

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Number of citations</th>
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<tr>
<td>Open review</td>
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<td></td>
<td>(0.0369)</td>
</tr>
<tr>
<td>Length of abstract</td>
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<tr>
<td></td>
<td>(0.0002)</td>
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<tr>
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<td></td>
<td>(0.0003)</td>
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<td></td>
<td>(0.2047)</td>
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<td>Second topic</td>
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<td></td>
<td>(0.3288)</td>
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<tr>
<td></td>
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</tr>
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</table>

Notes:
Standard deviations in parentheses.
\( * p < .1; ** p < .05; *** p < .01 \)

Table 2. Results of Regression Analysis

Our conjecture is that opting in the open review process may make the review cycle lengthier, which, in turn, may decrease citations. The academic community has become increasingly competitive in securing funding, positions, publications, and recognition. Due to the winner-takes-all nature of science, whoever makes a groundbreaking discovery first is awarded all of the accolades and credit (Balietti, 2016; Woolston, 2014). Within this highly competitive atmosphere, experiencing a faulty rejection or publishing delay may be significantly detrimental. Meanwhile, reviewers may exercise more caution when reviewing open-reviewed articles, which can lengthen the review cycle. To test this hypothesis, we employed a mediation analysis to investigate whether the review cycle contributed to the negative impact of open review on citation counts.

Mediation Analysis
We tested our hypothesis by using article review cycle, i.e., the time interval between manuscript received date and acceptance date, as a mediator between open review and citation impact. Nature Communications journal requires contributors to choose whether or not to open the peer reviews of their articles at the time of submission. This choice affects whether or not reviewers agree to review the article, the review cycle and the wording of review comments. Results in Figure 1 confirmed our hypothesis–review cycle partially mediates the effect of open review on citation counts.
Specifically, the direct effect is -0.5795 ($p < 0.001$); in other words, adopting open review directly results in a decrease of citation counts by $(e^{-0.5795} - 1) \times 100\% \approx 44\%$. Moreover, the mediation path suggests that adopting open review results in an increase of the review cycle by $(e^{0.1477} - 1) \times 100\% \approx 16\%$; for any 16% extension in the review cycle, there will be a drop in the citation count by $(1.16^{-0.3992} - 1) \times 100\% \approx 5.8\%$.

![Diagram of mediation analysis](image)

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

**Figure 1. Results of Mediation Analysis**

**CONCLUSION AND FUTURE RESEARCH DIRECTION**

This study investigates the effects of open review on article citation counts. Our preliminary analysis shows that articles that were open reviewed received fewer citations compared to those reviewed through closed peer review. In addition, our mediation analysis indicates that this decrease in citation counts was partially mediated by the lengthier review cycle during the open review process. To further ensure the robustness, we further controlled for the citation window to be the first three years since publication, which yielded qualitatively consistent results (the main effect became 29% fewer citations in this case). This challenges prior findings, which reported benefits of open review on citation counts, and hence calls for further efforts on identifying the tradeoffs of this novel peer review practice.

The current study is not without limitations. Previous research suggests that attributes such as pre-printing, conflicts of interest, the number of reviewers, the level of reviewer expertise, and article length could also influence the impact of an article. Including more possible influential factors would strengthen the empirical design. In addition, we are now focusing on material science articles in the *Nature Communications* journal, which may lead to the results are not generalizable to other journals or research fields. Future research efforts should consider including a more diverse range of journals and areas to validate the broader applicability of our findings.

In closing, by exploring the effects of open review on review time and citation count, our study contributes to filling the research gap and highlights the need for further research on the benefits of open review in improving the scholarly communication system. In particular, expanding the pool of qualified reviewers as a means of accelerating processing time may be a recommended strategy for scholarly publishers. Moreover, optimizing the recommendation algorithm in the scholarly database to facilitate the search and citing of relevant academic studies may also be necessary.

**ACKNOWLEDGMENTS**

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Transforming Indigenous Knowledges Stewardship Praxis through an Ethics of Care

Liew, Chern Li
Te Herenga Waka–Victoria University of Wellington, New Zealand | chernli.liew@vuw.ac.nz
Lipscombe, Ailsa
Te Herenga Waka–Victoria University of Wellington, New Zealand | ailsa.lipscombe@vuw.ac.nz

ABSTRACT
Extant discourses in Indigenous Knowledge Management [IKM] emphasize the need to support Indigenous self-determination, data sovereignty and self-governance. To channel archival attention in this manner contributes to a larger shift in IKM towards stewardship praxes that empower Indigenous communities through culturally responsive and responsible praxes. The role of radical empathy in motivating this change, however, remains under-explored. In this paper, we introduce eight mutually inclusive empathy-driven propositions to transform the stewardship of Indigenous knowledges through an ethics of care framework. Grounded in a te ao Māori worldview in Aotearoa (New Zealand), we discuss how orienting ourselves to empathy motivates specific kinds of dialogic engagement that gives voice to Indigenous peoples in diverse global Indigenous contexts to share what cultural values should shape their research and knowledge stewardship. In doing so, we offer actionable ways to make positive differences in the lived experiences of Indigenous individuals and communities as they interact with and lead contemporaneous stewardship praxes.

KEYWORDS
Dialogic Engagement, Indigenous Knowledge, Knowledge Stewardship, Cultural Heritage, Radical Empathy

INTRODUCTION
Extant discourses in Indigenous Knowledge Management [IKM] have thus far identified several key strategies for ensuring the collection, curation, and distribution of Indigenous cultural heritage within galleries, libraries, archives, and museums [GLAM] productively contributes to respectful and responsible engagement with Indigeneity (Banks, 2022; Becvar & Srinivasan, 2009; Clapham et al., 2021; Liew et al., 2021; Smith et al., 2003). Central to these conversations are the intertwined notions of Indigenous self-determination (O’Sullivan, 2021; Shiri et al., 2022; Thorpe, 2019, 2022), Indigenous data sovereignty (Thorpe et al., 2021), and Indigenous self-governance (Callison et al., 2021), all of which culminate around the idea that culturally responsible curation protocols are necessary for the ethical stewardship of Indigenous knowledges (Brown, 2007; Brown & Nicholas, 2012; Przkmowska, 2020). Indeed, they highlight rebuilding management praxes as stewardship praxes, in ways guided by Indigenous epistemologies.

To meaningfully expand these discourses into policy changes that directly benefit Indigenous communities, we believe a renewed focus on radical empathy and an ethics of care is warranted. Care’s emphasis on presence, sincerity, and trust provides an invaluable lens through which to both understand and address the culturally responsible archiving of Indigenous knowledges. Stewardship, then, becomes an expression of radical empathy that affectively and pragmatically supports the empowering of Indigenous communities in their local contexts. Exploring the intersection of IKM, responsible innovation, the social fabric metaphor, and the dialogic engagement frame, our following propositions advocate for empathetic orientations that are explicitly attentive to Indigenous cultural values in Aotearoa (New Zealand), grounded in a te ao Māori worldview. We elaborate how attending to Indigeneity offers actionable changes for ensuring contemporary IK stewardship in Aotearoa, as well as in diverse global Indigenous contexts, is culturally responsive and responsible. Through doing so, we seek to make positive differences in the lived experiences of Indigenous individuals and communities as they interact with and lead contemporaneous archival praxes.

TOWARDS CARE- AND EMPATHY-DRIVEN INDIGENOUS KNOWLEDGE STEWARDSHIP
Our intervention advocates for focalizing Indigenous stewardship praxes through Indigenous cultural values. It is vital to note upfront that this model of care is intrinsically relational, facilitating a (re)new(ed) focus in Information Science and Technology [IST] on dialogic engagement and its accompanying values of mutuality, trust, and immersion. Care, then, necessitates a kind of attentive listening and sincere presence. We see these praxes as instrumental in enabling an empathetic turn in cultural heritage knowledge curation and archiving. Moreover, it is a turn that must acknowledge any ongoing legacies of harm perpetrated by GLAM institutions, while also seeking to restore agency over Indigenous knowledges to Indigenous individuals and communities (Agostinho, 2019).

To achieve this empathetic turn, we recognize that first a discursive shift away from notions of management towards those of stewardship is necessary, thus significantly altering not only how we talk about the digitization and stewardship of cultural heritage knowledge resources (including those that are born-digital), but also fundamentally reshaping the motivations behind projects of digitization, especially in an Indigenous context (Liew...
et al., 2021). The emphasis here is deliberately on both process and outcome. This discursive shift leads to our initial five propositions:

**Instigating, and subsequently sustaining, dialogue that is respectful and generative necessitates a move away from consultation towards that of participation**

Inspired by Johnston (2010), we advocate for immersive and dialogic participation guided by an ethics of care and respect. Empathetic dialogue is an act that involves compassionate and sensitive listening (see also: Brown & Nicholas, 2012). Within the *Aotearoa* context, this discursive move acknowledges the historical lack of Māori partnership in the knowledge curation and archiving process, which continues to threaten Indigenous self-sovereignty and has been identified by Banks (2022) as contributing to “a milieu of colonizing and assimilationist rhetoric regarding [Māori] inherent traditional knowledges and intellectual property” (p. 19). Moreover:

**Consent needs to account for both individual and community concerns, and researchers must be prepared to navigate tensions or contradictions between the two**

To ensure the digitization of Indigenous knowledges is culturally responsive and respectful, it must be sought with sincerity and consistency (Callison et al., 2021)—affects which manifest our proposed empathetic turn. In dialogue with Prażmowska (2020), we believe that “the principle of free, prior, and informed consent of Indigenous communities should dominate the relations between public and business entities and Indigenous Peoples” (p. 146). Further, consent must not be seen as fixed: permission given once does not indicate or promise unrestricted consent evermore.

**Collaboration unfolds at the nexus of dialogue and sociocultural care**

In this discursive shift away from management rhetoric, we also assert that emphasizing the importance of collaboration requires an equal commitment to an ethics of care. Indeed, for collaboration to avoid perpetuating power imbalances, one must be attuned not only to the principles of dialogue, but also how these are both meaningfully textured and motivated by radical empathy. Understanding the dynamic relationship between collaboration and care is further nuanced by paying attention to the ways interpersonal bonds unfold within a social fabric framework (Avital et al., 2021) and across relational bonds (Thayer-Bacon, 2003). In this way:

**For the social fabric of a collective to be rendered meaningful, its prevailing beliefs and practices must be both recognized and honored through praxes grounded in an ethics of care**

We propose that a social fabric analysis—which helps clarify how an organization’s intertwined interpersonal dynamics shapes information production and utilization—relies on practices firmly rooted in care. Social order within any collective unfolds across relational lines (Orlikowski, 2007; Netto, 2016), which we argue can be best understood through an empathetic lens. While demonstrating care is a relational act, committing to relationality also imparts and facilitates further demonstrations of care (Nishida, 2022). Furthermore:

**A commitment to nurturing relationality through a lens and praxis of radical empathy necessitates a parallel commitment to understanding cultural safety**

A culturally safe space is one “where there is no assault, challenge, or denial of [Indigenous] identity” (Williams, 1999, p. 213). It is a reminder to address the real and potential harms enacted by systems against Indigenous communities and Indigenous worldviews (Lassere & Whyte, 2021). We are dialogically guided by the writings of Williams (1999) and Williams et al. (2021), advocating for an approach to cultural safety that both honors and produces empathy. We also acknowledge the thorny nature of contemporary discourses of cultural safety, such as in Thorpe (2022), where the author asks if there is a way to imagine or produce comfort and safety within institutions that have developed out of the colonial project (see also: Agostinho, 2019; Watson, 2016)? We encourage archivists and GLAM institutions to be mindful of how their work can either support or undermine the creation of culturally-safe spaces, while texturing such guidance with an understanding that present actions must acknowledge the legacies of harm, distrust, and inequality within such spaces—legacies that continue to resonate among Indigenous communities and continue to filter present interactions.

Acknowledging how contemporary archival praxes must grapple with and undo harmful resonant institutional legacies leads to our second overarching principle that argues that narratives of cultural heritage knowledge stewardship must destabilize and dismantle the power imbalances inherent in management discourse and praxis through enacting an ethos of empathy and mutuality. Guided by Di Guilio et al.’s (2016) call for “participatory democracy” as a means of destabilizing traditional hierarchies of knowledge politics (pp. 94-95), we put forward a further three propositions to highlight the significance of empathetic relations in redistributing power and respecting Indigenous sovereignty:

**Non-Indigenous researchers must show cultural humility to ensure Indigenous voices guide the research process and are upheld as the experts and owners of their knowledges**
Drawing on Tai (2021), we center issues of cultural competency and responsibility in the archiving of Indigenous knowledges (Caswell & Cifor, 2016). Cultural humility mandates continued learning in ways that prioritize the dialogic nature of ethical engagement. It acknowledges the limitations of one’s own perspectives and interpretations, thus speaking to the need of deferring to cultural and Indigenous experts when it comes to appropriate curation and archival praxes. In Aotearoa, this is additionally textured by Tuhiwai Smith’s (1999) call for Indigenous research to be led by Kaupapa Māori principles and values, which are fundamentally a demonstration of care: for oneself, for one’s community, and for wider sociocultural groups and contexts. To achieve this:

True dialogue between Indigenous and non-Indigenous stakeholders must establish and sustain trust

We recognize the importance of trust in facilitating ongoing dialogic engagement that is culturally responsible and responsive. In this context, trust is predicated on the intertwined notions of active listening, absorption, immersive presence, and vulnerability (Lane & Kent, 2018). We see radical empathy as critical in establishing trust, as well as necessary for sustaining such trust. In turn, this (re)produces the conditions for dialogic research. This relational dynamic must also address the links between establishing trust and addressing past hurts; where trust is preceded by acknowledging legacies of pain and marginalization (Callison et al., 2021; Thorpe et al., 2021). Conducting respectful and responsible Indigenous research in Aotearoa furthermore requires the following:

Embodying manaakitanga is a crucial step in transforming archival praxes from tools of colonial power to tools of community care

Manaakitanga (meaning “hospitality”, and acting with generosity, mutual respect, and care) is a powerful reminder of the positive potential of digital archives (Liew et al., 2021). It asserts that a researcher’s responsibility is to create and support research praxes that care for participants in ways that exceed legal obligation. It does so by emphasizing warmth, hospitality, and kindness (Opai, 2021). Manaakitanga focalizes our contemporaneous research praxes through principles of te ao Māori. In dialogue with scholars who link archives to causing Indigenous harm and erasure (Cocz, 2021; Przaczowska, 2020; Tai, 2021), it projects towards a respectful dialogic stewardship future.

WHERE TO FROM HERE?

In offering the above propositions, we are advocating for aligning the curation and stewardship of Indigenous knowledges with appropriate Indigenous cultural values and Indigenous protocols. We see empathy and care as critical in pragmatically facilitating this transformation. It is an affective orientation that should texture every stage of the archival process, significantly altering, through mutual dialogue how relational dynamics are identified, formed, and sustained between Indigenous and non-Indigenous collaborators. We understand this empathetic turn in the archives as part of a wider move in academia of Indigenizing methodologies, on the one hand acknowledging past grievances and on the other hand working towards ensuring these harms are not (re)produced in future settings and interactions.

We intend for these propositions to not simply act as theoretical reflections on Indigenization, but also offer strategies for rebuilding archival praxes. To this end, we wish to conclude our discussion with three main ways we see these propositions transforming our empirical process of stewardship protocols.

The first of these is in the form of co-design, an approach to the research process that prioritizes the involvement of all implicated parties at all stages. This transformation of consultation praxes into participatory ones posits that respectful and responsible stewardship of Indigenous knowledges must occur within dialogue with Indigenous individuals and communities (Morehu, 2016). We propose that the dialogic engagement frame, with its intrinsic commitment to reciprocal, responsible, respectful relationality, is profoundly motivated by our investment in empathy and care. Care necessitates attentive, immersive listening, which in turn necessitates a fluid dialogic process. In the context of conducting responsible stewardship, we envision a dialogic co-design process to be an organic collaboration grounded in emic Indigenous values and voices, which unfolds over many instances, rather than within a one-off consultation. As researchers working in Aotearoa, this means facilitating frequent hui (“meetings”, “gatherings”) with Indigenous stakeholders, which function not simply as opportunities to share what work has already been done to ensure it reflects and honors Indigenous priorities and concerns, but further invite Indigenous iwi (“tribes”) and hapū (“sub-tribes” or “descent groups”) to fundamentally shape the direction of the research and projected outcomes.

A second actionable change that flows from our propositions is the implementation of a research framework that prioritizes fluidity, and adaptability. Indigenous communities are not monoliths; they are rich in internal diversity and stewardship praxes must reflect and honor this. We see radical empathy as a critical way to address such diversity and facilitate the creation of policies and praxes that respond to this diversity of cultural epistemologies and ontologies. Care attunes us to contextual and cultural specificity, initiating dialogic processes that thus challenge the historical impetus to erroneously categorize Indigenous diversity as monolithic homogeneity. This work speaks to wider discussions in IST and IKM regarding how to increase Indigenous agency and ensure contemporary
archival praxes do not perpetuate harmful narratives of and about Indigenous cultures. We see care and empathy as critical for facilitating such institutional changes.

Working in Aotearoa, this prioritization of flexibility unfolds within a te ao Māori worldview, meaning our approach to care is grounded in Māori notions of whakapapa (“genealogy”, “relationships”), manaakitanga (“hospitality”, “care”, “mutual support”), rangatiratanga (“self-governance”), and kaitiakitanga (“custodianship”, “guardianship”). Focalizing our methods and goals alike through Kaupapa Māori principles and values reinforces the centrality of care in conducting culturally responsible research. It becomes a manifestation of Indigenous values significantly shaping Indigenous research. While we are concerned with ensuring praxes are responsive to their unique community contexts, we see an adoption of radical empathy and care by researchers in diverse Indigenous contexts as productively meaningful, such as with First Nations communities in Canada and, Aboriginal and Torres Strait Islanders in Australia. Orienting ourselves to empathy motivates specific kinds of dialogic engagement that gives voice to Indigenous peoples to share what cultural values should shape their research and the resulting praxis. We purport therefore, that introducing care as a pivotal research principle not only highlights the importance of acknowledging Indigenous diversity; it also provides a key tool for honoring it.

Lastly, we see radical empathy as initiating a re-calibration of expertise. In this context, it is a question of redistributing power and increasing Indigenous agency by reviewing and challenging assumptions about who an expert is. This realignment occurs when one commits themselves to empathetic listening and presence: to not only hear Indigenous perspectives but be critically guided by them. It creates relational dynamics and relational contexts that are grounded in mutuality and care, and that are committed to respecting Indigenous communities and their cultural relationships to knowledge. Here, radical empathy transforms how expertise is recognized and respected, ultimately shaping wider conversations in IST regarding the potential risk of (re)producing biased or incomplete narratives of Indigeneity within archives of cultural heritage knowledges. Thus, radical empathy impacts both contemporary relational research praxes and amplifies the harmful potentials of contemporary archives when they silence or undermine Indigenous expertise with colonial interpretations. Empathy, then, has the potential to radically and to positively transform archival encounters in both the present and the future.

To conclude, orienting ourselves to a radical empathy framework has the potential to meaningfully transform our archival relationships. It contributes to an Indigenization of digital archives - with their accompanying procedures, protocols, and policies, by amplifying the importance of careful listening (and listening with care). This is a change that we see as crucially aligned with projects of valuing Indigenous voices and knowledges. Our empathetic turn, then, is a transformation of archives of Indigenous knowledges through Indigenous cultural values in order to ultimately positively impact not only Indigenous communities, but societies at large through social cohesion.

Acknowledgments
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References


ABSTRACT
While major funding agencies are striving for diversity and fairness, the mechanisms behind funding success have yet to be fully elucidated. Existing studies reveal valuable evidences about the effect of the applicant's individual attributes, e.g., gender and age, on the funding success. However, the relationship between funding success and academic activities, e.g., characteristics, remains underexplored. This work collects massive scholarly data from open academic graphs and public data about National Institutes of Health awards to investigate the effect of various academic graph-based factors on the "K to R" success. Leveraging a heterogeneous graph model for predicting the "K to R" success, we regard the gain in the model performance of a factor as a proxy variable for the magnitude of its effect. Our preliminary results suggest that interest by peers in the applicant's research and the timing of the interest are strongly correlated with the outcome. Meanwhile, the applicant's social connections, e.g., their collaborators, can also contribute to the outcome.

KEYWORDS
Research Funding; National Institutes of Health; Academic Graph-based Factor

INTRODUCTION
Research funding has been viewed as a key determinant of scientific activity (Rusu et al., 2022), and can have a long-term and vital impact on the trajectory of researchers' careers. Funding affords researchers essential resources and opportunities to establish themselves in their fields and pursue their research goals (Jacob & Lefgren, 2011). Moreover, the research funding success has been shown to be consistent with the Matthew effect and the Halo effect (Liao, 2021). For example, in The Netherlands, early funding success can introduce a growing rift with narrow-win applicants accumulating more than twice as much research funding during the following eight years as near-miss applicants (Bol et al., 2018; Liao, 2021).

To ensure the career development of the researchers and protect the entire research system from inefficiency caused by inappropriate funding allocation (Kulczycki et al., 2017; Sandström & Van den Besselaar, 2018), it's imperative to understand the factors that affect the funding decisions in order to ensure that the fairness and impartiality are not compromised. With the increasing number of publicly available funding data, it's possible to conduct in-depth and quantitative analyses of the current mechanisms underlying the funding success, thus informing the current funding management, enhancing the credibility of scientific funds, and fostering a healthy academic atmosphere.

Prior studies have investigated the factors that potentially contribute to the researchers' funding success. While the quality of the research proposal and the relevance of the proposal to the funding's priorities are reasonable considerations (Ayoubi et al., 2019; Boyack et al., 2018), factors such as the researchers' gender or affiliation, which ought to have no bearing on funding decisions, may nonetheless be incorrectly taken into count and impose substantial impact on the application results (Viner et al., 2004; Witteman et al., 2019). For example, Van der Lee and Ellemers (2015) found that female researchers have lower success rates when applying for research funding compared to their male counterparts. It is important to recognize such potential biases in the funding application process and ensure equal opportunities for all researchers to advance their careers.

Although these efforts have yielded valuable insights and raised attention among researchers and funding managers regarding the issues, they have two major limitations. First, their focus is limited to the attributes of the researchers themselves, neglecting the potential impact of other factors inherent in the academic graph, e.g., social capitals conveyed by collaborators. Second, their empirical results are usually based on linear regression/correlation analysis, overlooking possible interactions between factors and factors with nonlinear relationships to the funding success (Armstrong, 2019).

To address the limitations of previous studies, in this work, we conduct a systematic investigation on the effect of a variety of academic graph-based attributes in the context of biomedical research funding. First, we collected data on
11,358 Principal Investigators (PIs) who had won the Career Development Awards (“K”) from the National Institutes of Health (NIH) and whether they subsequently became PI on an R01-equivalent awards (“R”), which is an explicit expectation of K funding. The PIs were further mapped to entities of authors in two open academic graphs (OAGs), PubMed Central database (PMC) and AMIner database. Second, leveraging emerging deep learning techniques, we developed a heterogeneous graph model and utilize it to predict whether the PIs ever received the R project based on the OAGs. To assess the effect of various graph semantics and their associated attributes on funding success, we evaluated the change in model performance when incorporating them into the prediction model.

Our contributions are threefold: (a) We introduce the academic graph-based factors into research on funding success, utilizing open academic graphs. (b) Leveraging a graph neural network, we design a simple yet effective approach to estimate the association between predictive factors and funding success, without any assumption on the form of the association. (c) We comprehensively evaluated the potential effects of the academic graph-based factors on the “K to R” success in NIH, which can provide empirical evidences to support effective funding management.

**DATA AND RESEARCH DESIGN**

![Diagram of the Composed Academic Graph](image)

**Data Collection and Preprocessing**

As shown in Figure 1, our academic graph integrated two resources. On one hand, we manually collected information on 11,358 K projects from NIH and their associated PIs from the NIH RePORTER database. Among these PIs, 5,382 individuals obtained subsequent R projects. On the other hand, we use open academic graphs (OAGs), i.e., PMC and AMIner, to obtain the academic activities of these PIs, e.g., their publications and collaborations. To map the PIs to author entities in the OAGs, we identified publications of the PIs in the OAGs by searching NIH project numbers, and further aligned the PIs with the author entities based on the same-named authors within the identified publications. As a result, a composed academic graph was obtained and the statistics of the number of nodes and edges of this graph is shown in Table 1.

<table>
<thead>
<tr>
<th>Node</th>
<th>Count</th>
<th>Edge</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI</td>
<td>11,358</td>
<td>PI →(IsMappedTo) → Author</td>
<td>16,663</td>
</tr>
<tr>
<td>Author</td>
<td>301,218</td>
<td>Author →(Writes) → Publication</td>
<td>717,999</td>
</tr>
<tr>
<td>Publication</td>
<td>91,837</td>
<td>Publication →(Cites) → Publication</td>
<td>16,899</td>
</tr>
<tr>
<td>K Project</td>
<td>11,358</td>
<td>PI →(Has) → K Project</td>
<td>11,358</td>
</tr>
<tr>
<td>R Project</td>
<td>5,382</td>
<td>PI →(Has) → R Project</td>
<td>5,382</td>
</tr>
</tbody>
</table>

**Table 1. Data Statistics of the Composed Academic Graph**

Additionally, we engineered features for each node in the composed academic graph. For PIs and authors, we inferred their gender and race based on their names and calculated their number of publications and the citation count of their publications. For K projects and publications, in addition to their original metadata such as application (or publication) year, we further assigned a topic distribution vector to them via the LDA algorithm (Hoffman et al., 2010). Moreover, we labeled the ranking of the PI’s agency organizations as an attribute of the K project and labeled the impact factor of journals as an attribute of the publication according to the Scimago ranking database. In this work, whether a PI obtained an R project is considered as the dependent variable of interest.

**Academic Graph-based Factors**

To construct factors associated with the academic activities, we first predefine a set of intelligible semantics derived from the relations/meta-paths (Dong et al., 2017; Wang et al., 2019) within the composed academic graph. For example, the relation “PI →(IsMappedTo) → Author →(Writes) → Publication” represents the PIs’ publications and
the meta-path “PI→(IsMappedTo)→Author→(Writes)→Publication←(Writes)→Author” represents the collaborators of the PIs. Based on these semantics, the semantic-conditioned attributes, e.g., publication’s topic or collaborator’s gender, are defined as academic graph-based factors which we examine in this work.

**Effect Magnitude Evaluation Approach**

Motivated by Zhang et al. (2023), we adopt a prediction-based approach to measure the effect of the factors on funding success. Assuming we have a baseline model that only utilizes the applicant’s individual attributes to predict the funding success, we can evaluate the effect of a factor (or a group of factors) on the application result by incorporating it (or them) into the baseline model and regard the change in model performance as a proxy variable for the magnitude of its effect. The greater the improvement in performance, the greater the effect of this factor. For example, in Figure 2, we can estimate the effect of PI’s citations by calculating the incremental improvement in model performance when citation semantics are included in the input, versus performance of the base model. Similarly, if we need to measure the effect of a specific academic graph-based factor separately, we can solely integrate the corresponding semantic with only the single attribute into the base model.

To handle such (heterogeneous) graph data, technically, we first jointly utilize three pooling-based aggregators (Hamilton et al., 2017; Xu et al., 2019), which are max-pooling, mean-pooling and sum-pooling, to encode the neighbor sets of various semantics. Then we leverage a Transformer-based merger (Vaswani et al., 2017; Yang et al., 2023) to fuse the encoded neighbor sets and the PI’s attributes into one single fixed-size representation. Finally, we predict the application result based on the representation by a multi-layer perceptron (Hornik et al., 1989). These modules can thoroughly capture the features of the semantic-based neighbor sets, facilitate sufficient interactions between the PI’s attributes and the academic graph-based factors, and automatically fit their potential relationship with the application results. This approach avoids erroneous judgments caused by the preconceived assumptions about the relationship between the academic graph-based factor and outcome, e.g., linear assumption.

**PRELIMINARY RESULTS**

In this work, our method is capable of handling all available semantics and associated factors. For the preliminarily analysis, we focused on only two semantics derived from the composed academic graph, which are “PI→(IsMappedTo)→Author→(Writes)→Publication←(Writes)→Author” (denoted as collaborators) and “PI→(IsMappedTo)→Author→(Writes)→Publication←(Cites)→Publication” (denoted as citations). We identified 389,161 collaborators and 85,257 citations of the PIs. To ensure the robust prediction performance in each setting, we conducted 10-fold cross-validation and reported the mean and standard deviation of F1 score, precision, and recall for successful applications.

As shown in Table 2, we first estimated the overall improvement in model performance over the base model by integrating the two semantics separately into the base model. It can be observed that either of the two semantics can enhance the model performance, and the integration of citation can even improve the performance exceed 10%.

At a fine-grained level, we further evaluated the performance gain associated with each specific factor, and the results are shown in Table 3 (where “#” means “the number of”). Specifically, among the collaborator’s attributes, the number of citations and publications are the most influential factors. Additionally, the gender and race of collaborators, especially race, can increase the recall for successful applications while only slightly decreasing the precision. As for the attributes of citation, the number of citations is the strongest predictor, which can significantly improve all three metrics (9.45%, 6.00%, and 12.61% for F1, precision, and recall, respectively). The second most influential factor is the publishing year, which significantly improved F1, precision, and recall by 8.68%, 4.34%, and 12.90% respectively. It is worth mentioning that the influence of these two factors can exceed the impact factor of
the journal, suggesting that the interest by peers and timing of the interest may be more important than quality. However, the topic of the citations seems to have little effect and it only marginally improve the precision by 2.43%.

<table>
<thead>
<tr>
<th>Input</th>
<th>F1</th>
<th>Precision</th>
<th>Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only PI (Base)</td>
<td>59.88±2.57</td>
<td>64.32±1.75</td>
<td>56.14±4.02</td>
</tr>
<tr>
<td>with Collaborator</td>
<td>61.53±1.81 (+2.76%)</td>
<td>65.58±2.40 (+1.96%)</td>
<td>58.10±3.28 (+3.49%)</td>
</tr>
<tr>
<td>with Citation</td>
<td>67.81±1.20 (+13.24%)</td>
<td>71.08±1.17 (+10.51%)</td>
<td>64.88±2.22 (+15.57%)</td>
</tr>
</tbody>
</table>

Table 2. Semantic Interfered Performance and Their Percentage of Change.

FINDINGS AND DISCUSSION
By aligning semantic features based on the OAGs with social concepts or theories, we can draw further insights from our experimental results regarding the underlying mechanisms behind NIH funding success of the R project.

Our findings suggest that the characteristics of an applicant’s personal publications are the most important factor. Firstly, experimental results show that publishing year of the applicant’s citations strongly impacts the model’s performance. Since the time when the citation occurred can reflect the time period when the applicant's work has attracted attention in the field, we can speculate that the recent value and attention given to the applicant's work may be an important factor in funding success. Secondly, the impact factors and the number of citations of the applicant’s citations have a significant positive effect on model’s predictive performance. As the impact factors and the number of citations of the applicant’s citations not only reflect the quality of the citations but also imply that the quality of the applicant’s publications, we can infer that high-quality work will increase the probability of success.

<table>
<thead>
<tr>
<th>Input</th>
<th>F1</th>
<th>Precision</th>
<th>Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only PI (Base)</td>
<td>59.88±2.57</td>
<td>64.32±1.75</td>
<td>56.14±4.02</td>
</tr>
<tr>
<td>#Publication</td>
<td>61.48±1.87 (+2.67%)</td>
<td>63.29±2.07 (-1.60%)</td>
<td>59.93±3.55 (+6.75%)</td>
</tr>
<tr>
<td>#Citation</td>
<td>62.07±2.71 (+3.36%)</td>
<td>64.87±2.08 (+0.86%)</td>
<td>59.90±5.57 (+6.70%)</td>
</tr>
<tr>
<td>Gender</td>
<td>60.11±2.13 (+0.38%)</td>
<td>63.97±2.19 (-0.54%)</td>
<td>56.83±3.45 (+1.23%)</td>
</tr>
<tr>
<td>Race</td>
<td>60.66±3.99 (+1.30%)</td>
<td>63.17±1.97 (-1.79%)</td>
<td>58.77±6.92 (+4.68%)</td>
</tr>
<tr>
<td>Year</td>
<td>65.08±1.87 (+8.68%)</td>
<td>67.11±2.42 (+4.34%)</td>
<td>63.38±3.73 (+12.90%)</td>
</tr>
<tr>
<td>#Citation</td>
<td>65.54±2.05 (+9.45%)</td>
<td>68.18±1.00 (+6.00%)</td>
<td>63.22±3.90 (+12.61%)</td>
</tr>
<tr>
<td>Impact Factor</td>
<td>62.70±2.07 (+4.71%)</td>
<td>64.88±2.53 (+0.87%)</td>
<td>60.82±3.47 (+8.34%)</td>
</tr>
<tr>
<td>Topic</td>
<td>60.24±2.54 (+0.60%)</td>
<td>65.88±2.54 (+2.43%)</td>
<td>55.79±4.73 (-0.62%)</td>
</tr>
</tbody>
</table>

Table 3. Academic Graph-based Factor Interfered Performance and Their Percentage of Change.

Our results demonstrate that integrating collaborators’ information can significantly increase the recall of successful applications at the cost of sacrificing precision. This suggests the possibility of a phenomenon where funding applications initially deemed unqualified have succeeded, and this outcome can be attributed to the consideration of characteristics about the applicants' collaborators. Specifically, it’s observed that the number of publications and the number of citations of the collaborators, as well as their race, are the main influential factors. The former can indicate the applicant’s social capital in academia, while the latter may reflect the academic circle of the applicants. Consequently, we can infer that applicants’ social capital in academia and the academic circle they belong, may contribute to the outcome.

CONCLUSION AND FUTURE WORK
This work introduces academic graph-based factors into the research of funding mechanisms by collecting data from OAGs. We design a prediction-based effect magnitude estimation scheme based on emerging techniques of graph neural networks. We further empirically analyze the effects of two factors: collaborators and citations. While this work provides valuable supplementary information for funding research, it has several limitations. For example, it currently cannot reveal the specific relationship between a factor and the funding success nor can it tell whether the factor is a causal factor. These issues will be addressed in our future work.

ACKNOWLEDGMENTS
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Developing Management and Leadership Course: A Case Study

Lopatovska, Irene
Pratt Institute School of Information, USA | ilopatov@pratt.edu
Parasnis, Eesha
Pratt Institute School of Information, USA | eparasni@pratt.edu

ABSTRACT
This case study describes the development of a management and leadership (M/L) iSchool course. To design a course that balanced traditional topics with current professional needs, we identified M/L topics currently covered in iSchools’ curricula, then assessed the importance of these topics for information professions through a survey of academic and professional communities. Survey participants selected topics in the areas of information economy, organizational management, and project management that they thought were most important for iSchool students to learn. They also suggested additional topics related to communication, diversity, equity and inclusion (DEI), financial literacy and strategic planning skills. Thirteen survey participants were interviewed by the researchers; they suggested further topics related to emotional intelligence and personal skills, such as time-management, risk-taking and confidence. This paper aims to support a culture of transparency in curricula design and, by sharing methods, findings, and lessons learned, ease the faculty tasks of course development.

KEYWORDS
Management; Leadership; Curriculum Development; iSchools.

INTRODUCTION
For decades, leadership, management and administration skills have been identified as core requirements for information professionals (see references to the standards and recommendations of the ALA (2009; 2019; 2023), Association for Computing Machinery (ACM (CC2020 Task Force, 2020), Topi et al., 2017, and others). In this study, management is defined as the administration of activities directed at a) fulfilling the purpose and mission of the institution; b) making work productive and supporting worker achievement; and c) managing social impacts and social responsibilities of the institution (Drucker, 2020, p. 29), and leadership as a process of influencing individuals or a group to achieve a common goal (Northouse, 2021, p.5). All iSchools, as well as ALA accredited library and information science programs not affiliated with iSchools, offer some version of a M/L course (or multiple courses) to their graduate and undergraduate students. This paper presents a case study of the M/L course development process at one U.S. iSchool and aims to share its methodology, findings and challenges with instructors who are involved in curricula development, specifically in the M/L area.

LITERATURE REVIEW
This section reviews several curriculum-related studies that informed the methodology of our course development project.

Within the context of iSchool curricular analysis, Ortiz-Repiso et al. (2018) identified data-oriented courses associated with data degree programs and assessed the subject matter of each course based on analysis of course title, description and syllabus. This research allowed the authors to identify areas of curricular strength (data science and big data analytics) and weaknesses (digital curation) and recommend improvements in interdisciplinary data education. In a similar context, Washington Durr (2020) analyzed job postings and iSchool course documentation with the aim of exploring the intersection of library and information science and data science. The study found a high degree of overlap between the job requirements for data-science professionals and the curricular offerings of the iSchools. The method of course content analysis was also employed by the Clarke (2020) study of design-relevant topics in MLIS programs’ curricula. The author found that while the courses cover design in the domains of technology, computing and other applied fields, they rarely address design as an epistemological approach that could apply to various professional contexts. Maceli (2015) analyzed the content of technology-related courses in ALA-accredited MLIS programs in North America and compared it to the LIS-specific technology job listings on Code4lib. The study identified the dominant topics in course offerings, as well as the gaps between curricula offerings and available jobs, and offered recommendations for aligning curricula with current employment requirements. In order to understand the current landscape of digital humanities (DH) in iSchools, Walsh et al. (2022) conducted a multi-stage analysis of DH courses and DH job advertisements and outlined the management and administrative challenges and opportunities in offering DH education.

In addition to analyzing course content and job postings, researchers often directly engage communities of stakeholders in curriculum initiatives. One example of such a project is a multi-year surveying of human-computer interaction (HCI) educators, professionals, and students with the aim of documenting the professional landscape, gauging HCI needs, and determining priorities for HCI teaching and training (St-Cyr et al., 2018). In an attempt to
understand the growing user experience (UX) field and ways in which educators and industry professionals can shape it, MacDonald et al. (2022) interviewed 71 senior UX professionals between 2017 and 2020. The interview findings confirmed some of the authors’ initial assumptions about the growing pains of this field and emphasized the need for academia-industry collaboration to develop reflexive, ethical, and resilient UX professionals.

The review of the included (and not included here) studies of educational offerings and professional needs within information disciplines points to several prevalent methods: content analysis of courses and job advertisements, as well as surveys of stakeholders, methods that informed the approach adopted by our project and described below.

METHODS
We chose to describe our project as a case study (Feagin et al., 2016) to offer an in-depth explanation of the methodology and findings in one particular instance of M/L course development. Some background information to better understand the project is provided below:

- For decades, the Pratt Institute School of Information offered an ALA accredited graduate-level library and information science (MLIS) education, and its curriculum included 1-2 courses in the area of management and leadership.
- With the expansion of the department into adjacent information science disciplines (user-experience, data analytics, and others) and graduate programs, the M/L courses designed specifically for the MLIS students did not satisfy the multi-disciplinary composition and various professional interests of the students.
- Enrollment in the M/L courses declined, and they were not offered for several years. We stepped in to design a new M/L course that could fill the curriculum gap and foster M/L skills in multi-disciplinary iSchool students.

The first step in the project was gathering evidence to inform the content of the course. The method of evidence gathering partially followed the model for curriculum development proposed by Noll and Wilkins (2002) in the context of developing critical skills for information professionals (Figure 1). In our study, the environmental review phase preceded the work with stakeholders and aimed to assemble a collection of M/L topics currently taught in ALA accredited master programs in the U.S., as well as in iSchools’ graduate and undergraduate programs not associated with ALA accreditation. The subsequent phase included reaching out to the stakeholders to understand the relevance of the managerial topics covered in the iSchool and LIS curricula, as well as to solicit their opinions about M/L skills required of information professionals. The qualitative data collected for the project was analyzed by a team of two researchers using the constant comparative method (Olson et al., 2016), including inductive identification and categorization of the recurring conceptualizations and phenomena, and iterative open coding to identify themes and refine them by comparing newly emerging patterns with previously discovered patterns until data saturation was reached.

The environmental review phase of the data collection included:

- Analysis of comparable curricular offerings. We searched for graduate and undergraduate courses in the areas of management (including project management), and leadership taught in iSchools and/or ALA accredited programs in the U.S. The search resulted in a list of 114 courses, and a dataset of publicly available syllabi for

![Figure 1. A Model for Curriculum Development (Noll and Wilkins, 2002).](image)
19 of these courses. The sample syllabi were content analyzed to extract the main topics covered in the courses, as well as to identify textbooks assigned or recommended by instructors.

- Analysis of textbooks (N=11). Tables of contents of the management textbooks identified in the previous step were content analyzed to identify the high-level topics covered.

Analysis of both the syllabi and textbook samples resulted in a list of nineteen topics grouped into three logical categories: (1) information economy and external/environmental factors influencing organizations, (2) organizational management, (3) project management. The findings of the environmental review were then compared to the expectations and experiences of the stakeholders.

The data on the needs and expectations of stakeholders were gathered through the following methods:

- Online polls. M/L topics extracted from the syllabi and textbooks were presented to a broader information professional community through an online questionnaire. The questionnaire asked respondents to rate (5-point scale) how important it is for iSchool graduates to have knowledge/understanding of the listed topics. The survey was distributed to the faculty, students, and alumni of the authors’ iSchool (resulting in 24 responses), as well as national professional mailing lists and social media channels (N=71 responses).

- Interviews with information professionals and faculty. Online questionnaires provided respondents with an option to share their email and participate in an interview to offer additional thoughts about the M/L skills required for an information professional. A total of 13 interviews were conducted over Zoom in the spring of 2022. The interviewees identified themselves as LIS professionals (5), faculty (3), user-experience (UX) professionals (3), and information technologists (2). Participants were asked about the M/L skills that have helped them in their careers, the skills they look for when working with or hiring people, and skills they wished they had learned during their time as a student in an information science program.

**FINDINGS**

The survey data collected from respondents affiliated with the authors’ home institution and those who were not affiliated with it did not vary significantly and was aggregated for analysis (95 responses in total). Table 1 illustrates the frequencies of votes for each topic in the three larger categories. Additional topics that were frequently added to the list of provided topics by the survey respondents were grouped into the categories of (1) effective communication (N=42), (2) awareness of DEI (N=26), and (3) strategic planning (N=22).

<table>
<thead>
<tr>
<th>Category</th>
<th>Topic</th>
<th>Votes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Economy/Larger Context</td>
<td>Professional ethics/policies</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>Broader social, cultural, political, and technological contexts f/organizations</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Information production/consumption</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>Competitive advantage/strategies for competing on the market</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Microeconomic principles and theories, e.g. supply/demand, elasticity</td>
<td>42</td>
</tr>
<tr>
<td>Organizational Management</td>
<td>Management basics: planning, organizing, controlling</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>Leadership and decision-making, problem solving, management styles</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Team management</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Managing across cultures</td>
<td>80</td>
</tr>
<tr>
<td>Project Management</td>
<td>Project planning, development, and implementation</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>Project performance evaluation</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Project stakeholder management</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Project risk assessment</td>
<td>71</td>
</tr>
</tbody>
</table>

Table 1. The Most Popular Management and Leadership Topics in the Three Larger Categories

The themes identified in the interview data expanded upon the topics covered in the survey. In discussing the M/L skills that were beneficial to them and would help iSchool graduates to succeed professionally, interviewees emphasized the importance of communication skills, including prompt, clear, and effective communication in various modalities and with people at different professional levels. Specific communication skills mentioned included ability to provide constructive feedback in a professional manner, ability to negotiate, ability to explain one’s thought process, storytelling and ability to communicate technical concepts to non-technical stakeholders. Interviewees also emphasized the importance of emotional intelligence (including an understanding of people’s motivations and recognition of their differences and the ability to put one self in the users’/employees’ shoes to
foster empathy), financial literacy (including the creation and management of budgets), and personal attitudes and skills (including organizational skills, time-management, independence, goal-orientation, risk-taking, having a learning mindset and confidence). Interviewees in non-academic positions (10) shared the sources of their current management/leadership knowledge, including formal courses they took in their respective programs, professional training/workshops offered by their organizations, individual professional development (e.g. watching videos, joining toastmasters.org to practice public speaking skills), and experiences that required them to work with people in a professional setting.

CONCLUSION
The M/L topics covered in iSchool curricula were assessed through the online survey by the members of a convenience sample drawn from academic and professional communities. Survey participants selected the most important topics for iSchool students to learn and suggested additional topics related to the development of communication and strategic planning skills. The importance of communication in M/L was confirmed by the 13 participants who agreed to be interviewed by the researchers. In describing M/L skills that help them to be successful, and skills that would be important for iSchool graduates, interviewees mentioned the importance of financial literacy that was noted by the survey respondents, but also added topics of emotional intelligence and personal attitudes/skills. Most of the M/L topics identified from the analyzed course syllabi, textbooks and participants’ data are consistent with the findings of other initiatives and curricular recommendations of professional organizations, including the Association for Computing Machinery (ACM) and American Library Association (ALA).

The study data informed the final selection of the course topics, grouped into three larger modules marked in Table 1. We acknowledge the limitations of our method’s reliance on existing information included in publicly accessible M/L course syllabi. We did not build our initial sample of possible course topics from the ground up (e.g. interviews with professionals, analysis of job marker requirements), a choice that might have led to reinforcement of traditional areas at the expense of emerging/innovative M/L knowledge areas. To bring fresh professional perspectives that might have been missed during the course development, and to engage students with current leaders, the course relied on guest speakers from various for-profit and non-profit institutions. Their talks complemented the course readings, discussions and assignments, and, being open to all students in the department, help to promote M/L concepts (and the course) to students not currently enrolled in the course.

We would like to acknowledge that the project was made possible by a semester-long course release and availability of a dedicated assistant, resources that are not usually available for the task of new course development. Despite access to additional resources, the project had a number of limitations: we did not reach out to instructors whose M/L course syllabi were not publicly available (a method used by Washington Durr, 2020), and we did not analyze job market data to gauge M/L skills sought by employers (as was the case with some of the reviewed above studies). In circumstances where iSchool educators rarely have necessary time and resources for new course development or systematic assessment of their existing courses against market demands, we would strongly encourage more transparent resource sharing among educators and administrative units, including publishing syllabi and other course materials, as well as sharing data and case studies that inform their curricula.

The course that resulted from the project was offered in the spring of 2023. The anonymous student feedback for the course indicates the following:

- Students appreciated the uniqueness of the course topics (that haven’t been covered in other departmental courses), readings and assignments (especially the assignment where students were asked to develop a project proposal using a project management software and a pop-up assignment that required students to monitor and report on economic/political news throughout the semester).
- Students valued the perspectives shared by the guest speakers from diverse professional backgrounds, but also felt that speakers took class time that could have been used for class activities, discussions and lectures.
- The course modules were sequenced from broader to narrower topics (mirroring Table 1 topic flow). The students recommended ending the course with topics related to organizational management and spending more time on project management and related assignments in the middle of the semester.

One student wrote that “more students should strive to be leaders (or at least know how to lead)” and programs should keep their M/L offerings abreast with the constant developments in the field. Our study has the potential to provide grounding for such initiatives and encourage knowledge sharing in the area of curricular development.

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Geofence Warrants, Geospatial Innovation, and Implications for Data Privacy

McGowan, Catherine
Rutgers University, USA | catherine.mcgowan@rutgers.edu

ABSTRACT
Geospatial technologies collect, analyze, and produce information about earth, humans, and objects through a convergence of geographic information systems, remote sensors, and global positioning systems. A microanalysis of Google’s U.S. Patent 9,420,426 Inferring a current location based on a user location history (Duleba et al, 2016) reveals how geospatial innovation employs artificial intelligence (AI) to train computer-vision models, infer, and impute geospatial data. The technical disclosures in patents offer a view within black-boxed digital technologies to examine potential privacy implications of datafied citizens in a networked society. In patented geospatial innovation, user agency is subverted through AI and anonymous knowledge production.

Presently, the Fourth Amendment does not adequately protect citizens in a networked society. Data privacy legal cases are interpreted through a lens of inescapability (Tokson, 2020), which assumes perpetual agency to consent to sharing data. In short, agency-centered privacy models are insufficient where AI can anonymously produce knowledge about an individual. Privacy implications are exemplified in geofence warrants—an investigative technique that searches location history to identify suspects in a geofenced region in the absence of evidence. This analysis demonstrates that digital privacy rights must expand to datafication models (Mai, 2016) centered on knowledge production.

KEYWORDS
geofence warrants; privacy; critical patent analysis; geospatial data inference; datafied citizen

INTRODUCTION
Geofence warrants—a technique to identify suspects through a location history search when there is insufficient evidence to otherwise identify a suspect—are a rapidly growing trend in law enforcement. The prevalence of geofence warrants has sparked scholarly debate regarding digital rights to privacy and Fourth Amendment rights protections. Legal scholars are debating if geofence warrants infringe on Fourth Amendment protections, while Google and law enforcement claim that all location history is voluntarily captured and subject to the third-party protections. Legal scholars are debating if geofence warrants infringe on Fourth Amendment protections, while Google and law enforcement claim that all location history is voluntarily captured and subject to the third-party protections. Court records document (United States v. Chatrie, 2020) that law enforcement and Google claim that this investigative method retrieves geolocation information is voluntarily logged by users. Subsequently, legal scholars have begun to explore if geofence warrants infringe upon a citizen’s Fourth Amendment protections, specifically from unreasonable searches and seizures and the right to privacy. Unfortunately, the Fourth Amendment does not adequately protect citizens in a networked society, particularly when the application of artificial intelligence anonymously produces knowledge about an individual (Mai, 2016).

The aim of this paper is to reveal how geospatial innovations and technology employ the use of artificial intelligence to infer geospatial data, train computer-vision models to detect and identify geospatial images and objects, and to impute (or fill in missing) geospatial data points in instances of incomplete datasets. This is achieved through a micro analysis of Google’s U.S. Patent 9,420,426 Inferring a current location based on a user location history (Duleba et al, 2016). This study is part of a larger, mixed methods research project that analyzes over 5,000 geospatial technology patents to reveal the growing trend in geospatial innovation that employs artificial intelligence to train computer-vision models, infer, and impute geospatial data in instances of incomplete datasets. The findings reveal a case of a patented geospatial technique to conduct inference and data imputation. In this case, consent for geospatial data collection is not obtained. Instead, user agency is subverted through anonymous knowledge production. The paper will begin with background on geofence warrants and how Google created these through an internal process. Next, I will present the datafication model of privacy to serve as a framework for understanding epistemological implications on privacy. Then I will discuss preliminary findings from a critical analysis of a geospatial patent that infers knowledge about individual’s location information history. Finally, I will conclude with a discussion on limitations and future research.

BACKGROUND
In August 2021, Google released their bi-annual transparency report with a new metric to indicate the number of geofence warrant requests they received from local, state, and federal authorities: Google has received over 20,000 geofence warrant requests since 2018 (Google, 2021). Geofence warrants request bulk anonymized data retrievals from geospatial datasets from aggregated databases, such as Google’s Sensorvault, for law enforcement to assess which location movements near the occurrence of the crime are suspicious. This anonymized list is reviewed in a three-step process where a final request by law enforcement to unmask the users is fulfilled by Google. In an amicus

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Legal precedent considers Carpenter v United States (2018), which requires specificity in a warrant request for cell site location information because the recorded logs of this information are inescapable; it is a public record. Therefore, law enforcement cannot be granted a warrant for cell site location information (CSLI) unless it specifically names an individual as a suspect with other evidence that identifies them and the CSLI merely corroborates this evidence. The data captured by Google, on the other hand, is not viewed legally as inescapable and is instead viewed as an opt-in service for enhancing customized user experiences. Geofence warrants exemplify the implications of privacy. Information policy and data privacy laws are interpreted through a lens of inescapability (Tokson, 2020), which situates digital privacy rights within a fallible dichotomic premise that assumes clear, perpetual agency to grant or deny consent to access data. In short, agency-centered privacy models are insufficient. Artificial intelligence can subvert agency to anonymously produce knowledge about an individual. In the next section, I will present scholarship on privacy.

THEORETICAL FRAMEWORK

The scholarship on privacy centers on three key themes for how to interpret invasions of privacy that inform the methods or approaches to protecting digital privacy today: consent, control, and context. Samuel Warren and Louis Brandeis (1890) make the claim for defining privacy as a matter of consent, in response to the development of photography and sound recording devices. Alan Westin (2003) makes the claim for defining privacy as a matter of control, in response to the development of databases and increased use of surveillance technologies. Additionally, Westin acknowledges that social values and political environments change with time, so it was necessary to gauge privacy values and concerns within the public, to further uphold democratic values. Daniel Solove (2002) and Helen Nissenbaum (2010) both focus on context to assess the individual’s ability to control the flow of information in a networked society. Context in the space of privacy seeks to address the issues related to information as an entity—information can have different meanings in different contexts. In short, privacy must be understood within the context of the social norms in which it is being considered. As such, informational norms can guide the appropriate flows of information and describe when violations of privacy occur. Context, along with control and consent, is only useful if the assumption is that the information flow has a sense of accuracy and a direct relationship to the individual. The issue is that context does not account for when data or information is produced anonymously about the individual. In this sense, what are the normative guidelines and roles for machine learning models classifying sensor derived data and anonymously producing knowledge about an individual?

Data privacy management is largely placed on the shoulders of the individual, typically through the acceptance of the terms of service agreements for each digital technology, app, and website. Many studies draw on Westin’s (2015) approach to gauge public perception of privacy values and how individuals protect their digital information. Empirical studies on privacy and user agency within systems and networks have been conducted to understand the privacy paradox and counterproductive calculations of a privacy calculus or cost-benefit analysis (Acquisiti et al, 2016; Barnes, 2006; Gerber et al, 2018; Marwick & Hargittai, 2019; Padyab et al, 2019). In these examples, the individuals are assessed for their understanding of how their digital privacy can be invaded, but these tests do not aid in the issue with technology that anonymously produces data and knowledge about them. In the next section, I will discuss the datafication model of privacy to account for knowledge anonymously produced about individuals.

Datafication privacy model

Jens Erik-Mai proposed a datafication model to privacy, as an addition to Philip Agre’s (1994) surveillance and capture models of privacy. Mai differentiates between ontological and epistemological implications of data privacy across these three models. Here he notes that the surveillance model and the capture model are ontological—it is about the concern with the control of data or information being collected. In the datafication model, there is an epistemological concern—what knowledge is produced about an individual. While the individual may have consented to the collection of data in a particular instance, how that data was used to produce knowledge about them was not consented to. ‘Privacy [is] violated due to data processing and analysis (Mai, 2016, p. 198). Shifting the focus away from consent, control, and context to datafication (processing, analysis, and knowledge production)
requires a deeper understanding of the design of technology. Mai’s datafication model of privacy motivates the exploration of legal interpretations of privacy and the futility of agential negotiations and protective measures for preventing data capture when knowledge can be produced by methods of inference and data imputation. In short, legal protections and user-centered approaches to attaining data privacy are ineffective in the new wave of geospatial technological innovations. In the remainder of this paper, I will discuss patented geospatial technologies that infer location information and the implications on data privacy.

METHODOLOGY
Critical patent analysis utilizes the patent as an object of analysis and employs a mixture of quantitative, computational, and qualitative approaches (Hlongwa, 2020; Hlongwa and Talamayan 2023; Iliadis & Acker, 2022). The technical disclosures in a patent offer a view within the innerworkings of black-boxed digital technologies and enable the examination of the potential privacy implications of datafied citizens in a networked society. Further still, patents as a document for analysis are particularly useful as the legal requirements that define specific protocols that must be followed in order to properly describe how their invention is statutory, novel, useful, and nonobvious to be awarded intellectual property protection. Patents as a genre are uniform, through a regulated process, and require a form of self-documentary disclosure by corporations which can reveal information about profit-driven computational techniques that are otherwise opaque. In other words, the information in patents serve as a glimpse into not only what is technologically possible, but what is technologically profitable. Critical patent analysis offers a close examination to be able describe how the inventions work, and to identify how technologically profitable inventions implicate privacy rights in the United States. In turn, this analysis can aid in identifying the gaps in policy and legal interpretations of rights to privacy that account for the innovation trends identified in patents.

The relevant patents were identified through an exact term search of “geospatial” in the title, abstract, claims, and detailed description sections of all patents available from 1976 to 2021. Each of these sections contain specific information that is integral to the nature of the invention, which ensures that that the topic, function, or purpose of the invention was directly related to the field of geospatial data, analysis, and visualization. The micro analysis of the patent presented in this paper is part of a larger research project that conducts a critical patent analysis of over 5,000 patents, which reveals the growing trend in geospatial innovation. In the next section, a micro analysis of a patented geospatial technique reveals that consent for data collection is not part of the calculus and are examples of anonymous knowledge production where user agency is subverted.

INITIAL FINDINGS
Google’s U.S. Patent 9,420,426 Inferring a current location based on a user location history (Duleba et al, 2016) is a method to infer the current location of a user or a device utilizing historical data through a process of scoring historical locations; the historical location with the highest score is selected to infer the current location. The problem this invention seeks to solve is when “the precise location of the device cannot be determined and a general location is not available, then the user location history can be analyzed to assist in inferring the current location of such device” (Duleba et al, 2016).

The method for scoring weighs the most recent location history entries higher than older entries. The detailed description for this patent defines the intended use-case to facilitate “location-enhanced service” despite the absence of a precise location information:

Example location-enhanced services include, but are not limited to, identifying, filtering, or promoting web search results based on device location; providing location-specific maps or directions […] identifying, filtering, or promoting content or advertisements based on device location; […] or any other suitable location-enhanced service, including aspects of web-based email, social networking, news or other content aggregation, or other suitable services or products.

Essentially, the purpose of identifying the precise location of a user or their device is to facilitate surveillance advertising, personalized recommendations, and targeted information retrieval. The detailed description further suggests that additional information can be collected and utilized to build a user’s location history:

Additional information can be used to build or supplement a user location history as well. As an example, whenever a user is logged into a user account and performs a web search or uses one or more applications, such as a mapping application, it is possible that such interaction can result in obtaining the user’s location. Therefore, an entry identifying such location can be formed in the associated user location history based on such interaction.

Tertiary information is utilized to infer the current location of a user or a device. The patent also indicates if a user typically carries multiple devices when traveling (such as a mobile phone and a tablet) if the location of the phone cannot be identified, but the location of the tablet can be identified, then “it is likely reasonably accurate to infer the...
location of the tablet as the current location of the smartphone. However, if the two devices are routinely in different locations, then such inference is less likely to be accurate” (Duleba et al, 2016).

DISCUSSION
Fixity and control are integral to the design of digital technologies and the corporate business models behind targeted advertising, which motivates the need for completed datasets. The algorithms, machine learning techniques, and the platforms are designed to fix users as a finite entity from both an ontological perspective and a geographical perspective (Özkul, 2021). If the system can maintain the user within specific categories and coerce the user to act within physical and virtual boundaries, the system can best predict future action which can be monetized through the processes of targeted advertising (see also Deleuze (1992) and his concept societies of control.) As such, in the case of Google’s patent to infer location information, the invention is designed for the purpose to fill in missing location information data to meet the demands of profit models. However, the corporate goals for complete location information history comes at the expense of individual privacy.

The value of overlapping many digital enclosures can be observed in Google’s patent (Duleba et al, 2016)—the continuous surveillance and capture of location information tied to user behaviors within applications and websites, as well as the relational behaviors between the user and multiple devices can facilitate this method for inferring an unknown current location. Mark Andrejevic (2007) defines data enclosures and how the intersection of multiple enclosures processes data to create unique and robust data profiles on users, which can be incredibly revealing of both personally identifiable information and intimate behaviors and locations of the users. While some of the data captured within these data enclosures are offered knowingly by the user in exchange for use of the particular application or website, the extent of the mobility and repurposing of this data is typically unknown to the average user. In the case of Google’s patent (Duleba et al, 2016), the user cannot be well-informed to calculate risk of privacy when information has been inferred about them. Furthermore, law enforcement agencies leverage the flexibility of current information policies. Current information policies do not prevent purchases of customer datasets which are compiled by corporate entities (Brayne, 2017), nor do they prevent the issuance of geofence warrants to identify user location history that coincides with the events of a crime (Elm, 2020). These flexible information policies impair the ability of the individual to preserve their rights to privacy through control and consent become increasingly difficult to manage.

In the case of Google’s patent (Duleba et al, 2016), location information is inferred through several approaches when location information is missing or incomplete. Primarily, the task is achieved through a computational scoring model to infer the most statistically possible current location based on patterns in a user’s complete location history when location information is missing or incomplete. The location data that this Google patent seeks to fill in could be a result of various causes. Perhaps the individual left their mobile device at home. Perhaps the battery died, or the device was in a location with no cell tower reception or Wi-Fi. Or, perhaps the individual made a deliberate decision to obfuscate or conceal their location, in an effort to maintain privacy, as is often recommended (Brunton & Nissenbaum, 2016). Regardless of the cause for the missing information, the qualification for consenting to the collection of location information, or, rather, the disclosure of location information by the individual to Google is absent when location information has been inferred. In this case, it is not possible for an individual to control the flow of information if technology can circumvent the efforts of control and consent to produce knowledge through statistical models of inference.

CONCLUSION
The aim of this paper was to analyze geospatial technologies to analyze the implications of a citizen’s digital rights to privacy. Geospatial technologies facilitate location-based services common in the design of modern applications and websites to personalize information and facilitate targeted advertising. Furthermore, models of privacy that center user agency and consent are ineffective when technologies can infer location information history, and the risk of violating rights to privacy are high in the case of geofence warrants. As the trend of geofence warrants continues to grow, so does the urgency to demonstrate the complications of user privacy and the limited ability to share information through informed consent. Future research could expand the analysis conducted in this paper to all patents that describe methods for capturing geospatial information by platforms. Policy, legislation, and legal interpretations of digital rights to privacy and the protections of the Fourth Amendment can benefit from Mai’s datafication model of privacy in response to emerging technologies that anonymously produce knowledge about individuals through machine learning models and statistical methods of inference. The limitations of the micro analysis of a single patent does not reveal the broader themes across the field of geospatial innovation. Future research can employ critical patent analysis to reveal the emerging trends of anonymized knowledge production in technologies that are described in patent documents.

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Theorizing Cultural Heritage Informatics as the Intersection of Heritage, Memory, and Information

Modrow, Sebastian  Syracuse University, USA | smodrow@syr.edu
Youngman, Tyler  Syracuse University, USA | tdyoungm@syr.edu

ABSTRACT
This paper explores the relationship between cultural heritage and collective memory through the lens of information. We explicitly frame the heritage-memory-relationship as constituting a theoretical foundation for the field of Cultural Heritage Informatics. In framing heritage and memory as information phenomena, we leverage two information frameworks that appear most suitable to host, translate, and overlay heritage and memory theory: Context, relevance, and labor (Fremery and Buckland, 2022) and Information as thing (Buckland, 1991). Altogether, this preliminary exploration 1) establishes a terminological understanding of cultural heritage, collective memory, and information/informatics; 2) maps these concepts with recourse to the Context, relevance and labor framework (Fremery and Buckland, 2022); 3) articulates cultural heritage informatics as the intersection of heritage and memory focused on processes of selection, transfer, and integration of historic information in the service of identity maintenance; and 4) offers a cultural heritage information framework that highlights the unique potential of Cultural Heritage Informatics to guide future information research in cultural information studies.

KEYWORDS
Cultural Heritage Informatics, Collective Memory, Cultural Heritage, History of Information, Documentation

INTRODUCTION
In Context, relevance, and labor, Fremery and Buckland (2022) propose a framework that “promises a view of the oak tree that supports all of information science’s communities and the variety of contexts within which they work” (p.1276). Within the ‘oak tree’ of information studies, we locate a ‘branch’ of information selection and integration relevant to the process of identity formation and maintenance. The making and maintenance of cultural heritage is an act of collective remembering that draws on selected cultural expressions and is, in its essence, an information process, centrally concerned with how people approach and ‘distill’ historic information into a framework of meaning in which they situate themselves. We interpret this ‘branch’ as Cultural Heritage Informatics, an emerging area of scholarly inquiry in information science that has alternately been described as: the “intersection of access, preservation, and advocacy” (ASIST, n.d.); the “[application of] digital methods and computational approaches to cultural heritage…” (MSU, n.d.); “concerned with the role of [ICTs] to support the creation, capture, organization, and pluralization of culture” (Kent State, n.d.); related to how we “manage, describe, organize, preserve, and provide access to [cultural heritage] data and information in a wide range of technological forms” (UT Austin, n.d.); and concerned with “collecting, preserving, and exhibiting cultural heritage in both physical and digital form” (Simmons, n.d.). However, these interpretations yield ontological imprecision, theoretical ambiguity, and disjointed definitions in articulating the intersections of heritage, memory, and information. Indeed, an epistemological gap emerges when defining cultural heritage informatics, in part due to minimal existing theorizations and formal literature regarding cultural heritage information (e.g., Marty et al., 2003; Dalbello and Vamanu, 2010; Bonn et al., 2016; Koya and Chowdhury, 2020; Singh 2022). The combination of previous scholarship, current definitions, and educational potential of cultural heritage informatics necessitates a theorization of cultural heritage as an informational process and product shaped and maintained through acts of collective remembering.

HERITAGE AND MEMORY AS INFORMATIONAL

In 1991, Michael Buckland, referring to the Oxford English Dictionary, distinguished three meanings of information: 1) information-as-process, 2) information-as-knowledge, and 3) information-as-thing. Within this distinction, information-as-process denotes that “[w]hen someone is in-formed, what they know is changed. In this sense, ‘information’ is ‘[t]he act of informing…; communication of the knowledge or ‘news’ of some fact or occurrence; the action of telling or fact of being told of something.’” In contrast, Information-as-knowledge is “‘Information’ [which] is also used to denote that which is perceived in ‘information-as-process’: the ‘knowledge communicated concerning some particular fact, subject, or event; that of which one is apprised or told; intelligence, news’ […]”. The notion of information as that which reduces uncertainty could be viewed as a special case of ‘information-as-knowledge.’” While the first two information types focus on the act of information transfer as well as internalized information, Buckland describes external information carriers as information-as-thing: “‘The term ‘information’ is also used attributively for objects, such as data and documents, that are referred to as ‘information’ because they are regarded as being informative, as ‘having the quality of imparting knowledge or communicating information; instructive’’” (Buckland, 1991, p.351, with citations from The Oxford English Dictionary, 1989, vol. 7,}

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knowledge could speak of heritage as an potential. This process, to return to Kirshenblatt, produces heritage. Building on Buckland (1991), we “contexts frame the properties and powers of documents” (2022, p.1270). True to its etymological root, the word context denotes here “the sum of connections (and distinctions) drawn into a weave that articulates the boundaries of documents and the horizons beyond them” (Fremery and Buckland, 2022, p.1277). Within that ‘weave’, an agent applies “relevance judgments […] about the affordances of certain connections within a context while pursuing a specific end. Labor can be described as a function of the effort needed to make relevance judgments as they are afforded by a context” (p.1277).

Heritage
Since the early 21st century, heritage has been harder to define than ever: “certainly there seem to be as many definitions of the heritage concept as there are heritage practitioners” (Harvey, 2001, p.319). Between paradigm shifts and critical turns, Heritage Studies has become “a bricolage, an autoethnography, listening to other voices, discourse analysis, the visual, each of these is used to create a more meaningful notion of heritage, developing a conceptualization that would not previously have ‘counted’” (Waterton and Watson, 2015, p.9). We contribute to this ‘bricolage’ by arguing that heritage is fundamentally informational. Established theoretical approaches to heritage remind us that heritage preservation is not a simple act of preserving the past but rather one of selecting from and rearranging the past: “Heritage is not lost and found, stolen and reclaimed. Despite a discourse of conservation, preservation, restoration, reclamtion, recovery, recreation, recuperation, revitalization, and regeneration, heritage produces something new in the present that has recourse to the past” (Kirshenblatt-Gimblett, 1995, p.369). Indeed, heritage encompasses “a process of what is done with the past” (Moody, 2015, p.113). It is less a thing and more a way in which “human societies engage with, and make use of, their pasts” (Light, 2015, p.144). Expanding on Kirshenblatt-Gimblett (1995), we have interpreted cultural heritage as the "ongoing production of identity-relevant meaning in the present through recourse to traditions and artifacts rooted in the past" (Youngman et al., 2022, p.359). Altogether, heritage is an act of subjective and value-oriented anchoring, a projection of stability and permanence through the course of time, serving to continuously recreate and stabilize identities. Leveraging Fremery and Buckland (2022), we detect here an act of *heritage-as-knowledge*, a knowledge of belonging, being *heritage-as-knowledge*. To situate how surviving documents (things containing *information* about the past) give people knowledge about themselves—how heritage information is internalized and creates cultural identity—we look to collective memory theory.

Collective Memory
Before mapping collective memory onto heritage and/as information, we must establish a basic understanding of the term. The first commonality between heritage and memory is their seemingly protean nature: “Memory eludes any neat definition…It is as difficult to define as it is for any one of us to stop and consciously note its use as we engage, as part of our human being-ness, in our everyday memory work of collecting, recollecting and employing knowledge gained through experiences in and of the past” (Sather-Wagstaff, 2015, p.191). More succinctly, memory encompasses “acts of recounting or remembering experienced events […] something intangible but performed in some manner over space and time” (Sather-Wagstaff, 2015, p.191). Since the seminal work of Maurice Halbwachs (1925), we have learned that individual memory exists within a framework of collective remembering, an act that fundamentally contributes to the development and maintenance of group identities. Over the course of their lives, individuals aggregate multiple group memberships, and it is this constellation of multiple narratives of belonging that enables them to ‘remember themselves’, that is, to form a unique and personal identity. This emphasis on the ‘social’ aspects of remembering inspired a whole field of social memory studies predominantly in Anglophonic scholarship: memory is as much a set of *practices* and *processes* as it is a *product* or rather *constellation of mnemonic products* (Olick and Robbins, 1998; Olick 2010). Memory studies have also taken a distinctly ‘cultural turn’ (see, e.g.: Nora, 1984-86; J. Assman 1992/2011), acknowledging collective remembering as not only an interaction of neurons in multiple brains but as an act of learning that has recourse to externalized meaning (dare we say ‘information’?) embodied in cultural expressions (monuments, literature, rituals and performances, oral
traditions, archival records, etc.); the retrieval of this meaning is dependent on interaction with these cultural artifacts and practices.

We perceive collective memory as both social and cultural, just like culture itself cannot be conceived outside society, as Tylor’s 1871 definition already reminds us half a century before Halbwachs: “Culture or civilization taken in its wide ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society” (Buckland, 2015, p.14). Building on Jan Assmann’s distinctions of communicative and cultural memory, Kwa Chong Guan (2008) reminds us of the memory-heritage relationship: “our collective memories, objectified as reusable texts, images, monuments, and perhaps more critically, commemorative ceremonies and other bodily practices, becomes the heritage that defines who we are as citizens of our nation-state…” (p.623). The development of identity-relevant knowledge is a process involving acts of communication with ‘fellow brains’ that draws on externalized meaning, meaning that can be retrieved as information through reference to or interaction with cultural expressions. Remembering who we are is an ongoing process of learning and integrating information into a system of negotiated and agreed upon narratives the meaning of which is anchored in, attached to, and thereby triggered and amplified by a canon (A. Assmann, 2010) of relevant cultural expressions.

In revisiting Fremery and Buckland (2022), we can state that collectives of agents—for the purpose of explaining the stability of their group through time to satisfy their members’ need for belonging—use relevance judgements in selecting from the pool of all informational things documenting the past, the ones that offer evidence for the group’s permanence through time. This evidence contributes to a cohesive narrative that receives confirmation through the process of continuous reference to these external documents, an act of remembering their relevance. Memory, as a narrative product, has become information-as-knowledge. Furthermore, since this knowledge has been created through information transfer from an external context (a constellation of historic documents that we may call heritage-as-things) to an internal one (a self-explaining narrative projecting same-ness (identity) into the past), we can call this internalized and integrated information heritage-as-knowledge. It is the process of remembering the connection between the delineated set of documents and a group’s persistence through time that anchors individual identity through group membership. The relevance of the documents to the group constitutes their relevance to the group’s individual members. The continuous (re)narrativization of that relevance, an act of remembering the connection between the document (information-as-thing) and the “self”, confirms and stabilizes identities, thus establishing the heritage relationship. Due to this process of continuously remembering their identity relevance, external documents are in consequence charged with value, things are transformed into identity markers, and this delineated set of documents becomes thereby heritage-as-things, things that these collectives are willing to preserve due to their function in the identity-maintenance process.

TOWARD CULTURAL HERITAGE INFORMATICS
The Intersection of Heritage, Memory, and Information

These aforenoted framings of heritage and memory indicate an informational relationship, yet we still require an understanding of how heritage and memory are themselves informational. In mapping Buckland’s (1991) definitions of information to concepts of cultural heritage, we previously distinguished “tangible and intangible heritage as information-as-thing, our participation in and sharing of heritage between individuals and groups as information-as-process, and the value that we derive from those interactions as information-as-knowledge” (Youngman et al., 2022, p.359). In revisiting memory, a closer examination of Sather-Wagstaff’s conceptualization of memory as “acts of recounting or remembering experienced events” is in itself informational. In echoing sentiments by Cornelius (2002) describing information as being “perceived as a data set embedded in a communication situation” (p.394), so too is memory a process of communication among group members about the past from a framework situated in the present—defining the self, the group, as well as intergenerational relationships—supported in part by the information resources that in and of themselves constitute cultural heritage (Youngman et al., 2022, p.359). These have been selected, therefore, in a value judgment as being identity relevant.

It is here where the concept of informatics comes into play in situating cultural heritage informatics, which is first dependent upon the domain in which the term is used, echoing Buckland’s (1991) observation of the immediate trouble with defining information. Given the scope of this paper in relation to cultural information studies, we are inclined to interpret informatics as it was originally conceptualized in the context of library science. Here, original meanings of the term informatics trace back to the mid 20th century, introduced and used as a shorthand name for the field of information science/studies (e.g., Mikhailov et al., 1968; Belkin, 1978). This constituted a shift beyond traditional and former framing of documentation science and venturing into the humanistic aspects of information, namely including information behavior (e.g., Foskett, 1970, pp.343-344). The initial debate over the use of the term informatics arose in part around contentions relating to the potential terminological vagueness of information science (e.g., Wellisch, 1972; Belkin, 1978). Despite the adoption of informatics in computational settings, we are particularly drawn to Wellisch’s (1972) framing of informatics: “the study of information in all its aspects” (p.177).
In doing so, we echo Buckland’s concerns regarding the reduction of cultural experiences as a purely computational and extractable information phenomenon: “Cultural heritage and cultural identity are especially subjective and emotional (“affective”) areas of understanding and so attention to them requires an awareness and sensitivity to how meaning is constructed. That awareness is liable to be lacking when information services are seen as technical fact-finding or document delivery services suitable for delegation to algorithmic systems” (2015, p.13).

Mapping Cultural Heritage Information

Altogether, we observe that things with potential informational value may constitute documents. These exist in a context of other interwoven document relationships, forming an information context. From this context, agents undertake the labor of selecting a document or interrelated document threads according to purpose-driven relevance criteria. During this process of extracting relevant information, information moves into a new context defined by said relevance criteria. Falling under what Bates (2015) describes as “disciplines of the cultural record”, we suggest Cultural Heritage Informatics is the relational study of information selection, transfer, and integration during processes of heritage formation and identity maintenance, a process and product that is fundamentally shaped by acts of collective remembering (see figure 1).

![Figure 1: Mapping Cultural Heritage Information](image)

Future Directions for Cultural Heritage Informatics

In this short paper, we provide a preliminary sketch of the informational relationship of heritage and memory. In turn, we interpret cultural heritage informatics as an interdisciplinary approach that ‘branches out’ from the enormous ‘oak tree’ that constitutes the divergent areas of information inquiry. However, cultural heritage informatics demands a more extensive and formal definition, particularly as this branch continues to grow into a formalized area in iSchools and professional organizations. Definitory refinement should encompass interrogations of the differences between cultural heritage informatics and digital humanities so as to acknowledge existing advancements. To encourage cross-disciplinary dialogue, subsequent refinements to this framework should foreground the relationship between cultural heritage informatics and digital humanities so as to acknowledge existing advancements. To encourage cross-disciplinary dialogue, subsequent refinements to this framework should reflect, embody, or surface the informational relationship between heritage and memory. Through this theoretical expansion, we heed Buckland’s advice: “Attention to cultural heritage issues moves information system design beyond the practical manipulation of well-defined objects in operational contexts [...] into socially sensitive, politicized areas [...]” (2015, p.14). Although often implied, a fully understood informational relationship between heritage and memory will also better prepare professionals working at so-called ‘memory institutions’ as “responding to the turn toward memory necessitates complicating comfortable and ‘accepted’ notions of both tangible and intangible cultural heritage. Taken to its logical conclusions, it also demands that archives and museums work closely and participatively with communities of memory to develop management practices and curatorial interpretations capable of highlighting diverse, critical, contingent and dynamic understandings of the past.” (Gilliland, 2015, p.84). Ultimately, this succinct discussion of cultural heritage informatics will enable further novel theorizations of heritage and memory at the information intersections, thus ensuring a unified framework that informs future cultural heritage information research, teaching, and praxis.

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When Push Comes To Pull: Place, Mobility, and Information Access for Vehicle Residents

Montague, Kaitlin E. Rutgers University, the State University of New Jersey, USA | kaitlin.montague@rutgers.edu

ABSTRACT
This high-exposure study explores the information seeking practices of a specific unstably housed, mobile population. Vehicle residents earn a wage but have chosen to move into their vehicles as a survival strategy during a time when housing expenses account for more than half of lower-income Americans’ monthly income. Drawing from previous work that highlights the importance of place in information behavior, this study investigates the ways that places influence information seeking for a population whose information environment is ever-changing. This study is informed by two sets of semi-structured interviews with seven individuals, including information horizon interviews and guided tours, from November 2020-June 2021. Key initial findings demonstrate that both place and mobility constrain and facilitate information seeking for participants. Overall, understanding the unique features and needs of this particular group results in a more thorough comprehension of their information seeking practices to better understand information and service provision, information inequality, and inequity.

KEYWORDS
information behavior, information access, information horizons, place, mobility

INTRODUCTION
Research on place in information behavior has largely focused on context (Cox & Fulton, 2021). Cox and Fulton (2021) urge information behavior researchers to look beyond context to understand how the physical properties of spaces constrain or facilitate information access, which impacts information behavior. Grouped into the setting, environment, or background to the subject of interest, place is continually treated as a set of conditions that shape human behavior in an objective manner (Cox & Fulton, 2021). Understanding where a person is in place and the ways that their immediate surroundings impact and influence how and why they begin the information seeking process is central to information resolution.

Gibson and Kaplan (2017) posit that library and information science (LIS) has failed to develop “a coherent, complex body of theory related to place, space, and information behavior” (p. 131). The present work aims to further extend the concept of place in information behavior research in order to better understand a) how places limit and enable information access, and b) how mobility impacts the information seeking process. With the understanding that our environments and the characteristics of place influence how and why we search for information, researchers in LIS can continue to push the concept of place forward.

This qualitative study seeks to examine mobile information access among vehicle residents through their information behaviors. I explored the implications of a place-based, mobile-focused approach to understanding information and service provision, information inequality, and inequity.

BACKGROUND
Place in information behavior
Places are connected to memories, meanings, and history, and they are spaces that people have made meaningful over time (Corbett & Loukissas, 2019). Placemaking as a process, and “denotes the ways in which settings acquire recognizable and persistent social meaning in the course of interaction” (Dourish, 2006). Therefore, without the act of ordinary people naming, identifying, and representing places, a place cannot exist (Norrie & Singer, 2005). This conceptualization of place finds meaning in Sonnenwald’s (1999) acuity—places and information are both influenced by, and influence human behavior. Therefore, places and human behavior have a mutual, reciprocal relationship through the ways that people impact and inaugurate a place. Meaning is created through the ways that people assign sentimental value to specific places through the process of meaning making. Serving as the setting for social relations, this process is socially constructed, containing location and fixed coordinates on the globe (Withers, 2009). In sum, the spatial, the structural and the social, produce place (Gibson & Kaplan, 2017).

Sonnenwald (1999) posits that within a context situation exists an “information horizon” in which we can act. Everyone has a relative and specific information horizon, which includes social networks, documents, information retrieval tools, and experimentation and observation in the world (Sonnenwald, 1999). Assessing the relevance of the available information sources in the information environment, Savolainen and Kari (2004) conceptualized an information source horizon. Information sources are positioned closest to us in order of preference from most to least important. Savolainen and Kari (2004b) depict information source horizons and three zones of source preferences: zone 1 consists of the most preferred information sources; zone 2 contains information sources that are of secondary importance to the user; and zone 3 comprises peripheral information sources.

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Identifying three distinct approaches to the information seeking process and space which assume different metatheoretical beliefs about human agency, Savolainen (2006) extends the status of space in this information source preference model. First, the objectifying approach assumes that space has reifying characteristics beyond human control (see Gibson & Kaplan, 2017); second, the realistic-pragmatic approach recognizes more human agency and social interaction in deciding how to navigate through spatial aspects of information (see Fisher & Naumer, 2006); and third, the perspectivist approach uses space as a metaphor for the ways that information resources relate to the individual (see Lloyd, 2006; Sonnenwald, 1999). Together, these approaches suggest that characteristics of space shape how information is sought.

Adapting the concepts from information source horizons and zones of source preferences, Gibson and Kaplan (2017) further develop the concept of information horizons based on the additional spatial metaphor (Savolainen, 2006). Focusing on the resolution of information and service needs in terms of distance, space, and place, Gibson and Kaplan (2017) refer to this concept as information zones. Rather than concentrating on the specific information behaviors of participants, their study illuminates the interactions between place, information needs, and information access. They constructed a framework that describes and investigates geographic zones of information access in local communities. Their findings revealed that proximity was explained in terms of “travel time” or distance from participants’ home or place of residence, and factors such as proximity and distance impact accessibility. However, their focus was not on participants’ movements to gain accessibility.

**Vehicle residents**

Interrogating the affordances and limitations of places in the information seeking process, in amalgamation with a person’s mobility in any given information environment, offers a vibrant opportunity for a deeper understanding of information behavior. Taking both into consideration, this study aims to illuminate a growing mobile population in the United States (US). Vehicle residents are understudied and underrepresented in the academic literature, likely due to their inherent mobility. Pruss and Cheng (2020) have attempted to define vehicle residency based on what it is not: #vanlife and digital nomadism (Müller, 2016; Nash et al., 2018) and older “snowbirds” chasing fair weather in RVs (Counts & Counts, 1996). Wakin (2005, 2014) found that their houseless participants reject the identity of the home-less, highlighting participant’s perspective of having a home space. Vehicles provide homeless people with a private, legally defensible space in which to conduct activities usually done in a home. Those who legally own their vehicles represent a form of identity work that homeless people are usually not able to access or sustain: the procurement and arrangement of a legally owned physical setting (Wakin, 2014). The mere act of owning a vehicle represents sustainability. The simplicity of having a vehicle as an “option” indicates having a choice, autonomy, and a degree of control over their own living situation.

Mobility is a vital factor in understanding the effects of legal policy for vehicle residents (i.e. criminalizing the overnight parking of vehicles that serve as residences). Through community member complaints and “punitive pushes” (Pruss & Cheng, 2020) from law enforcement, vehicle residents can be forced to migrate to new locations regularly through location-based bans, which can vary between cities, counties, and states. Despite this variety, it is still illegal across many parts of the US to sleep in a vehicle. The result is that this group is further forced to the margins of society, off the grid, where cellular service and Wi-Fi are not easily accessible which directly impacts their information access.

For this study’s participants, vehicle residency takes shape in the decision to pare down their belongings, moving into their vehicles (SUVs, vans, and mini-vans) to save money due to the unaffordability of rent in their current locations. Earning wages and maintaining jobs allows them to sustain ownership of their vehicles and make a home inside them. Their inherent mobility both affords and restrains their information seeking processes.

**Mobility as a framework**

If “mobility is central to what it is to be human” (Cresswell, 2006, p. 1) then it can be argued that mobility is also central to information behavior. Cresswell (2006) posits that mobility is a fundamental geographical facet of human existence, and it is as ubiquitous as moving fingers and toes to international migration. Mobility is a way of being in the world; it plays a central role in discussion of the body in society as it is practiced, experienced, and embodied. Aiming to end sedentarism and focusing on the rise of nomadism, disciplines like philosophy and social theory argue that mobility is more about routes than roots (Clifford, 1997; Deleuze & Guattari, 1986).

Cresswell (2006) simplifies the idea of mobility as getting from point A to point B via routes. Therefore, mobility involves displacement—the act of moving between locations (Cresswell, 2006). The locations of point A and B will always vary. Drawing from migration theory, there is a choice of whether or not to move, as a result of the push and pull factor in A and B (Lee, 1966). Movement describes the displacement that allows people to move between locations. Cresswell (2006) posits that it is possible to think of movement as the dynamic equivalent of location in abstract space. If movement is the dynamic equivalent of location, then mobility can be the dynamic equivalent of place. As we continue to interrogate dynamic information environments, it makes sense that through these
examinations, we focus on the movements that must occur throughout the information seeking process, which highlights the ways that people’s movements can impact their information horizons. Therefore, this study seeks to answer these research questions: 1) what are the information seeking practices of vehicle residents? And 2) how do they obtain information in remote areas without Internet or cellular service connection?

METHOD
Data collection was completed from November 2020-June 2021 using two sets of semi-structured interviews and guided tours (Spradley, 2016; Thomson, 2018), both via Zoom. Nodding to longer-form, extensive ethnographic interviews (Weeks, 2020), I framed this study as a high-exposure study because it employs multiple interviews with the same participants using different modalities over time, rather than obtaining a more limited sense of people and their situations in one-off verbal interviews. This required greater commitment on both sides resulting in smaller, but more concentrated set of respondents and respondent data. The first set of interviews were designed to gain a general understanding of vehicle residency followed by guided tours (Thomson, 2018) of participant’s vehicles. Participants were asked to virtually lead me through their vehicles while describing and explaining its features, thinking aloud feelings and ideas that arise (e.g. how they built different parts of the interior, which areas feels like home, etc.). The second set were conducted with the same participants about four months after the first. The main focus was member checking (Creswell & Miller, 2000) and to complete information horizon interviews (Sonnenwald, 1999; Sonnenwald et al., 2001) to encourage participants to describe their information seeking process, information resources, and whether they were useful. Interview questions were followed by a drawing component where participants drew a diagram of themselves in the middle surrounded by their most frequently used information sources, while justifying their information source preferences aloud.

Participants were located in different parts of the US (i.e., Colorado, Louisiana, California, and Arizona). I was introduced to a vehicle resident who connected me with others for initial recruitment and then used snowball sampling to obtain subsequent participants. Inclusion criteria for the study population included people who, due to financial strain, have chosen (or have been forced) to pare down their belongings to move into their vehicle. Additionally, participants needed to be earning wages and living in a functioning vehicle for at least six consecutive months prior to the interviews. Participants took photos on their mobile phones throughout the guided tour. After each interview, participants emailed their photos to me and gave informed consented for use of their photos in presentations and publications from this study.

I transcribed the interviews as a means of staying close to the data (Corbin & Strauss, 2014). Transcripts were then coded using the constant comparative method (Charmaz, 2014), including iterative open coding to identify themes and illustrative quotations. During content analysis, I used induction to identify and categorize recurring conceptualizations and phenomena, then refined them by constantly comparing newly emerging patterns with previously discovered patterns. This process continued until data saturation was satisfactorily reached (Miles, Huberman & Saldana, 2020).

FINDINGS AND DISCUSSION
The final sample included seven participants: four males, two females, and one non-binary person. Their ages ranged between 23-29. All participants obtained college degrees and acquired some level of student debt. Three participants remain in the same general area due to employment while four participants cross state borders regularly.

Consistent with Gibson and Kaplan’s (2017) results that illuminate the interactions between place, information needs, and information access, preliminary data analysis revealed two major findings: a) places facilitate and constrain information access, and b) mobility constrains and facilitates information access. Participants’ descriptions of information seeking detailed the importance and characteristics of the location where their information seeking process began. As Cox and Fulton (2021) posited, it is important to understand how physical properties constrain or facilitate information access. For example, places outside of cellular service range constrain information access, resulting in geographic mobility within service range. The subsequent sections divide the study results into the aforementioned themes. I elaborate on both categories below, drawing on particular cases to illustrate broader trends across participants.

Place facilitates and constrains information access
Vehicle residents reported that their specific locations both facilitated and constrained information access in the information seeking process. While mobility is inherent for this population, a constant concern is finding stealthy parking places to avoid law enforcement and angry community members. Participants Emily and Zach, a couple, live in a resort mountain town during the winter months where “it’s usually quiet and the cops usually leave us alone in the winter so long as we don’t park on private property,” Emily explains, “which is ideal because then we always have cell service.” Emily makes an important point about the affordance of cellular service in town. Cellular service results in information access. In contrast, “the summers are hard,” reports Zach, “town gets overrun with tourists and we have to go live in the woods so we don’t get tickets. The thing about the woods is we live outside of cell service...
range and our phones are like useless when we find most things we need from the Internet.” Clearly delineating the importance of remaining in cellular service range, Emily and Zach face barriers to access when living in remote places during summer months. Alex corroborates their experiences, “I spend a lot of time in Bureau of Land Management (BLM) land so I don’t get tickets for parking in illegal spots overnight. I prefer the woods, but at the cost of no service.” Alex continues, “so sometimes I don’t get work opportunities when I’m out there. I do a lot of mechanical and handy work, but if people can’t reach me, I can’t fix their shit.” Findings reveal that a remote location’s physical characteristics constrain information access, depriving an unstably housed population of access to critical information needs like employment and health information. In contrast, urban and suburban locations facilitate information access, but it is often illegal to sleep in a vehicle overnight in many urban areas.

Mobility constrains and facilitates information access
The above findings illuminate the importance of a location’s characteristics which facilitate and constrain information access through cellular service. Participants expressed their accessibility struggles while moving out of cellular service range to dodge law enforcement and ticketing. Lily, Noah, Molly, and Calvin also discussed disruptions in service due to movement for similar reasons. These movements out of cellular service range result in barriers to information access. However, participants also talked about their resolution strategies. Lily explains, “I head out of the city, service gets spotty, and I need to be reachable for my job. I started my own business as a busker…I facilitate play time with large bubbles.” While policy pushes Lily out of the city, accessibility and a service connection also motivated their movements to return. Pushing and pulling vehicle residents between places, information access drives a cyclical narrative that results in movements in and out of cellular service range. Noah explains, “we’ll even lose service on some desolate highways without expecting it and sometimes we just have to keep driving to find a connection again.” For vehicle residents, mobility constrains information access through their movements to places out of cellular service range after they have been pushed to the margins by policy. When these places present barriers to information access, participants move back to places within cellular service range, facilitating information access.

LIMITATIONS, FUTURE DIRECTIONS, AND CONCLUSION
While this high-exposure study nods to the ethnographic tradition of longer-form, comprehensive interviews with recurring participants (Weeks, 2020), the small sample size poses limitations like generalizability, snowball sampling, and accessibility. Because participants were sometimes located on the fringes of urban and suburban areas for Zoom interviews, calls were lost and disrupted due to poor service connection resulting in broken interviews. Poor connection resulted in rescheduling in some instances.

Future directions will expand on this present work with a larger, more diverse sample using ethnographic methods to gain a deeper understanding of participant’s experiences. Forthcoming work will provide a deeper exploration into how places facilitate, constrain, and impact information access. Additionally, ethnographic methods will provide a more comprehensive understanding of ways that mobility is deeply embedded in the information seeking process.

Implications echo Gibson and Kaplan’s (2017) results that illuminate the interactions between place, information needs, and information access. With an emphasis on place and mobility, findings suggest that each participant’s information horizons were place dependent and change in areas with and without a cellular service connection. Remaining in service range, participants were able to access information sources via the Internet and their social networks. Moving out of service range, participants experience barriers to information access, resulting in limited information horizons and fewer information sources. Relying on mobility to facilitate information access, vehicle residents moved to new locations to regain cellular service. Findings indicate that place and mobility were interdependent on one another in participants’ information seeking processes. Practical implications have the opportunity to strengthen conceptualizations of place and mobility within the field, in turn enabling a deeper understanding of information inequity and implications for libraries’ and other community-based organizations’ service design and provision. There may also be nascent policy implications for this work. The mobility of vehicle residency brings about unstable access to the mobile Internet and phone service needed to maintain a livelihood and basic existence. Legal policy and law enforcement are vital to understanding why vehicle residents must continuously move out of Wi-Fi and service range, avoiding punitive pushes due to the legality of the lifestyle. These policies (e.g., criminalizing overnight parking in areas where people might use their vehicle as a residence) have been in place for decades and have not been revised despite increasing numbers of people who live in their vehicles.

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Anti-Black Racism, Anti-Immigrant Sentiment, and Misinformation: A Recipe for Profound Societal Harm

Ndumu, Ana
Department of Information Studies, University College London, UK | ndumu@umd.edu

Orie Chuku, Nenna
College of Information Studies, University of Maryland, USA | chuku.17@ucl.ac.uk

ABSTRACT
Mass media and big data constitute powerful information tools that fuel extremist, populist messaging. Demagogues turn to information tools to convey polarizing views, and governments increasingly rely on data and artificial intelligence to manage immigration. The speakers will describe how three global, deep-seated, and historic societal ills—anti-Black racism, anti-immigrant sentiment, and misinformation—converge to typecast, vilify, and pathologize Black diasporic immigrants. The speakers will also share examples of anti-Black, anti-immigrant, and misinformed policymaking, rhetoric, and cultural norms within the United Kingdom and United States. Particular attention is granted to problematic assumptions within large-scale population datasets that narrate migration tropes.

KEYWORDS
Misinformation, Social Justice: anti-Black racism, Information economies, Immigration

INTRODUCTION
Black diasporic people comprise a large segment of the global migrant population. Among this group, Haitians and Nigerians make up the largest proportion of migrants by country, and groups relocating from Africa—described as a “continent on the move” (Apitsa & Milliot, 2020)—account for a sizeable segment of worldwide migrants. Black people are increasingly emigrating even from countries in which they are relatively few: Mexico, Cuba, Panama, and Honduras, for example (Lacarte, 2022). The reasons for migration are as varied as the Black diasporic population itself. Although migration data specifically on Black people remains “fragmentary, fluid, and imprecise” (United Nations, 2023), climate and politically induced displacement, labor and educational migration, and family reunification are recognized as significant pull factors. Yet, Black diasporic immigrants are often the subjects of hot-button political debates and sensational media imagery. Mischaracterizations of Black refugees, migrants, and asylees as a dispossessed lot reflect what African library and information science scholar Dennis Ocholla calls derogatory forms of knowledge that affix Blacks to barbarism and servitude (Ocholla, 2007).

Anti-Black racism and anti-immigrant sentiment are at once misinformation vehicles and tactics for othering rooted in “motivated reasoning”—that is, motivations to be right that shape information reception such that cognitive processes are more likely to yield desired conclusions (Kunda, 1990). Motivated reasoning justifies the intentional misuse and distortion of facts. It helps explain why negative attitudes toward Black and immigrants alike facilitate the widespread acceptance of inaccurate claims (Paek et. al, 2015). Greater dislike for Black and/or immigrants is consonant with the reliance on erroneous, falsified, or intentionally misleading information. Little wonder, for example, that a former president of the United States compared majority-Black nations to feces (Villazor & Johnson, 2019). Elsewhere in the United Kingdom and commonwealth countries like Australia, Black migrants are compared to a “norovirus” (Anderson, 2019) and called “African gangs” (Majavu, 2020). Anti-Black racism, anti-immigrant sentiment, and misinformation effectively mainstream hate toward Black diasporic immigrants.

Excusing these ideologies as mere prejudice discounts strategic, institutionalized belief systems that perceive Blacks and immigrants as subhuman and their nation-states inherently flawed. Anti-Black racism and anti-immigrant sentiment emanate from white racialized, Eurocentric, and colonialist subjugation rather than mere individual temperaments or dispositions. Together, nativism, racism, and malicious information fashion an unjust global racial order that subjects Black diasporic immigrants to the bottoms of Asian, Middle Eastern/North African, Latin American, North American, and European societies. For decades, scholars have argued that Black diasporic immigrants comparatively fare the worse economically, socially, and politically in every part of the world (Bashi, 2004). Disenfranchisement, then, is not a state that Black diasporic immigrants and Black people broadly devise themselves, but that is intentionally and internationally imposed. We argue that discrimination toward Black populations, or anti-Black racism, coupled with xenophobia, or anti-immigrant sentiment, work in tandem with misinformation (e.g., stereotypes, pseudoscience, propaganda) as the throughline.

Despite data suggesting that countries like the United Kingdom and United States benefit from the skilled labor, professional capacities, as well as cultural vibrance of new Afro-Caribbean, Afro-Latinx and African neighbors (Bashi, 2004; Migration Policy Institute, 2022), the messaging around Black diasporic migration remains alarmist and threatening. The practice of problematizing Black migration is embedded even within seemingly authoritative information, thereby drawing into question what is societally understood to be factual and informational. For example, aggregated data drawn from contemporary English and Welsh censuses publicly available on nomisweb.co.uk (a web based service provider for the producer of official statistics in the UK, the Office of

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National Statistics) provides pre-identified tabulation options to present demographic information. Yet, such a presentation and use of census information creates a silencing on the implication of British colonialism on Black movement and presence in the UK. Likewise, with the rise in the Black immigrant population, the 2020 U.S. Census introduced questions that, for the first time, distinguished non-U.S.-born Blacks from those who are U.S.-born. However, the requirement to specify heritage or ethnic origins is not asked of White or White-racialized U.S. groups, whether U.S.-born or otherwise, who are historically treated as an axiomatic conglomerate, thus statistically positioning whiteness as a master status (Zuberi & Bonilla-Silva, 2008). During the 2023 ASIS&T convening, we presented findings using an informational epistemic justice perspective of population datasets (Patin et al., 2020), through which a methodological amnesia (Demir, 2022) is observed due to the erasure of colonial and imperial bases of the information infrastructures. Methodological amnesia is akin to motivated reasoning in that flawed logic undergirds anti-Black and anti-immigrant information.

The dual effects of anti-Black and anti-immigrant framings are such that major international headlines purport that Black diasporic immigrants are prone to disease and poverty (Ventura, 2016). We thus wonder about the connections between these premises and immigration governance that disproportionately criminalizes, surveils, and detains Black refugees, asylees, or migrants, as well-known reports substantiate (Goff et al., 2022). In what follows we outline how Black immigrants face racial, immigration, and information harm in majority-white Global North nations such as the United States and the United Kingdom.

UNITED KINGDOM

When placed in the context of the United Kingdom, nationalist ideologies and imperial nostalgia are two consistent factors in the information harm of Black people. While current debates place the Hostile Environment and recent Home Office activities, such as increased monitoring systems, destruction of documents, and focus on removal rates (Griffiths & Yeo, 2021; Webber, 2019), as centrepieces, the possibilities of such policies and procedures connect to colonialism. As argued by legal scholar Nadine El-Enany (2020) and radical psychologist Guilaine Kinouani (2021), colonialism was a breach of boundaries where the metropole is centred and a false imperial view crafted by the coloniser is projected. Yet, as colonised populations navigate independence, the metropole remains rooted as the holder of all the plunders of coloniality and source which many people from formerly colonised nations seek to access. The information harm caused pertains to how the dominant public consciousness of national ideologies and imperial nostalgia reveal (through its absence in the conversation) the ongoing implications of coloniality via the racialisation of migration. Through this, the role of the construction of recorded information of people’s biography and movement impacts this recorded information as well as access to key information, education, healthcare, employment, and housing provisions. Consequently, there is need to unpack the epistemic injustices (Patin et al., 2020, 2021; Youngman et al., 2022) Black people face as users and (unwilling) informants of information institutions and systems in the U.K. that are purposely built to exclude them and place them as Other.

White denial of anti-Black sentiment in U.K. policy is typified in policy documents like that of former Prime Minister Johnson’s 2021 Commission on Race and Ethnic Disparities (CRED) report. In an attempt to sanitize and rationalize the transatlantic slave trade, the report portrays “the slave period not only being about profit and suffering but about how culturally African people transformed themselves into a remodelled African/Britain” (Commission on Race & Ethnic Disparities, 2022, pg. 8). The report also claims that “immigrant optimism” explains why pupils of immigrant heritage, including Black Africans, perform better than White British groups: “recent immigrants devote themselves more to education than the native population because they lack financial capital and see education as a way out of poverty” (Commission on Race & Ethnic Disparities, 2022, pg. 32). The flaws in reasoning—an assumption that Whites are native to the U.K. while Black Africans (and other groups) are not; the premise that those of immigrant heritage must be striving out of poverty; the dubious claims that Whites are outperformed academically—demonstrate the metropôle’s denial. Remedial and rescue narratives couched as data and evidence form the basis of exclusion.

These information tactics attempt to keep Blacks in positions of subservience and liminality—never quite welcome citizens, as the popular phrase “You may be British but you will never be English” signals. Rising British nationalism including the populist-led Brexit policy dominate headlines, yet the racialised constructions of citizenship remain largely ignored. This, despite the fact that migrants of colour especially Blacks are vilified in the media; their targeting is remarkably normalised. The notorious British mass media and its attendant tabloid culture regularly trafficks anti-Black immigrant hate. In 2015, the United Nations called upon U.K. authorities, media, and regulatory bodies to curb xenophobia, misinformation, and distortion after one influential press labelled migrants “cockroaches” and “a plague of feral humans” (United Nations, 2015). Global anti-Black xenophobic hate speech abounds. Most recently, Tunisia’s President Kais Saied has faced international condemnation for false and misleading information about migrants in an attempt to decry the “presence of Black Africans as a ‘criminal plot’ to alter the country’s demographic composition” (McDowall, 2023). The worldwide migration debate therefore dials in on pervasive information caricaturing purporting the unfitness of migrants of colour and the particular alienness of
Black migrants. It is a microcosm of wider forms of anti-immigrant propaganda that run parallel to racism targeting people of African descent.

**UNITED STATES**

White preference in immigration is foundational to America’s origin story. Whiteness was privileged in the very first U.S. immigration policy, the 1790 Naturalization Act, that granted citizenship and property to White men who resided in the U.S. for two years. That same year, the very first census took place and, if recognized at all, enslaved Blacks were tabulated as dependents of White male heads of households. Not long after in 1787, Congress famously codified that Blacks are partially human in that they were counted as three-fifths of a White person. Black Americans would not be granted citizenship until the 1868 ratification of the 14th Amendment that legalized birthright citizenship for all people born in the United States (Andersen, 2021). Despite these constitutional rights, Blacks and/or those of immigrant heritage are repeatedly denied full recognition, as witnessed with propaganda-fueled refutation of even former President Barack Obama’s U.S. citizenship. “Birther” misinformation relied on more than opinions that the nation’s first Black president belonged to the wrong political group, but on the conviction that the son of a Kenyan immigrant did/does not belong in the highest ranks of U.S. society at all. These types of informational cues and demagogic messaging are rooted in anti-Blackness. Research links misinformed conspiracies about former President Obama’s birthplace to anti-Black racial animosity (Hughey, 2012; Pasek et. al, 2014; Tesler & Sears, 2010; Jardina & Traughitt, 2019).

There has seldom been a time in U.S. history when speech acts were not systematically employed in attempts to curtail the in-migration of specific people groups. The pattern becomes distinct when one ponders the “Yellow Peril” and the quotidian exclusion of Chinese immigrants in the 19th century, the Anglicizing imperatives that drove discrimination toward southern and eastern Europeans in the early 20th century, and the discourse of moral abhorrence and “culture of poverty” attached to those from the Global South, particularly Central American, Afro-Caribbean, and Sub-Saharan African migrants. The U.S. immigration landscape continues to depend on race-making, class constructions, and principles of “Americanness”. Throughout U.S. history, harmful immigration policy has relied on pseudoscience used to deny entry to all “inferior races” especially Blacks who were said to be doomed on account of the “Negroid strains inherent in their biological character” (Wang 1975, p. 61 as cited in Bashi, 2004). Political ideologies around American national purity continue to influence both immigration and information flows. So-called *All-American* identity motivates some Whites to oppose immigration, as posited by Mangum and Block’s (2018) studies linking American nationalism to anti-immigrant public opinion. American patriotic symbolism fortifies against those perceived to be *unAmerican* (Worrall, Ndumu, & Gerrido, 2022). This debate on immigrants’ assimilability is hardly new. Rather, it has dominated U.S. public consciousness for more than two centuries, and the notion of American cultural pureness coincides with legal utilitarianism (Ndumu et. al, 2023) along with tangential fixations with public welfare, disciplinary surveillance, and the management of illegality. “America-first” policy now relies on sophisticated information systems in determining immigrants’ admissibility and permanent residence. The weaponization of a century-old public charge rule and broader criminalization of immigration, including the overreliance on detention and custody, shape a uniquely anti-Black, nativist immigration policy landscape.

All the while, more information vendors are entering the immigration corporatization space. Legal research database firms such as LexisNexis and Thomson Reuters now partner with the U.S. Immigration and Customs Enforcement (ICE) to mine immigrants’ personal data (Lamban, 2019; Harwell, 2021). Demonstrably flawed big data risk management systems such as Palantir and Venntel are now used in deportation decision-making and immigrant surveillance, respectively. As of January 2023, the U.S. government requires asylum seekers at the U.S.-Mexico border to use the CBP One smartphone application to be granted an immigration hearing. Within days of launching, the system crashed and was critiqued by human rights groups for its privacy violations. These big data tools pose considerable threats for Black immigrants who are three times more likely to face deportation despite the fact that this population comprises just 5.6 percent (582,300) of the overall U.S. undocumented population. When detained in immigration facilities, Black immigrants report more instances of abuse and violence, as indicated by a coalition report’s findings that Black migrants account for 53% of all high-intensity and life-threatening abuse complaints (Goff et. al, 2022). The data on Black immigrants’ lived experiences paints a grim picture of structural, information-driven anti-Black racism in U.S. immigration policy.

**PROVOCATIONS**

The intersection of misinformation, anti-immigration policy, and anti-Black racism warrants greater attention within information science scholarship. Black diasporic immigrants all over the world and, as we argued here, in the U.S. and U.K. are uniquely penalized on account of misinformed ideologies around Black inferiority and criminality. We call upon the information science field to join advocates in decrying anti-Black racism in all of its forms, divest from the crimmigration industrial complex, as well as train emerging professionals to critique and redress information technologies, specifically, mass media and big data, that commingle Black diasporic immigrants with deviance and trespass.
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Tuning Out the Noise: Benchmarking Entity Extraction for Digitized Native American Literature

Parulian, Nikolaus Nova | Department of Library & Information Science, University of Illinois at Urbana-Champaign, USA | np2@illinois.edu
Dubnicke, Ryan | Department of Library & Information Science, University of Illinois at Urbana-Champaign, USA | rdubnic2@illinois.edu
Evans, Daniel J. | Department of Library & Information Science, University of Illinois at Urbana-Champaign, USA | ddj3@illinois.edu
Hu, Yuerong | Department of Library & Information Science, University of Illinois at Urbana-Champaign, USA | yuerong2@illinois.edu
Layne-Worthy, Glen | Department of Library & Information Science, University of Illinois at Urbana-Champaign, USA | gworthey@illinois.edu
Downie, J. Stephen | Department of Library & Information Science, University of Illinois at Urbana-Champaign, USA | jdownie@illinois.edu
Heaton, Raina | Department of Library & Information Science, University of Oklahoma, USA | rainaheaton@ou.edu
Lu, Kun | Department of Library & Information Science, University of Oklahoma, USA | kunlu@ou.edu
Orr, Raymond I. | Dartmouth College, USA | Raymond.I.Orr@Dartmouth.edu
Magni, Isabella | Department of Library & Information Science, University of Sheffield, UK | i.magni@sheffield.ac.uk
Walsh, John A. | Department of Library & Information Science, Indiana University, USA | jawalsh@indiana.edu

ABSTRACT

Named Entity Recognition (NER), the automated identification and tagging of entities in text, is a popular natural language processing task, and has the power to transform restricted data into open datasets of entities for future research. This project benchmarks four NER models—Stanford NER, BookNLP, spaCy-trf and RoBERTa—to identify the most accurate approach and generate an open-access, gold-standard dataset of human-annotated entities. To meet a real-world use case, we benchmark these models on a sample dataset of sentences from Native American authored literature, identifying edge cases and areas of improvement for future NER work.

KEYWORDS

Named entity recognition, machine learning, cultural analytics, Native American studies, HathiTrust

INTRODUCTION

Named Entity Recognition (NER), the identification and extraction of words representing named people, places, and groups, is a common and relatively accurate (Dekker et al., 2019) methodology in text and data mining. Across the humanities, NER-derived data has been used to make novel arguments about interpersonal relationships in Swedish literature (Kokkinakis et al., 2014), to trace how feminist ideas travel through novels (Moravec & Chang, 2021), and to study networks of day-to-day life contained in historical personal diaries (Fields et al., 2023). Outside of the humanities, NER is commonly used to mine research literature for new medical insights (Wang et al., 2020; Ramachandran & Arutchelvan, 2020), and to study manufacturing processes (Kumar & Starly, 2022) and marketing strategies in high-end fashion (Chilet et al., 2016). As NER continues to be a powerful part of many research pipelines used in cultural analytics (Piper, 2018; Underwood, 2019; D’Ignazio & Klein, 2020), we seek to understand which NER implementations are most effective under two particular conditions: 1) on texts digitized as uncorrected optical character recognition (OCR), which includes “noise,” and 2) on non-canonically literary texts, in this case, Native American-authored literature. To do so, we benchmark four common NER implementations—Stanford NER (Finkel et al., 2005), spaCy-trf (Transformer · spaCy API Documentation, n.d.), BookNLP (Bamman, et al., 2014), and Happy Transformer (About, n.d.) using a version of RoBERTa fine-tuned for NER (Hugging Face, 2023)—and report on accuracy and challenges. As practical research applied to a very common data type and benefitting an under-resourced textual community, this work directly addresses this year’s ASIS&T theme: “Making a Difference: Translating Information Research into Practice, Policy, and Action.”

DATA

In order to create a realistic, challenging, and open test dataset, we required a meticulous curation process. To aid in diversifying research in cultural analytics, we decided to use data derived from a workset created under the HathiTrust Research Center’s Scholar-Curated Worksets for Analysis, Reuse and Dissemination (SCWARed) project (HTRC, n.d.), which focuses on collections of digitized volumes assembled to foster cultural analytics research in traditionally marginalized or under-resourced texts. Co-authors Heaton, Lu, and Orr, scholars engaged in a larger cultural analytics project in Native American studies, assembled Native-authored literature, including memoir, folk tales, novels and poetry, available in the HathiTrust Digital Library. This set of digital volumes, a “workset,” was the source of our test data. As this study seeks to benchmark methodologies for NER extraction, we curated a sample dataset of sentences selected semi-randomly, a few from each volume, both to avoid copyright restrictions in releasing our data and to make manual review feasible. We assembled this dataset by avoiding pages at the start or end of a volume, identifying sentences with at least one entity (using the spaCy-trf implementation), and extracting the sentence containing the entity and the sentences before and after to make accuracy evaluation feasible. This culminated in a sample of 2,789 total sentences, 1,175 of which are known to contain at least one unique entity, while the other sentences contain the context for that sentence.
METHODOLOGY
Experimental Framework
Figure 1 illustrates the experimental design and framework used to evaluate various off-the-shelf named entity recognition (NER) prediction models on our sample dataset. The dataset was annotated by human annotators tasked with identifying and annotating entities in the sample sentences. The entity classes were Person (PER), Location (LOC), Organization (ORG), and Geopolitical Entity (GPE). We also tracked Miscellaneous (MISC) entities, as these could be relevant for future exploration (these entities will not be used for evaluation) and allow for disagreement amongst reviewers. These entity classes were chosen as the Stanford NER and RoBERTa implementations only tag these four classes, allowing for comparison across models. Each sample sentence was annotated by two annotators, yielding two sets of annotations for each sentence.

![Diagram](image.png)

Figure 1. Evaluation Framework of Named Entity Recognition Implementations

To ensure the accuracy and reliability of the annotations, the inter-annotator agreement at the sentence level was computed and used to create the benchmark entity dataset. Evaluating inter-annotator agreement helps reduce biases of any single reviewer as well as increase overall entity tagging accuracy. In order to assess the performance of various prediction models on our sample sentence dataset, the predicted entities generated by each model were compared to our benchmark dataset. We evaluated accuracy on two aspects: entity span detection and entity tagging accuracy—how well the algorithms detected the entity words in the text and how accurately the models assigned the correct entity labels to entities, respectively.

Named Entity Recognition (NER) Models
Overall, we evaluated four NER models. Stanford NER, one of the most popular NER implementations, first released in 2006 and being cited over 4,000 times, and BookNLP, a pipeline for entity identification and coreference optimized for book-length documents, represent two popular, established NER implementations. Newer approaches leverage large language models (LLMs), such as BERT (Devlin et al., 2018), which are predictive models trained on large amounts of text in order to better understand semantic meaning of language. To incorporate the very latest techniques, we evaluated two LLM-based implementations: spaCy-trf, which uses an out-of-box BERT transformer model, and a Python implementation of RoBERTa from Happy Transformer.

Human Review & Annotation
The human annotators played a pivotal role in creating the benchmark dataset for model evaluation. Annotators carefully reviewed each sample sentence and manually annotated the entities of interest. The annotation process was carried out rigorously to ensure accuracy and consistency in entity annotation. To minimize bias and ensure impartiality, we pre-populated half (50%) of the entity extraction results from all the models above as unknown entities (UNK), while the other half remained hidden for annotators to identify and tag. Two annotators independently annotated the same set of sentences, resulting in two sets of annotations for each sentence. Discrepancies between annotators were resolved through discussions and consensus-building, and final annotations were then used as the benchmark (gold-standard) dataset. Annotation consisted of five tasks: 1) review entity span, 2) tag unknown entities with specific classes, 3) tag and identify any untagged entities, 4) review and remove any erroneous tags, and 5) resolve overlapping, but not identical, entity spans.

RESULTS
Annotator Agreement
We annotated our dataset in two rounds, taking our annotator agreement evaluation method from Kolditz (2019), using mean F1 as our evaluation metric. Our first round of annotation achieved an overall F1 score of 0.616, as presented in Table 1. Among the different entity types, PERSON had the highest agreement score, with an average...
mean across documents of 0.770. On the other hand, GPE had the lowest agreement score due to numerous mismatches and disagreements during the annotation of LOC and GPE entities. We took this into consideration for the second round of annotation in order to establish a consistent standard for addressing GPE entities. Specifically, our definition of GPE includes not only geopolitical, but also social entities, encompassing not only geographical locations like states and cities, but also social groups like cultures, ethnicities, and tribes.

After the second round of annotation, we achieved an average F1 agreement score of 0.869. Reconciliation resulted in improvement for all missing entities and a more complete dataset, identifying almost twice as many total entities. The PERSON entity annotation achieved the highest agreement with an F1 score of 0.917, and highest occurrence, identifying 1,195 entities. Between rounds, GPE entities showed the most improvement, with an F1 score of 0.828. Overall, our annotated dataset yielded 2,309 human-verified entities, making this gold standard dataset useful for future benchmarking of off-the-shelf NER models.

**NER Results Versus Annotated Gold Standard**

We gathered the matched entities between pairwise annotations based on the second round of annotation. These labeled entities served as our gold standard for benchmarking the results of the off-the-shelf NER models. We then ran the four NER models on our sample datasets and compared their results to the annotator gold standard.

To evaluate the performance of the NER models, we checked the performance of entity span tagging, which identifies the location of the entity in the text. We compared how well the pre-trained NER models identified the entity location compared to the gold-standard data from human annotators, using accuracy (total correctness of all entity tags), precision (portion of correct entity predictions), recall (portion of total entities accurately tagged) and F1 score (harmonic mean of precision and recall).

Secondly, we compared the distribution of the NER matched span labels to the expected labels provided in the gold standard dataset, allowing us to assess how different prediction models matched our expected label criteria. It's important to note that we did not perform any fine-tuning or reclassification of the NER models used in this evaluation, so the results are based on the published models at the time of evaluation.

<table>
<thead>
<tr>
<th>NER Model</th>
<th>Accuracy</th>
<th>Precision</th>
<th>Recall</th>
<th>F1</th>
<th># Entities</th>
<th># Span Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanford</td>
<td>0.313</td>
<td>0.446</td>
<td>0.513</td>
<td>0.477</td>
<td>2,005</td>
<td>1,027</td>
</tr>
<tr>
<td>BookNLP</td>
<td>0.419</td>
<td>0.620</td>
<td>0.563</td>
<td>0.590</td>
<td>2,547</td>
<td>1,428</td>
</tr>
<tr>
<td>RoBERTa</td>
<td>0.366</td>
<td>0.654</td>
<td>0.454</td>
<td>0.536</td>
<td>3,332</td>
<td>1,506</td>
</tr>
<tr>
<td>spaCy-trf</td>
<td>0.413</td>
<td>0.729</td>
<td>0.488</td>
<td>0.585</td>
<td>3,463</td>
<td>1,680</td>
</tr>
</tbody>
</table>

Table 2. Span Tagging Performance

Table 2 presents a comparison of performance metrics for the four models. Among them, the Stanford NER model exhibited the lowest overall performance, with the fewest entities tagged (2,005). This could be attributed to the limited variation of entity types that the model recognized compared to the other models. Only 51.3% of the tagged locations from the Stanford NER model matched with the gold standard. Both the BookNLP NER and RoBERTa NER models performed similarly in terms of precision in detecting the gold standard annotations. However, BookNLP NER tagged far fewer entities (2,547) compared to Roberta NER (3,332), likely due to our exclusion of pronoun coreference detection from BookNLP, as our benchmarking focused on named entities. On the other hand, the spaCy-trf model demonstrated the highest precision overall, with 72.9% of the tagged entities matching the gold standard locations, and the highest number of entities tagged (3,463). However, in terms of F1 score, BookNLP NER achieved a higher score of 0.590 due to fewer false positives and higher recall.

The labeling performance of the different models compared to the annotator gold standard varied in the detection of different entity types (see Figure 2 for full results). First, all models showed good accuracy in detecting entities labeled as PERSON, though Stanford NER performed the worst, often misclassifying entities as LOC or ORG. Second, there were issues with confusion between LOC and GPE entities in all models. The Stanford NER model tagged LOC and GPE interchangeably, while BookNLP and spaCy-trf models exhibited confusion between these two entity types. This may have been due to relaxed definitions of LOC when used in the text context, such as referring to a physical place. Third, the RoBERTa NER model classified GPE entities interchangeably within LOC and MISC categories in our current implementation. Finally, BookNLP and spaCy classified some of the geopolitical and social entities that referred to GPE in our annotation as PERSON entities, with spaCy having its own targeted class of NORP. These differences highlight the need for further refinement and standardization of
entity type definitions to improve the consistency and accuracy of entity labeling in artificial intelligence models for our specific purpose of fitting with the gold standard. A link to our full data, annotations and NER implementations is included in the “Conclusion” section.

**LIMITATIONS**
First, we limited our project’s scope to Native American-authored literature sourced from the HathiTrust Digital Library. In selecting these texts, we recognize the uniqueness of this literary form amongst a general American canon and chose to center these works to promote diversity of study in cultural analytics (Mahony, 2018; Risam, 2015). Our choice to use Native American texts also introduced linguistic complications, as a subset of these are in Native languages and contain a significant threshold of OCR errors, and entity extraction is complicated by the ambiguity of how some Native entities, such as tribes, are classified by algorithms largely reflecting a colonial view of institutions. These errors affected our results (but are themselves a significant finding); still, we chose to limit our study to the English language and leave non-English analysis for future work.

Furthermore, in order to isolate entities for our annotation process, we used entity tagging from various NER models to provide baseline features. In order to comply with non-consumptive use, we created a dataset from random sentences across random pages in our texts. We recognize that this data is far from representative of the entirety of the whole volumes and publish this dataset in order to comply with legal precedent of non-consumptivity established in the Authors Guild v. Google legal settlement (Kowalczyk, et al., 2014).

Finally, our results reflect that we are a large team evaluating a unique genre of literature. We had many conversations defining the nuances of language as we annotated tribes and tribal leaders, while remaining cognizant of the sovereignty of Native peoples. We also debated colloquial and non-standard language use. While these issues might be easily surmountable by a lone scholar, we also appreciate that they led us as a team to fruitful conversations about the diversity of language and NER models as we worked through this study.

**FUTURE WORK**
For future work, first, we plan to further examine our results and models with more evaluation data. In particular, we want to apply our models to a comparative, non-Native-authored dataset to compare performance and entity results. We also intend to optimize our pipeline through using our gold-standard annotated dataset to fine-tune our NER models, where possible. Additionally, we plan further experiments with larger datasets in order to eventually derive entities from full worksets of volumes, unlocking Native-authored data for further study. Our existing work demonstrates NER models’ potential for transforming copyrighted data into publicly accessible derivative datasets, increasing scholarly accessibility and usability of previously unavailable data. Additionally, we release our dataset of sentences containing entities as well as our dataset of human entity annotations for use in evaluating and fine-tuning other NER pipelines from the broader research community.

**CONCLUSION**
This paper contributes an updated, state-of-the-art benchmarking of popular NER implementations over messy, OCR-derived data, identifying un-tuned BookNLP and spaCy-trf implementations as most accurate (F1). Much previous work has been conducted using hand-keyed or born-digital data that does not include OCR errors and is almost exclusively English-language materials resembling data for which the NER tools were optimized, leaving a gap in understanding of NER success for real-world data, and data that includes non-English characters and concepts. Further, we release our sample dataset and annotated, gold-standard entity dataset both for reproducibility, evaluation and for use in fine-tuning other NER models for future work, available on GitHub: https://github.com/htrc/tune_out_the_noise
Acknowledgments

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Older Adults’ Attitudes toward Digital Technology and Perceptions of Its Usefulness: Example of the City of Osijek, Croatia

Petr Balog, Kornelija Faletar, Sanjica Jakopec, Tomislav

Faculty of Humanities and Social Sciences, University of Osijek, Croatia | kpetr@ffos.hr
Faculty of Humanities and Social Sciences, University of Osijek, Croatia | sfaletar@ffos.hr
Faculty of Humanities and Social Sciences, University of Osijek, Croatia | tjakopec@ffos.hr

ABSTRACT

Digital technology has a great potential for assisting older people in their everyday tasks and general well-being. However, older adults are relatively slow to adopt the new technology and one of the obstacles may be their negative perception or perceived uselessness of the technology. The paper presents preliminary findings from a study into the attitudes toward digital technology and its perceived usefulness among the older adults in the city of Osijek, Croatia. Results show that majority of respondents have positive attitudes toward digital technology and majority perceives it as very useful. The study identified a number of factors, such as age, gender, education and quality of life that affect the respondents’ varying attitudes toward digital technology and its perceived usefulness. The research findings can help policy makers and local institutions such as libraries in designing digital literacy courses and provision of support to older adults.

KEYWORDS:

older adults, digital technology, perception, perceived usefulness, Osijek, Croatia

INTRODUCTION AND BACKGROUND

The increased life expectancy has led to the growth in size and proportion of older persons in the world population. According to World Health Organisation (WHO) the proportion of the world's population over 60 years will nearly double from 12% to 22% between 2015 and 2050 (WHO, 2022). In Europe, there were 21.1% of people aged 65+ in 2023 whereas Croatia was at 22.5% already in 2021(Eurostat, 2023). The latest census reported that the city of Osijek had the population of 75535 inhabitants whereas the number of inhabitants aged 65+ was 16823 or 22.3% (Croatian Bureau of Statistics, 2021).

Digital technology can have a great potential of assisting older people in their everyday tasks and activities, such as financial planning and connecting with friends and family. In addition, it can assist them in maintaining their health and independence (Geraedts et al., 2014) or increase their subjective well-being and life satisfaction (Hofer et al. 2019; Morris et al., 2012). However, digital technology cannot solve all problems connected with ageing. Some authors warn that older adults’ non-use of digital technology is purposeful and connected with cultural changes driven by technological innovation. Those changes will remain barriers to adoption unless new technologies are designed with sensitivity to values fostered through such experience (Knowles & Hanson, 2018; Vines et al, 2015).

Although there are obvious advantages of using new technology, the older generation is relatively slow to adopt it. In Croatia, for instance, only 28.0% of population aged between 65-74 used computers and 35.0% used the internet in 2019 (Croatian Bureau of Statistics, 2019). Several models and theories, such as Theory of Reasoned Action (Fishbein & Ajzen, 1975), Technology Acceptance Model - TAM (Davis et al. 1989) or Unified Theory of Acceptance and Use of Technology - UTAUT (Venkatesh et al. 2003) provide possible frameworks for the investigation of technology acceptance processes among older adults and indicate that acceptance of digital technology is affected by various psychological factors such as individual’s beliefs about technology, perceived need and usefulness of the technology for individual’s purposes. Researchers report the following barriers to older adults’ digital technology adoption: lack of knowledge, negative attitudes, age-related changes such as vision and hearing loss and fine motor difficulties, educational limitations, limited access to technology (Yazdani-Darki et al, 2020; Gitlow, 2014), fear of losing privacy, safety, increased isolation (especially in relation to the connection with family or acquaintances), or social stigma (Jo & Hwang, 2021; Vassli & Farshchian, 2017). A large percentage of senior citizens lacks awareness of the perceived benefits of digital technology, which is coupled with deep-seeded hesitations about its social value. This consequently leads to senior citizens’ unwillingness to purchase, invest time in and gain mastery over its use (Vroman et al, 2015). At the same time, there are studies that show that senior citizens want health-related technology that gives them independence, safety and security, allows them to socialize, manage their own health, and helps them in their daily activities. In order to adopt it, they need easily accessible support in using digital services and tailored training (Vassli & Farshchian, 2017, Enwald et al, 2016).

Since the understanding of older people's perception and attitudes toward digital technology is crucial for their subsequent adoption of that technology, this research provides insight into the attitudes and perceptions of older
adults in the city of Osijek, Croatia, towards the usefulness of digital technology in their everyday lives. The results presented here are part of the data collected within the EU project "Golden Age," funded by the European Social Fund.

**METHODOLOGY**

This paper presents a small portion of the preliminary findings obtained within the larger study on perceptions of and experiences with digital technology by older adults in the city of Osijek, Croatia. The focus of this paper is on attitudes toward and perceived usefulness of digital technology for the respondents’ everyday life activities. The term digital technology used in this paper refers to smartphones, personal computers, laptops, tablets, the internet and related services.

The study was motivated by the following research questions:

RQ1: What are the attitudes of older adults in the city of Osijek towards digital technology?
RQ2: How do they perceive the potential uses and usefulness of digital technology?
RQ3: Are there any differences in the attitudes and perceived usefulness of digital technology among respondents based on demographic characteristics?

Besides demographic questions (gender, age, education, living arrangement, marital status, and children) and a question about satisfaction with their life quality, the questionnaire contained 11 questions (open, closed, and 5-item Likert-type questions) about attitudes towards and perceptions of the usefulness of digital technology that were modelled according to the TAM model (Davis et al., 1989). The study was conducted from September through December 2021. The paper questionnaire was distributed to respondents at several locations in the city: in the local senior care home, at the local farmers’ market, and at workshops for senior citizens organized by a local non-profit organization. The data was analysed using statistical software SPSS (version 22), and statistical differences were calculated with the help of the chi-square and Kruskal-Wallis tests (for nonparametric group testing).

**RESULTS AND DISCUSSION**

A total of 188 respondents participated in the study: 52 (27.8%) male and 135 (72.2%) female. The average age of respondents was 74 (with the majority of respondents in the age category 65-74: n=86, 46.7%, followed by the age category 75-84: n=59, 31.4%) and all were retired. Some research participants retired earlier due to the nature of their profession (e.g. policemen, war veterans) or illness. Therefore, an additional age category was added (48-64 years) (n=17, 9.0%). The largest portion of participants had a high school degree (n=91, 48.4%) and children living in Osijek (n=120, 63.8%). Only 27.1% had children living somewhere else in Croatia (n=51) and 20.7% had children living abroad (n=39). A large majority of respondents (n=137, 72.9%) indicated that they were satisfied with the quality of their lives.

Respondents, particularly the oldest ones (85+), were rather concerned that digital technology contributed to social alienation and obviously preferred physical contact, but, at the same time, did not reject digital technology. They tended to agree with positive statements about digital technology and disagree with negative. They agreed that digital technology would gain importance in the lives of older adults and that it would be fun to learn to use digital technology. Statistically significant differences were observed for age, education, living arrangement, marital status, residence of children, and quality of life. No differences were found for gender. The oldest respondents (85+), those with the lowest level of education (primary school), and single individuals perceived themselves to be too old to learn how to use digital technology. The oldest respondents (85+) and those with the lowest educational level mostly did not see any use of digital technology in their life. Respondents whose children lived outside of Osijek (either in Croatia or abroad) were more likely to report that they could not afford digital technology, that nobody could teach them how to use technology, and to express fear of technology. They were also more likely to believe that it would be fun and useful to learn how to use digital technology. Respondents with the highest level of education, who were living with a partner, were more likely to know other older adults who used digital technology. Respondents who perceived technology as useful, did not believe they were too old to learn how to use it, and whose friends also used digital technology were more likely to be satisfied with the quality of their lives (see Table 1).
Table 1. Attitudes toward digital technology

Table 2 illustrates uses and usefulness of digital technology as perceived by respondents. Mean values indicate that possibility of communicating with friends and family, accessing medical emergency services and performing everyday activities which would normally involve time-consuming and physically exhausting queueing were perceived as most useful uses of digital technology. Least use was perceived for operating appliances, planning healthy meals or playing games. Age and quality of life seemed to have the highest effect on the positive perception of usefulness and resulted in many significant differences. Other factors included gender, education, and children’s place of residence. No difference was indicated for living arrangements and marriage status. Although almost all respondents seemed to agree that the digital technology was useful for free (video) communication with family and friends, it was seen as slightly more useful by respondents with secondary school and for those respondents whose children lived abroad. The usefulness of digital technology for financial transactions was regarded in the highest degree by the youngest respondents (aged 48-64) and those whose children lived abroad. The oldest respondents in the sample, in general, failed to see the usefulness of the digital technology, and it was particularly visible in their reluctance to use digital technology to connect with peers, operating appliances at home, planning healthy meals or playing games for entertainment. The youngest respondents seemed to be most appreciative of the gaming and entertainment aspect of digital technology. The most educated respondents seemed to appreciate the usefulness of technology for monitoring one’s physical activity more than other respondents. Respondents who perceived technology to be useful for communication, performance of activities online instead of queueing, keeping track of their obligations, connecting with peers with similar interests and performance of financial transactions were more likely to be satisfied with the quality of their lives.
### Table 2. Perceived usefulness of digital technology

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Gender</th>
<th>Age</th>
<th>Education</th>
<th>Residence of children</th>
<th>Quality of life</th>
</tr>
</thead>
<tbody>
<tr>
<td>have (video) communication with my family and friends for free</td>
<td>3.99</td>
<td>$\chi^2=7.861$, p=0.049</td>
<td>$\chi^2=4.259$, p=0.039</td>
<td>$\chi^2=17.209$, p=0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>be connected with medical emergency services</td>
<td>3.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>perform activities for which I normally have to wait in queue</td>
<td>3.60</td>
<td>$\chi^2=4.300$, p=0.038</td>
<td></td>
<td>$\chi^2=15.959$, p=0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>remind me of my obligations</td>
<td>3.34</td>
<td>$\chi^2=9.677$, p=0.022</td>
<td></td>
<td>$\chi^2=17.292$, p=0.033</td>
<td></td>
<td></td>
</tr>
<tr>
<td>connect with my peers with similar interests</td>
<td>3.18</td>
<td>$\chi^2=9.753$, p=0.021</td>
<td></td>
<td>$\chi^2=10.750$, p=0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>perform financial transactions</td>
<td>3.09</td>
<td>$\chi^2=15.842$, p=0.001</td>
<td>$\chi^2=4.591$, p=0.032</td>
<td>$\chi^2=5.012$, p=0.025</td>
<td></td>
<td></td>
</tr>
<tr>
<td>monitor my physical activity</td>
<td>2.97</td>
<td></td>
<td></td>
<td>$\chi^2=8.172$, p=0.043</td>
<td></td>
<td></td>
</tr>
<tr>
<td>operate (remotely) appliances or systems in my home</td>
<td>2.90</td>
<td>$\chi^2=11.880$, p=0.008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plan healthy meals</td>
<td>2.60</td>
<td>$\chi^2=8.595$, p=0.035</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>play games for entertainment</td>
<td>2.47</td>
<td>$\chi^2=15.650$, p=0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSIONS**

Since various authors agree (Davies et al., 1989; Venkatesh et al., 2003; Enwald et al., 2016) that positive attitudes toward and perceived usefulness of digital technology are important for its adoption, the goal of this paper was to investigate the attitudes toward and perceived usefulness of digital technology among older adults in the city of Osijek, Croatia. Using quantitative methodology, we surveyed a total of 188 older adults, and this paper presents only a portion of our preliminary findings.

The majority of respondents in our sample had positive attitudes toward digital technology (RQ1). Digital technology was seen as rather useful for a number of purposes, such as communication, medical emergencies, avoiding queues, keeping track of obligations, or connecting with peers with similar interests (RQ2). Our results also indicate that many factors affect attitudes toward and perceptions of the usefulness of digital technology. The most significant factor is age, while other factors include gender, education, marital status, living arrangements, residence of children, and quality of life (RQ3).

The oldest respondents in our sample (85+), those with the lowest educational level, and those who were single (unmarried or widowed) were more likely to have negative attitudes toward digital technology. Additionally, the oldest respondents failed to see the usefulness of technology for various everyday transactions, such as paying bills or avoiding queues. Respondents whose children lived outside of Osijek were more likely to express fear of technology, think that it was too expensive, or believe that nobody could show them how to use it. Respondents with a positive perception of digital technology's usefulness were more likely to be satisfied with the quality of their lives (RQ3).

Although our findings cannot be generalized due to our limited sample, they contribute to the general understanding of older adults' perception of digital technology. On a practical level, they can serve as evidence-based guidelines for creators of social policy in Osijek, digital service providers, and local institutions such as libraries in the provision of digital literacy courses and support for the growing population of older adults. Although the analysis of our data has not been completed yet, and a qualitative study is underway, our preliminary findings suggest that proactive and timely engagement of decision-makers and information professionals is required, targeting older adults (85+), those with lower education levels, those living in single households, and those whose children live outside of Osijek. Since digital technology has become a prerequisite for normal functioning and active participation in modern society, we must find a way to communicate the benefits of digital technology to non-users and prevent their social and digital exclusion.

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Polkinghorne, Sarah  
RMIT University, Australia | sarah.polkinghorne@rmit.edu.au

ABSTRACT
This paper brings concepts from social practice theory into conversation with the question of how information practices relate to one another. In doing so, this paper speaks to the persistent challenge of articulating interconnections among information practices. To illustrate these interconnections, the paper presents the concept of embodied mutual constitution, which results from a recent empirical study of everyday information practices. This concept holds potential as a next step in identifying how multiple co-existing information practices can be explored. By contributing in this way to the advancement of information practices theory, this paper supports our expanding understanding of the nature and role of information in diverse life experiences.

KEYWORDS
Information practices, everyday life, embodiment, practice theory, qualitative research

INTRODUCTION

McKenzie’s model of information practices in everyday life (2003) is often acknowledged as an early landmark in the study of information practices (Savolainen, 2007). In the intervening twenty years, researchers have found it persistently challenging to articulate, describe, and explain interconnections among multiple practices. Savolainen’s observation (2007), that “researchers have encountered difficulties in trying to draw clear boundaries” between information practices and related concepts, remains true today (p. 125). The question of interconnection is important for information science (IS) researchers who consider information practices to be a conceptual key to understanding information experiences in holistic, non-individualistic ways (Polkinghorne & Given, 2021), as sites where “social forces, people, and technologies fuse together” (Floegel & Costello, 2021, p. 3). Being able to describe how information practices intertwine and interrelate is critical to the operationalization, and the enduring distinctiveness and value, of the concept of the “information practice.”

Fortunately, insights are available from social practices theorists. They do not offer a single, simple answer, but in social practice theory the question of how to articulate multiple practices continues to be a topic of active discussion. Understanding practices as “embedded in routines and connected to a multitude of other practices” has been taken up by multiple theorists (Castelo, Šaifer, & Silva, 2020), several of whom have already appeared in IS literature (e.g., Bourdieu, 1984; Giddens, 1984; Reckwitz, 2002; Schatzki, 2002).

The purpose of this paper is to contribute to the advancement of information practices theory. It does so by bringing selected insights from social practice theory, particularly the work of Castelo et al. (2021), into conversation with findings from a recent empirical study documenting embodied information practices in people’s everyday food lives. More specifically, this paper introduces and describes the concept of embodied mutual constitution as a next step in exploring how to articulate the interconnectedness of information practices. By considering the mutual constitution of information practices, we can begin to examine the nature of the relationships among them. Doing so will enrich the contributions of information practices research to our field’s expanding understanding of the nature and role of information within diverse life experiences.

BACKGROUND

Information practices: definitional work continues

Zhong, Han, and Hansen (2023), in a systematic review of information practices research, note that “researchers have not reached a consensus about the notion of information practices” (p. 246). The discussion around “information practice” has generally focused less on defining it, and more on distinguishing it from the more predominant “information behavior” (Savolainen, 2007, p. 126). In charting the emergence of the information practice, Savolainen (2007) observes that it represents “an alternate viewpoint” to the “dominating discourse on information behavior” (p. 126). “Information practices” came into wider intentional use in the early 2000s through several key works including Savolainen, writing about “everyday-life information-seeking practices” (1995); McKenzie, studying the information experiences of women pregnant with twins (2003); Tuominen, Savolainen, and Talja, characterizing information literacy as a sociotechnical practice (2005); Talja and Hansen, exploring information sharing as practice (2005); Talja, applying a domain analytic approach (2005); Veinot, examining the workplace information practice of hydroelectric vault inspection (2007); Savolainen, expanding the concept of everyday information practices (2008); and Lloyd, bringing social practice theory, particularly Schatzki’s site ontology, into the exploration of information literacy practice (2010). McKenzie (2003) articulates concerns with human information behavior (HIB) research that, in part, have fueled interest in information practices: namely, the
tendency of HIB research to focus on conscious information needs, its reliance on settings such as workplaces, and, echoing Savolainen (1995), its overall emphasis of individual, cognitive processes of information seeking.

More recently, an increasing number of researchers have chosen the terminology of information practices for studies of domains that have been relatively underexamined within LIS, such as the embodied experiences of being transgender (Huttunen, Hirvonen, & Kälkönen, 2020), the experience of navigating social and structural barriers (Kitzie, Wagner, Lookingbill, & Vera, 2022), and the strategies contained in people’s own narratives and terminologies (Willson, 2022). These studies share a commitment not only to understanding information activities in social contexts, but to understanding them as practices, marked by a “continuity and habitualization of activities affected and shaped by social and cultural factors,” as Savolainen puts it (2007, p. 26). Although ambiguity remains around the definition of “information practice,” in part because the term has entered the field from different theoretical perspectives, there is growing familiarity with the term’s conceptual intentions. At the same time, widespread uncertainty remains around how to proceed with analysis of multiple information practices.

**Information practices, plural?**

Over the past twenty years, there have been examples of researchers addressing the challenge of multiple information practices. McKenzie (2003) again provides a foundational example. She reflects on how naming and listing information practices within people’s accounts of information seeking has “the disadvantage of obscuring the complex ways that the components interacted in participants’ actual accounts” (p. 36). In other words, McKenzie is considering how an information practices approach can avoid portraying people’s experiences reductively. She includes in the paper “some longer examples [of participant accounts that] serve to show how fluidly the practices move from one to another within descriptions, and how a single connection/interaction can be described by a variety of information practices” (p. 37). In doing so, McKenzie models one approach to representing interactions among information practices, which is to give space to participants’ own words to convey these interactions.

Other examples reflect awareness that information practices cannot be analyzed in isolation. Talja and Hansen (2006), studying collaborative information activities, stress that such activities cannot be separated from others. They “are best captured by naturalistic research that pays attention to the dynamic interplay of work practices, information practices, and information technologies in everyday settings” (p. 116). In the school context, Sundin and Francke (2009) highlight how user-centred, collaborative information resources, and their popularity in educational settings, correspondingly increase the need to understand how learning practices and information practices intertwine (para. 2). Lloyd (2010), focusing on information literacy, frames it as “a dispersed practice that hangs together as a bundle of information focused activities that are constituted within larger integrative practices” (p. 249). These examples illustrate that information practices are always shaped by context, including related practices. However, few strategies for engaging directly with this multiplicity have been offered within the literature to date.

**Social practice theory: starting points for multiplicity**

We can look to social practice theory (SPT) for ideas on which to base a discussion of how to understand interwoven information practices. At the same time, as Cox (2012) observes, the question of multiple practices also remains a persistent challenge in social practice theory: “The practice approach asks us to look at concrete mechanisms through which practices interconnect or compete […] The question of how some practices may shape or ‘anchor’ others becomes acute” (p. 183). It is a tenet of SPT that practices do not exist in isolation from one another (Schatzki, 2009). Social practice theorists have proposed a range of concepts to convey this inherent interconnectedness; examples include the field (Schatzki, 2005), network (Higgison, et al., 2015), constellation (Schatzki, 2011), ecologies (Kemmis et al., 2012), and bundles (Shove et al., 2012). At the same time, as Hui (2016) has discussed, most SPT studies also wrestle with the operationalization of these concepts.

Fortunately, we can draw upon works of SPT that focus on analyzing multiple practices. Castelo et al. (2021), extending the work of Nicolini (2009, 2012) and others, provide a standout model of a way forward, with their case study on food practices. They take the practice of eating as a starting point, which like many information practices may seem familiar and straightforward, but only at first. Castelo et al. begin by deciding that their analysis will “follow” the “carrier” (as people enacting practices are sometimes called in SPT) (p. 3). This means that their analysis originates with one practice, and then traces its relations “wherever it leads, appears and/or produces notable effects on others” (p. 3). They then operationalize Nicolini’s approach of “zooming in” and “zooming out” on practices (2012). As Castelo et al. “zoom in” on eating, they begin by defining the practice, and then articulate its internal elements (p. 4). From there, they examine its variations in spatial, temporal, and social dimensions (p. 4). These examinations enable them to articulate how the practice of eating is shaped by its setting and context.

Castelo et al. (2021) then “zoom out” to examine connections between eating and other practices. They introduce three forms of interconnection in order to operationalize “zooming out” (p. 5), ordered “from closer to more distant relations” among practices: complexes, bundles, and nexuses. Complexes of practices are “bundled together in ‘stickier’ forms of co-dependence” (p. 5), meaning that they cannot be understood in isolation from one another. As
a practice, eating at home is inseparable from practices of acquiring, transporting, and preparing food. Bundles of practices are “linked, but not entirely, strictly, or necessarily co-dependent on each other to happen or co-exist” (p. 5). Practices within a bundle may compete for and influence one another in time and space, such as how eating practices and childcare practices can relate to each other (p. 5). Nexuses have practices at the intersection of other practices. Castelo et al. use the example of mobility to illustrate nexuses; mobility practices connect many other practices, including shopping, cooking, and dealing with waste, which all relate to eating (p. 6).

The final step in Castelo et al.’s approach is to examine how practices influence one another. This step involves exploring the interlinking of practices through their “cultural-discursive, material-economic and socio-political arrangements” (p. 6). In other words, complexes, bundles, and nexuses must ultimately be examined within larger social structures such as class, gender, and political economy. The concept introduced in the following sections of this paper, embodied mutual constitution, picks up the work of Castelo et al. and builds on it to propose co-constitution as a lens for unpacking interconnected information practices, specifically.

EMPIRICAL CONTEXT & METHODS
The concept presented in this paper as a step toward analyzing how information practices interconnect, embodied mutual constitution, results from an interpretivist, qualitative study of everyday-life information practices (Polkinghorne, 2021). The study’s purpose was to explore everyday information practices in pursuit of a basic human need: to feed one’s self and one’s inner circle. Using Reckwitz’s definition (2002) of practices as clusters of cognitive and emotional experiences, know-how, bodily routines, and interactions with the physical world, the study documented people’s food-related information practices. Participants, 14 in total, were recruited initially for maximum variation, and later, for emerging theoretical needs (Emmel, 2013). Participants were recruited in both urban and rural communities in Canada. They ranged in age from twenty (20) to seventy (70), and had diverse living situations, varying from a one-bedroom, city-centre apartment to a farm with a large garden and orchard.

The study also aimed to explore the embodied elements of information practices. As such, data collection followed Pink’s sensory ethnography (2015); this approach involves sensitizing ethnographic techniques to people’s embodied experiences, which are often tacit or unexamined. In the first phase of data collection, each participant sat for a semi-structured, audio-recorded interview at a location they chose. The interviews asked participants to describe their food lives, including meaningful information sources, and to narrate an “ordinary” and an “extraordinary” day. Interviews ranged in length between 35 and 103 minutes.

After each interview, participants chose a location for a “video tour.” A video tour is a participant-centred, semi-structured encounter where the participant leads the researcher around a place, or through an activity. The researcher asks prepared and unscripted questions throughout, to elicit verbal observations. The video tour approach draws on existing mobile methods including “guided tours” (Thomson, 2018) and “walk-throughs” (Polkinghorne, Given, & Carlson, 2017). Whereas the semi-structured interviews involved “talking about food,” the video tours were “doing something related to food.” Participants chose a place or activity that was meaningful to their food life. Most participants chose their own home, often undertaking an activity such as cooking, baking, or harvesting. Other participants chose private businesses (e.g., a café) or public (e.g., City Hall market) spaces. The video tours ranged in length between 47 and 104 minutes.

The data resulting from these participant interactions were analyzed using constructivist grounded theory, which can be beneficially paired with ethnographic data collection in exploratory studies like this one, with a focus on everyday phenomena and processes (Charmaz, 2014, p. 38). The study finds nexuses of information practices supporting four broader practices, which are: learning about good food (trial and error being the predominant information practice here); maintaining social connections (with information practices such as family food secrecy); exercising moral reasoning (with information practices such as studying where food comes from); and drawing on bodily meanings (characterized by kinetic and sensory information practices). As these findings were identified through analysis, they were accompanied by a recurring, overarching theme of embodied mutual constitution. This led to the development of embodied mutual constitution as a proposed explanatory concept resulting from the study.

DISCUSSION: EMBODIED MUTUAL CONSTITUTION
The data created in this study demonstrate that participants continually enact and adjust their information practices through their food practices, and vice versa. These interrelations can be traced with Castelo et al.’s approach of following lead practices (2021), which in this study are information practices. As in other disciplines, mutual constitution conveys the co-constructing nature of experiences or structures that have often been isolated within predominantly positivist social science research (cf. Markus & Kitayama, 2003, in psychology; Copley & Morris, 2020, in political science). Out of this study, situated in information science, the concept of embodied mutual constitution is proposed. It is defined as the quality of continuous reciprocal influence between information practices, and between information practices and other practices. The modifier embodied emphasizes the finding that information practices always have some sensory or physical dimension (Reckwitz, 2002).
A rich example can be found in participant Tanya’s description of her experience learning to cooking gluten-free pasta. Tanya is 30 and describes herself as Métis, a mother of two, and an academic librarian. Having been diagnosed with celiac disease at a young age and therefore unable to eat wheat or gluten, Tanya describes the process of informing herself about what pasta is “supposed to” taste like. She relies on multiple information sources, including the abundance of options at the supermarket, as well as her family, who let her know whether (or not) her pasta-cooking attempts are successful. She is also informed by her own embodied experiences of different gluten-free pasta options. Tanya observes, “corn pasta tastes really good, but on the second day, it doesn’t, so much, because it gets that crunchy kind of taste to it. Whereas quinoa pasta’s pretty tasty, and it holds up in the fridge, which is nice. Usually if I’m at a grocery store now, there are so many brands, that I just try one.” Tanya’s food practices here involve cooking, eating, and feeding her family the best gluten-free pasta she can find. The leading embodied information practice existing in a complex with these food practices is trial and error, which leads her to try different gluten-free pastas and recipes in a quest to determine which option is best.

In addition to information practices such as trial and error, the participants in this study also enact their identities, and how they negotiate life within larger social systems such as class, health, and the family. Participants rarely set out to develop information practices for their own sake; rather, they develop information practices as part of doing, being, or accomplishing something. At the same time, information practices are not solely functional or supportive, but are co-constitutive with other everyday practices, mainly in complexes (e.g., feeding ourselves) but also in nexus relationships (e.g., learning, decision-making, relating to others, being in our bodies). The social production of identity has a large body of scholarship surrounding it, including landmark theoretical work such as West and Zimmerman’s “Doing gender” (1987), which illustrates how elements of identity benefit from being understood as practices. West and Zimmerman explain gender as “the activity of managing situated conduct in light of normative conceptions of attitudes and activities” (p. 127). In other words, an element of identity such as gender is a practice requiring bodily arrangements with reference to socially-constructed norms.

Overall, this study finds that people develop information practices in nexus relationships to broader practices of becoming and being who they are. Embodied information practices support identity practices, such as being celiac, being a family member, being independent, being someone who has moral priorities, and being healthy. All of these practices rely upon information practices that enable people to make decisions, take action, and understand themselves in relation to others. To extend the above example, Tanya constructs her identity as a person with celiac in large part through the everyday information practices she uses to keep informed about gluten-free food options.

The concept of mutual constitution has come under critique for “fuzziness.” Haggis (2009), writing in education, argues that “the desire to express mutual co-specification can result in an extremely generalized articulation of ‘things working together’ […] The attempt to create a sense of interrelatedness, dynamic construction and change through time arguably works to fragment each unit of analysis at the same time as it tries to create it, leaving only a vague sense of mutual co-specification” (pp. 47-48). This is a valuable caution. At the same time, the state of our information practices discourse lends current value to embodied mutual constitution for information science. It draws attention to the nature of interconnections between information practices, and makes a start at articulating the nature of these interconnections.

Researchers can apply, test, and extend embodied mutual constitution by articulating specific practices within a given context, and then tracing how these practices intertwine and influence one another, drawing on Castelo et al.’s gradation of complexes, bundles, and nexuses as appropriate. Information science researchers can also analyze the role of larger structures within a context under study, such as gender and class, and how people’s information practices are influenced by these structures. In these ways, information science researchers can mitigate potential “fuzziness,” and move toward more precise understandings of people’s information practices in context.

CONCLUSION

Savolainen’s 2007 observation still rings true, that “the number of researchers advocating the concept of information practices has remained small, and the discourse community interested in the concept is likewise also small” (p. 125). Information behavior continues to predominate, and most studies that use the terminology of information practices do so without reflecting grounding in any form of social practice theory (Zhong, Han, & Hansen, 2023). Despite these challenges, the conceptual potential of information practices to advance studies of human information experiences is very important. The concept of practices opens up new meanings; activities “often analysed from a behavioural perspective […] look different and reveal new sides when looked at as part of the social negotiation of meanings” (Talja, Tuominen, & Savolainen, 2005, p. 91). This paper has contributed to this ongoing project of opening up new perspectives and meanings, and to the continuing emergence of the concept of information practices, by introducing the explanatory concept of embodied mutual constitution to information science.
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ABSTRACT

While accessibility is a core part of diversity, equity, inclusion, accessibility, and social justice (DEIASJ) considerations, disability and accessibility are rarely centered in Library and Information Science (LIS) curricula. The lack of disability and accessibility coverage is problematic since information professionals must have the required knowledge and skills to effectively serve patrons with disabilities. This paper presents preliminary findings from a content analysis of 39 pre-filtered syllabi examining how disability and accessibility topics are covered in LIS courses. While nearly all of the syllabi analyzed contained a high level of detail, only 13 were ultimately determined to contain a “partial” depth of coverage of disability- and accessibility-related content and two a “detailed” level of coverage. Even fewer syllabi included a conceptualization of disability or accessibility beyond simply including the words alone. The paper offers suggestions for LIS instructors to better address disability and accessibility within their syllabi and course content.

KEYWORDS

LIS curricula; Accessibility; Disability; Usability; User-Centered Design

INTRODUCTION

Over the past few years, library and information science (LIS) academic programs have been working to address systemic bias within the field and to improve their coverage of issues related to diversity, equity, inclusion, accessibility, and social justice (DEIASJ). While accessibility is a core part of DEIASJ considerations and the American Library Association (ALA) values (ALA, 2019), disability and accessibility are seldom covered in LIS courses (Alajmi & Alshammari, 2020; Ren et al., 2022). Moreover, scant comprehensive research exists examining what is – and is not – covered in LIS courses that address disability and accessibility as it applies to disability.

In this paper, we present preliminary findings from a content analysis of 39 syllabi examining how disability and accessibility topics are covered in LIS courses. Our analysis considers the following exploratory questions:

- How do the syllabi differ by the level of detail provided?
- How do the syllabi differ by the amount of disability and accessibility coverage?
- What specific disability and accessibility issues or concepts are addressed in the syllabi?

We first summarize prior research on syllabi reviews within LIS, especially reviews related to DEIASJ. After briefly describing our data collection and analysis approach, we discuss each question in detail and offer preliminary suggestions to integrate and emphasize disability and accessibility topics within LIS syllabi and course content.

BACKGROUND

Scholars have analyzed LIS curricula to determine how programs teach diversity, equity, and inclusion values (Alajmi & Alshammari, 2020). While these values are essential for the field, foundational and required LIS courses seldom cover services to diverse populations (e.g., culturally, ethnically, and racially diverse communities) (Maestro et al., 2018). To serve diverse populations, students seek electives within and outside a program (Ren et al., 2022).

In particular, students aiming to serve disabled patrons may struggle to find courses addressing accessibility. According to previous content analyses of LIS syllabi, only nine courses covered disability (Alajmi & Alshammari, 2020), and eleven addressed accessibility or ability (Ren et al., 2022). However, such analyses only give a cursory look at how disability and accessibility are covered, as these studies have typically only coded for the presence of topics within a course without examining the specific details. For instance, when Ferati and Vogel (2020) reviewed 14 syllabi to determine how often accessibility for disabled users is covered in Web development courses, the authors simply reported that “usability and accessibility” are covered in two syllabi without providing further detail.

A lack of detail in both accessibility-related syllabi and syllabi analyses is common for LIS courses covering social justice topics. For example, Alajmi and Al-Quallaf (2018) and Alajmi and Alshammari (2020) reviewed diversity-related courses’ titles, descriptions, learning objectives, modules, and readings. However, the authors did not detail...
the coverage within those sections. Similarly, Ren et al. (2022) analyzed 28 LIS syllabi to assess their coverage of diversity topics, sharing that courses’ calendars lacked specific coverage details (e.g., “Community-Based Programming,” “Defining Cultural Competence,” and “LIS Meets Social Work: Best Practices and Lessons Learnt”). Accordingly, the present study elaborates on previous scholarship by exploring the detail offered in accessibility-related LIS syllabi and how disability and accessibility topics are covered.

**DATA COLLECTION AND ANALYSIS**

This paper analyzes syllabi collected from 20 North American LIS programs belonging to the Association for Library and Information Science Education (ALISE), American Library Association (ALA), and/or iSchools Consortium. This analysis builds on a previous study, where the full collection procedure and selection criteria for gathering syllabi are described (Mallary et al., 2023). While over 200 courses were initially identified as potential candidates to collect syllabi from 2020–2022; however, five courses were taught between 2018–2019, and six were undated.

Of the 75 syllabi initially collected, 39 were selected for this analysis due to the presence of one or more of the following keywords or terms: “accessibility,” “disability,” “information access,” “Universal Access,” “Universal Design,” “usability,” or “User-Centered Design.” These terms were selected due to our previous familiarity with LIS curricula and research (Alajmi & Alshammari, 2020; Guedes & Landoni, 2020; Jia et al., 2021; Mulliken, 2016; Ren et al., 2022; Shinohara et al., 2018). To address our three exploratory questions for these syllabi, we employed a qualitative content analysis approach (Drisko & Maschi, 2015).

We first considered the level of detail present in each syllabus, iteratively developing a simple categorization schema of “low,” “medium,” and “high” detail. “Low” detail syllabi typically only contain a course’s description and objectives, with some potential additional categories such as high-level assignment overviews. Syllabi with “medium” detail typically include features such as a list of topics and required materials, along with the course’s description and objectives. Finally, possessing a detailed course schedule was the determining factor in categorizing syllabi as having a “high” level of detail. Detailed course schedules typically contain a combination of elements, including module topic names, module-specific materials, and module assignments. Other elements, such as guest speaker information, may also be included. While some elements, including materials and course topics, may also be covered elsewhere in the syllabus, these elements are typically more general when found outside the schedule. For example, a “Course Materials” section may only list a single required textbook, while the “Course Schedule” of the same syllabus may also include a list of articles attached to each module.

We next considered the depth of coverage of disability and/or accessibility-related content indicated within each syllabus. Syllabi categorized as “surface” coverage include at least one topical keyword but contain no other detailed coverage. “Partial” coverage syllabi contain at least one of the following: a named module on the topics of disability and/or accessibility, a course material that directly references disability and/or accessibility, and/or a distinct course topic on disability/accessibility (typically found in a list among many others). “Detailed” coverage courses contain disability and/or accessibility as the major or only focus of the course. We additionally created an “unclear” category for syllabi that we felt unable to fully assess (see “Findings and Discussion” section).

At the same time, we examined each syllabus for direct references to disability and accessibility-related keywords. The easiest concepts to identify were direct uses of words such as “accessibility,” “ability,” “disability,” and “disabled.” (“Access” was quickly excluded from analysis, as we found it can be too ambiguous; referring to concepts including “information access” more broadly, access to collection materials, or even technical issues related to cataloging practice.) We used prior familiarity and course context to identify other related concepts, such as specific terms related to disability (e.g., “Spoonie”) and particular disabilities (e.g., “Mobility impairments”).

**FINDINGS AND DISCUSSION**

Each of our three exploratory questions yielded findings with implications for how LIS instructors might better feature disability and accessibility within their own courses and syllabi. We discuss each question below, followed by a discussion of some limitations and implications for future work.

**Level of Detail in Syllabi**

An ongoing limitation of this study, and syllabi studies more generally, is that many LIS courses that significantly cover these topics may not be sufficiently analyzed due to a lack of relevant detail within the available syllabus. We were initially surprised by how many of the 39 syllabi had a “high” or “medium” (n = 33) amount of detail to analyze. However, this ratio may be primarily related to our data collection approach rather than a generalizable observation about LIS courses that cover disability and/or accessibility. That is, more detail in the syllabus also provides increased opportunities for a match to the keywords used to assess the relevance to disability and/or accessibility at a document level. Some programs also seem to have shared norms around the detail included in...
syllabi, as well as around making syllabi publicly available, leading to many detailed syllabi being analyzed from the same LIS programs. Only eight distinct institutions were represented, with all but one providing multiple syllabi.

This outcome also has the positive effect of allowing us to do a more meaningful analysis of the content of these courses and to assess how disability and/or accessibility are covered more accurately. While syllabi analyses may be artificial and constrained, the experience echoes students’ review of current and prior syllabi to assess course and instructor selection; students may even use a similar “word search” analysis to look for relevant terms and concepts. This process is especially important for students who select courses to fill a limited number of elective hours.

Accordingly, we argue that instructors aim to include as much relevant detail as reasonably possible in syllabi about their coverage of disability and accessibility. This detail serves two important functions: (1) providing students with more information to make an informed decision about which courses to take, and (2) raising awareness of the importance of disability and accessibility in LIS for both students and fellow educators.

**Level of coverage of topics**

Similar to previous research on DEISJ courses (Alajmi & Alshammari, 2020), only two of the syllabi indicated that disability and/or accessibility were a major or sole focus of the course. This result is unsurprising, given previous research that this content is rarely considered a “foundational,” or even “required,” part of LIS curricula; this content is typically found in elective courses, where in-depth coverage is more supported (Ren et al., 2022).

On close analysis, 11 syllabi were determined only to contain surface-level references to the keywords. We found some disconnect between course goals and implementation: one “surface-level” syllabus contained a course objective mentioning “accessibility” and another syllabus contained a reference to “ability” in the course description, but neither contained clear content on the course schedule related to disability and/or accessibility. An additional seven of these syllabi included shared program-level objectives related to our keywords, but the course did not engage with these topics deeply. Accordingly, while program-level objectives are valuable, it may be worth evaluating the effectiveness of such objectives for integrating specific topics related to disability (and accessibility in the context of disability), and DEISJ more broadly, into individual courses – and, thus, into the program as a whole.

Another 13 syllabi were coded as having an “unclear” level of coverage. These syllabi fell into two general categories: (1) syllabi that simply contained too little detail (n = 5), and (2) syllabi that heavily incorporated “usability” and/or a “user-centered” focus but made no direct reference to disability or accessibility (n = 8). We believe disability and/or accessibility may be considered so central to their use of frameworks related to User-Centered Design, User-Experience Design, and/or Universal Design that instructors do not see a need to mention these concepts explicitly. However, previous critiques indicate that disability and accessibility are not universally considered central to such frameworks (Costanza-Chock, 2020). Therefore, while courses focusing on such frameworks undoubtedly have great potential for educating students about accessibility and the needs of disabled users/patrons, we argue that potential must be made more explicit to be meaningful.

We are encouraged, however, that so many (n = 13) courses included partial coverage of disability and/or accessibility content. Most courses are electives, with only seven being foundational or required. Most courses included only one or two topics, modules, or materials on disability and/or accessibility. However, this level of coverage is still an improvement over only including a mere surface-level mention. Notably, only one course labeled “partial coverage” (Information Professionals in the Makerspace) included meaningful coverage in multiple modules. We are also encouraged to find various course foci reflected in our analysis, including archives and preservation, health informatics, museum services, public libraries, Web development, and youth literature.

Instructors can follow these examples by integrating meaningful partial coverage in various course types. Moreover, we encourage instructors to improve upon our findings and to strive to include coverage in multiple ways: include more than one topic in this area, intersperse content throughout the course (rather than a single module), and present materials that thoughtfully and critically engage with disability and accessibility. We echo others’ calls (Dali & Caidi, 2017) to embrace a “diversity by design” mindset that more fully integrates this content from the ground up.

**Conceptualizations of “Accessibility,” “Ability,” and “Disability”**

Our findings echo previous research (Ferati & Vogel, 2020) on the troubling lack of specificity in dealing with disability and accessibility. In total, 22 syllabi included some keyword(s) directly relating to ability (n = 4), disability (n = 12), or accessibility (n = 18). Of these 22 courses, two have “detailed” coverage of disability and/or accessibility, 13 have “partial” coverage, two have “surface” coverage, and five have “unclear” coverage.

If a syllabus mentions “accessibility,” “ability,” or “disability,” further elaboration or specification is rarely given. Nine syllabi include specific accessibility challenge or considerations such as, “issues related to the design of usable digital text focusing on user-experience and user-centered design and accessibility,” “factors influencing intention to introduce accessibility in makerspace planning and implementation,” “charting sonic accessibility and social equity
in creative urban contexts,” and “Section 508: IT Accessibility Laws and Policies.” Only five syllabi mentioned any specific types of ability or disability, such as “National Library Service for the Blind and Physically Handicapped” (now the National Library for the Blind and Print Disabled), “ICT accessibility for persons with physical access challenges,” “understanding autism and planning for autistic community members,” and “visual impairments.”

As we might expect, the courses offering detailed coverage of accessibility (Universal Design for Information Technologies/Universal Access) and disability (Disability Informatics & Information) were more detailed in their conceptualizations. Disability Informatics & Information provided an incredibly rich list of both accessibility issues and ways of conceptualizing disability. Somewhat surprisingly, however, some other specific discussions around disability and/or accessibility were in courses focused on a narrow, practice-oriented topic, especially Digital Reference, Museums and Community, and Information Professionals in the Makerspace.

Notably, most of the specific uses of “disability” and “accessibility” we identified were found listed in the “course schedule” sections of the syllabi. Only eight disability or accessibility concepts were found in course descriptions, 13 in course objectives, and three in a list of course topics outside the schedule. Specific concepts could be found within the schedule in a variety of locations, including module-specific materials (n = 44), module topic names (n = 12), and even guest speaker affiliations (n = 6). Most detailed concepts – beyond simple “accessibility” or “disability” – were identified as part of the title of materials listed within modules, such as “Web accessibility: An introduction and ethical implications,” “All technology is assistive: Six design rules on disability,” and “Bodies with new organs: Becoming trans, becoming disabled.” These materials provide important clues to the topics that students will encounter in the course; clues that would otherwise be completely absent in syllabi.

We encourage LIS educators to be more deliberate in selecting materials and identifying topics beyond a broad definition of “accessibility” or “disability/ability.” The use of more specific materials and topics in narrowly focused, practice-oriented syllabi indicates that these courses may be particularly suited to deeper dives into issues related to the course focus. As with incorporating more detail into syllabi, offering more detail on the specific accessibility/disability issues and concepts covered in the course allows students to make more informed course selections—especially if they want to address a particularly relevant issue/topic. Similarly, this specificity also allows students and instructors more awareness of issues/concepts addressed throughout the program and the field.

Limitations and Future Work
The primary limitation of this study is that we reviewed course descriptions from 20 programs, of which only eight programs’ syllabi were publicly available and relevant for analysis. Although the latter number is small, we thoroughly examined each of the 39 syllabi for the course’s description, learning objectives, assessments, and materials. This sample reflects prior analyses of LIS curricula (Alajmi & Alshammari, 2020; Ren et al., 2022).

The presence of both program- and course-level objectives featuring “usability,” “user-centered services,” and “user-centered design” signify some commitment from LIS programs to these areas of study. However, it remains unclear how effectively courses focusing on these topics engage with concepts related to disability and accessibility. Accordingly, future research should more deeply investigate to what extent the usage of “usability” and “user-centered” within LIS curricula truly addresses disability and accessibility in LIS courses. We recommend that this analysis be enhanced by conducting interviews with LIS instructors to learn more about their conceptualizations of “usability” and “user-centered,” particularly how they operationalized these concepts in their courses.

CONCLUSION
Analyzing 39 syllabi from North American LIS programs, this study offers a preliminary analysis of disability- and accessibility-related topics within LIS curricula. While nearly all syllabi analyzed contained a high level of detail, only 13 were determined to contain a “partial” depth of coverage and two a “detailed” level of coverage. Even fewer syllabi included a conceptualization of disability or accessibility beyond simply including the words alone.

Ensuring that information professionals meaningfully engage with disability and accessibility is necessary for the field to further its social justice progress. Educators must push themselves to go below the surface; they must embrace a “diversity by design” mindset (Dali & Caïdi, 2017) both by incorporating specific discussions of disability and accessibility throughout their courses and by surfacing that content in their syllabi. For course design, we encourage instructors to (1) integrate meaningful partial coverage in various course types; (2) strive to include coverage in multiple ways (e.g., including more than one topic in this area, interspersing content throughout the course rather than a single module, and including materials that thoughtfully and critically engage with disability and accessibility); and (3) be more deliberate in selecting materials and identifying topics beyond a broad definition of “accessibility” or “disability/ability.” For syllabus design, instructors should include a high level of detail about their coverage of disability and accessibility (e.g., incorporating a course schedule that features course materials and sub-topics), including listing particular accessibility/disability issues and concepts covered in the course. Surfacing these topics more clearly allows students to make informed course selections and gives fellow instructors more visibility into what kind of issues/concepts may be addressed throughout the program – and the field more broadly.
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Detection of Musical Borrowing Using Data Science

Walczak, Steven  
University of South Florida, USA | swalczak@usf.edu
Moore-Pizon Jr., Thomas E.  
Keiser University, USA | temoore@usf.edu

ABSTRACT
Data science may be used to determine similarities between musical scores. Programs are written in C++ to capture note progressions from musical scores and to compare progressions from different songs to identify overlapping areas. These tools enable the study of musical borrowing across musical genres and may assist in copyright violation cases. Results indicate that within the Celtic music genre, borrowing occurs across greater than 10% of the songs.

KEYWORDS
Borrowing, copyright, data science, music, note patterns.

INTRODUCTION
Borrowing in music means using parts of a composer’s or artist’s work by another composer or artist and in other works by the same composer. Historically, classical composers such as Handel have been shown to frequently imitate or borrow from their previous works (Burkholder, 1994), and in more modern music, sampling, a form of borrowing, is ubiquitous (Margulis, 2014). Another famous example are the 3 songs known to most American and Canadian school children (Upitis, 1990): The Alphabet Song; Twinkle, Twinkle, Little Star; and Baa Baa Black Sheep, which are different songs that are all sung to the same tune, which is itself borrowed from a French folk song from the early 1700’s and was also used by Mozart to compose 12 variations in the 1780’s (Peng, 2018). The same tune is later borrowed by the Taiwanese band Mayday for the interlude in their song Contentment (Peng, 2018). Borrowing has occurred throughout the history of music and is pervasive to current music production practices (Arewa, 2006). The use of the same or similar musical scores for different songs and the re-use of a composer’s work in future works leads to our first two research questions:

- What is the relative frequency of borrowing across a musical genre?
- How often do composers re-use parts of their previous works in more current works?

In modern times, musical borrowing is associated with musical copyright violations when borrowing occurs from one composer by another. An example case is the copyright infringement lawsuit brought against George Harrison on his first solo album following the breakup of the Beatles for his 1970 song My Sweet Lord by Bright Tunes Music for The Chiffons 1962 song He’s So Fine (Marinescu, 2019). Interestingly, both the Harrison and The Chiffons songs borrowed melody from a public domain religious hymn from 1755 called Oh Happy Day That Fixed My Choice. Copyright laws began in 1710 in England and 1790 in the United States but were first applied to written music in 1777 in England (Barron, 2006) and 1831 in the United States (Arewa, 2006), with works prior to these times considered public domain. However, when it comes to prosecuting claims of musical score copyright infringement, jurors frequently have difficulty understanding the complexities of music and arguments made by music experts (Palmer, 2015). Which leads to our last research question:

- Can data science enable explicit determination of copying/borrowing from prior musical scores?

Our research will capture note progression patterns, where a note of C followed by a note of D would be denoted as a progression step of 1 and vice versa would be a -1. When flats and sharps are present in a song, they are denoted by a corresponding half step, so a B to a C# would be 1½ steps. The progression patterns are then examined and compared to other songs in the genre and for compositions by the same author to answer the research questions denoted above. The reason for using note progression patterns is it does not matter which key a song is sung in, it is still recognized as the same song. A song sung by a bass voice versus the same song sung by a soprano voice also does not change the recognition of the song. Similarly, while different note lengths can change the interpretation of the feeling of a song, the song is still recognized, such as Happy Birthday sung normally or the elongated and sultry sounding version Marilyn Monroe sang to President Kennedy (Quora.com, 2022). Therefore, note progression patterns are used to identify identical patterns of changes in notes across songs to ignore tempo and key changes.

METHOD
Musical scores for Celtic folk songs, including Irish and Scottish folk songs, are collected in portable document format (pdf). A total of 527 Irish folk songs and 215 Scottish folk songs are currently collected. The authors of the collected songs are frequently unknown as the song has been passed down through the generations. Songs of a modern Scottish composer who writes music in the Celtic tradition are also collected, with 29 songs, to examine single composer borrowing and self-borrowing.
Each song is first converted into HTML format using the PDFtoMusic™ Pro software from Myriad Software. A C++ program, called MusicPatterns, has been written by the researchers to extract the notes from the HTML formatted documents and calculate the corresponding note progressions for each song. Every song’s first note is denoted as the value zero (0), which also denotes when two consecutive notes are the same. Subsequent note progressions are then recorded as the number of scale spaces between the current note and the next note. An example of a score and the corresponding note progressions is shown in Figure 1, with the progressions arranged in lines to match the score for readability. The full note progression for a song is then written into a database file along with the name of the song.

Aisling Gheal

(A Bright Vision)

Traditional Irish

Aisling Gheal,

0,0,1,1.5,0.5,1,1.5,-1.5,-1.0,0.5,0.1,1.5,-1.5,-1.0,0.1,-1.0,0.5,-3.5,1,-3.1.5,
0.1.5,1,-1.5,0,0.5,1,-1.0,0.5,-2.5,1.5,-1.5,-1.0,4,0,2.5,0.5,0.1,1.5,0.5,1,-1.0,-2.5,0.1,1.5,-1.5,-1.0,1,1.5,
-5.5,0.1,-1.5,1,1.5,0.5,-0.5,-1.5,-1.0,1,-4.0,1,1.5,-1.5,-1,0.3,-3.1.5,0.5,1,-1.0,0.5,-2.5,1,1.5,-1.5,-1.0,
0,0,1,1.5,0.5,0,1,1.5,-1.5,0.5,1,-1.0,0.5,-2.5,1,1.5,-1.5,-1.0

Figure 1. Irish folk song score and corresponding note progressions

Once all songs have been scanned and the series of note progressions identified and entered into the database, then another C++ program, called MusicMatch, reads in an individual song’s note progression pattern and compares it against all other song note progression patterns in the database note by note using a sliding window. The size of the window enables a user defined minimum, which currently is 12, meaning that shared patterns of 12 note’s progressions or greater are identified. The window works by comparing the first note of both songs then the subsequent notes as long as a match occurs. If the length of the match equals or exceeds the specified minimum window, the match is recorded. The note progression for the song being compared against the database of songs is then slid over by one note to now begin with the second note and the pattern comparison is reiterated. This process continues iteratively until the sliding window reaches the end of the song being compared against the others in the database. The output for MusicMatch is the name of each of the songs being compared, the length of the match, where in each song the match occurs, and the actual pattern of the match.

RESULTS

The comparison of identical note progressions indicating borrowing is shown in Table 1.

The average length of all songs for Irish folksongs, Scottish folksongs, and the more modern Celtic composer’s folksongs are 113.5, 110.7, and 111.7 respectively. When borrowing occurred, the average number of notes borrowed from one song by another is 22 notes, with the largest amount of borrowing from one song to another being 105 notes that occurred over 6 locations in each song. The lengths of the two songs sharing the largest number of notes, Egan’s Hornpipe and Belfast Hornpipe were 141 notes and 199 notes respectively, representing 74.5% and 52.8% of the songs sharing note progressions. The single largest continuous note progression was shared between the songs Larry Grogan (92 notes long) and Waves of Tramore (122 notes long), with 45 contiguous borrowed note...
progressions. The 45 note borrow between the songs Larry Grogan and Waves of Tramore is shown highlighted in light blue in Figure 2, which also shows that the remainder of the 2 songs do not share any additional 12 note or greater note progressions. As it turns out, the borrowed notes are identical in the variations shown for these two songs.

<table>
<thead>
<tr>
<th>Song Origin</th>
<th>Irish folksongs borrowed from (total borrows)</th>
<th>Scottish folksongs borrowed from (total borrows)</th>
<th>Self-borrowing occurrences of modern composer</th>
<th>Average borrows (Max borrows from one song)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irish</td>
<td>85 (123)</td>
<td>15 (22)</td>
<td>N/A</td>
<td>1.63 (6)</td>
</tr>
<tr>
<td>Scottish</td>
<td>15 (22)</td>
<td>3 (4)</td>
<td>N/A</td>
<td>1.53 (4)</td>
</tr>
<tr>
<td>Modern composer</td>
<td>0</td>
<td>0</td>
<td>2 (3)</td>
<td>1.5 (2)</td>
</tr>
</tbody>
</table>

Table 1. Matching note progressions

**DISCUSSION**

The sliding window size of 12 is used to identify significant borrowing. The smaller the window size the more likely that a coincidental match will occur that is not related to borrowing. The 12 note minimum window in standard music time typically represents 3 stanzas of matched music. What length of note progression repetition in a song is needed to note the similarity? This is dependent on the listener’s familiarity with the original song and other factors. While the borrowed portions of many songs may be recognized with fewer notes, the minimum window size of 12 was chosen to err on the side of caution and have relative surety that the music was borrowed and did not occur
incidentally or share commonly used musical patterns such as a scale of upward or downward progressing notes of the same step size (Burkholder, 2018).

As may be seen in Table 1, borrowing is not universal within Celtic regions or across regions either. Irish folksongs borrowed 123 different series of notes of at least 12 notes from 85 different songs, indicating that just within the Irish folksongs studied, just over 16% borrowed music (as note progressions) from another Irish folksong, and borrowing across all examples of captured Celtic music, borrowing occurred almost 14% of the time.

The modern composer, at least for the songs studied, did not borrow from earlier Celtic songs. However, he did borrow across two of his compositions and utilized 3 borrowed note progressions from these two songs. This indicates that composers may have particular melodic techniques that they choose to reuse across multiple songs.

**Answering the Research Questions**

Evidence has been shown that borrowing occurs with regularity that enables us to answer the three research questions. MusicMatch’s output has shown that across a collection of several hundred musical scores from both Irish and Scottish Celtic folksongs, that greater than 13% of the songs borrow from each other across geographic regions. Early results from continuing research has shown that similar patterns exist when English folksongs are included into the mix. Other researchers have claimed that borrowing is a persistent and ongoing practice in music composition across all types of music (Arewa, 2006).

Composer self-borrowing, for the small collection of a single composer’s songs studied in the current research indicates that composers do self-borrow. The studied composer self-borrowed across 6.9% of his songs. This may indicate that certain musical themes exist within their music, and they rely on these themes across various compositions.

The combination of the two data science-oriented programs MusicPatterns and MusicMatch are able to first capture note progression patterns and then apply those patterns to definitively identify musical borrowing across songs. Preliminary results for specifying smaller pattern window sizes have indicated that numerous additional borrowed note progressions occur when the window size is decreased to 10 consecutive notes, including patterns of 11 consecutive notes.

**Using Data Science Identified Borrowing in Music**

What are the potential uses of MusicMatch’s note progression patterns? The first is the difficulty in prosecuting musical copyright infringement. As mentioned, jurors in these types of cases often have difficulty in understanding the arguments presented by the plaintiffs’ and defendants’ legal teams. The output of MusicMatch will be able to show jurors exactly where borrowing has occurred, which will also allow the plaintiff to provide visual aids of the two scores and highlight the borrowed areas between the songs. Alternately, MusicMatch may also be used to verify that no borrowing of the specified length occurred between the two songs. In a similar vein, the MusicPatterns program may be used, with a smaller window size, to identify patterns in music that form musical constructs which may be frequently used in composing and similarities and differences between these constructs across musical genres.

Another potential use of MusicMatch that requires additional research would be to aid librarians in identifying musical scores from a partial set of notes. A patron may have heard a tune but does not remember the name or author and would like to see if the library has a copy of the desired song. We believe that using fast-Fourier transforms (FFT) would enable a patron to hum, whistle, or even sing the notes they remember, which would then be transformed into a partial score by the FFT program (Li et al., 2018), which in turn would be processed by MusicMatch against a database of tunes owned or available to the library. These partial matches could then narrow the search for the library patron down to a few possible selections. This of course would require the encoding of the library’s musical holdings, but the MusicPatterns software would be able to do this for all pdf scores owned and the corresponding FFT note transformation software once developed could be used to encode all audio recordings. Other potential uses of MusicPatterns and MusicMatch are a topic for future research as well.

**CONCLUSION**

Data science pattern definitions and matching protocols for musical note progressions have been defined and implemented in two C++ programs: MusicPatterns and MusicMatch. The results from applying these programs to a collection of Celtic music demonstrate that musical borrowing happens for more than 10% of the songs for this type of music. Furthermore, the results demonstrate that composers self-borrow their own music for future compositions.

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Connecting iSchools and Society Through Scientific Research: A Worldwide Exploratory Study

Wang, Di
School of Information Management, Wuhan University, China | di.wang@whu.edu.cn

Zhou, Lihong
School of Information Management, Wuhan University, China | l.zhou@whu.edu.cn

Chowdhury, Gobinda
Department of Computer & Information Sciences, University of Strathclyde, UK | gobinda.chowdhury@strath.ac.uk

ABSTRACT
The research reported in this paper is part of a larger project focusing on the iSchools’ identity and interactions in a globalized world. This paper presents the research management strategy for conducting a global research project among international research communities, and for investigating the current research focus of iSchools members based on the insights of global iSchools’ leaders. It found that information management was the dominant research area and that digital humanities, data science, and “informatics+ scenarios” are the key growth points. The most significant contribution of iSchools to society lies in social services. The research focuses on and benefits worldwide iSchools by outlining development strategies and strengthening the connection between research and society to increase social awareness, influence and reputation.

KEYWORDS
iSchools; library and information science; research and society; internationalism; diversity

INTRODUCTION
Since the “information age” started in the 1990s (Kline, 2015), the scope of library and information science (LIS) has changed and expanded enormously (Tang et al., 2021). The fast development of information and communication technologies (ICTs) enlarged the sphere of this discipline by continuously bringing in new research topics (Given & Willson, 2018), such as big data, digital humanities, and health informatics. “Interdisciplinary” has become a highlighted tag for LIS in the research literature (Urbano & Ardanuy, 2020). Given the practical nature of their applications (Hjørland, 2000), LIS scholars constantly update their knowledge, skills, and abilities to keep pace with the evolving world of information (Saunders, 2019). At the same time, the core research focus, the definition of LIS as a discipline, and the boundaries of LIS have become vague (Burnett & Jaeger, 2011), which makes the connections between research and practice in LIS as a whole more elusive and harder to distinguish (Bawden & Robinson, 2016). Thus, it can be noticed that, although important and timely studies have been carried out by LIS scholars, the implementation and influence of current research on society have not yet been fully understood.

Since it is a leader in LIS education, research, and professional domains (Chakrabarti & Mandal, 2017; Olson & Grudin, 2009), the iSchools organization seeks to maximize the social visibility and influence of its member iSchools on a global scale (Cai et al., 2019). Considering the research focus of its members, the growing and diverse body of its more than 130 worldwide member institutions provides a good opportunity to understand the connection between iSchools’ research scopes and society. Such an exploratory study will help shape the iSchools’ collective identity (Thomson et al., 2021), define and redefine the profession of information (Bruce, 2010), and encourage knowledge exchange on a global scale (Wu et al., 2012).

At present, only a limited number of studies directly investigate the research focus of iSchools members in the sphere of LIS due to the difficulty of getting reliable samples (Ma & Goray, 2020). Existing studies mainly depend on literature and bibliometric analysis (Ahmad et al., 2020), which look at the research from the perspective of individual scholars. Instead of this kind of analysis, higher-level investigations of the LIS focus of individual institutions and their connection to society are rare. A comprehensive study of iSchools leaders’ opinions about the scope and development of LIS was also unusual, especially when the list includes chairs, deans, department directors, and institutional representatives. The diversity of the iSchools’ members (Ma & Zou, 2020) increases the difficulty of getting a complete view because the research undertaken by two different iSchools may appear to be the same, even though their social context may be significantly different, due to the employment market, funding bodies, governance structure, etc. (Thomson et al., 2021).

As a subsection of a larger research project, this study seeks to identify the research focus of global iSchools members and its connection with society from the perspectives of iSchools in different countries, so as to gain a general landscape of the worldwide LIS discipline. Two research questions guided this exploratory study:

RQ1: How to explore the research focus of an international research community such as the iSchools Organization with an institutional-level investigation?
RQ2: What is the research focus of LIS and its connection to society from the perspectives of iSchools’ leaders?

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This paper describes the details of the research design for a global investigation of iSchools members and presents the initial results for the analysis of the current research focus of iSchools and the contribution of their research to society based on the collected research data.

**METHODS**

**Grounded Theory Approach**

Grounded Theory (GT) is a widely used method for studying social phenomenon and their context (Douglas, 2003). It is particularly suitable for this research because the analysis needs to situate the iSchools within a distinct set of national and regional contexts. GT can effectively generate an inductive theory by systematically applying a set of analytical methods to context-specific data (Strauss & Corbin, 1994). Thus, GT was adopted as the general methodology for this study.

**Establishing Regional Groups**

To address the difficulty of covering the worldwide membership, a research management strategy was specially designed for this international research community. The project team was led by a principal investigator and included three regional groups led by iSchools leaders from North/South American (NA), European-African (EU), and Asia-Pacific (AP) regions. These three groups were set according to the zoning classification of the iSchools organization. The regional groups were responsible for the data collection and analysis of their own region. This is a very important factor in GT research, as claimed by Nunes et al. (2010): The researchers’ contextual sensitivity, awareness, and the capability of “making locally-informed and locally-significant contributions to theory are embedded in the very propositions of Grounded Theory as a methodology committed to understanding emic perspectives” (p.74). An experienced scholar was appointed as a consultant to the project to bring in iSchools perspectives to the research design and to ensure long-term sustainability. Monthly meetings were carried out for the project team to coordinate research design, share the latest progress, and solve emergent issues together.

**Data Collection**

This study adopted a theoretical sampling for the data collection and analysis. Theoretical sampling is one of the iconic features of GT methodology. It is initiated by taking an initial step with data collection, followed by analysis, and then collecting more data, until theoretical saturation is reached (Corbin & Strauss, 2008).

In order to collect qualitative data, the project team decided to interview the leaders of the various iSchools for two reasons. On one hand, iSchools leaders are the ones who control the most updated information about their institutions. Also, some of the leaders were deeply involved in the iSchools movement for many years. Thus, they are ideal interview candidates for gathering qualitative data. A semi-structured question script was used to guide the interviews with iSchools leaders. Open-ended questions were designed by the project team according to the research purposes of the whole project and were modified after four pretest interviews to avoid any misinterpretation. Interviewees were asked about the research areas of their iSchool and given these, how their iSchool contributes to the society. Another critical factor influencing the research design was the selection of interview language. Although English is predominantly used by nearly all iSchools for international activities and communication, language can be a barrier to in-depth and meaningful discussion. Thus, expressions in the interview questions were adjusted by regional groups according to their local languages. Translations were also allowed if the interviewees preferred to use their regional languages. For example, the AP group used English and Japanese when interviewing deans in Japan, and Chinese for iSchools leaders in China. The EU group also used English and German for interviewing deans in Germany.

All interviews were carried out between April 2020 – March 2022 and lasted one to two hours. The preference of the interview language was asked before the interviews. Most of the interviews were conducted in English. Three regional groups acted individually and interviewed iSchools leaders of their region. Because of the COVID-19 pandemic, all interviews were carried out virtually on ZOOM and were recorded and transcribed afterwards. A total of 75 iSchools leaders were interviewed, covering 61.48% of all iSchools members in 2021. 35 of them are from the NA region, 17 from the EU region, and 23 from the AP region. The distribution of regions of the interviewed leaders roughly follows the distribution of the number of iSchools members for each region at that time.

**Data Analysis**

All interview recordings were transcribed verbatim. The software MaxQDA was used to facilitate qualitative data analysis. Following the Strauss and Corbin approach (Strauss & Corbin, 1994), a coding scheme was first developed after three discussions within the project team. It was based on the key research questions of this project and was inclusive enough for all three regions. Three GT analytical techniques were further applied to the qualitative data, namely coding, memoing, and constant comparison. Three types of coding were included in this study: open coding, axial coding, and selective coding. Theoretical memoranda are “written theoretical questions, coding summaries, and hypotheses” (Douglas, 2003, p. 48). They were used during the whole coding process to monitor and stimulate coding, so that the data analysis process was consistent and coordinated among different regions. The constant
comparison method was used to distinguish different types of coding and to synthesize key categories and conceptual properties (Douglas, 2003). For the research questions of this paper, two main categories of coding were used: one is the research focus of iSchools, and the other is the contributions of iSchools research to society.

**FINDINGS**

**Research Focus of iSchools**

Data analysis results show 10 broad research themes for the iSchools, namely information management, library science, digital humanities, “informatics+ scenarios”, data science, information technologies, archival studies, media studies, bibliometrics, and knowledge management. Among them, information management (IM) was the dominant research area in many iSchools. Three traditional research topics are still the key focus of IM, which are information organization (including information retrieval, information standards, cataloging, database design, ontology, and metadata), information behavior, and information literacy. However, it can be noticed that many new research topics are drawing more and more attention. Information ethics was also mentioned by many iSchools leaders. It is closely related to important social issues such as privacy, misinformation, and disinformation. Other original and trending topics include information design, information ecology, and information security.

Library science (LS) was the second largest research area among the iSchools community, focusing on library services. However, many iSchools leaders mentioned the trend of moving away from the traditional research scope of LS to match the development of data and information technologies. For many iSchools, LS is one of the main areas for teaching, instead of for research. At the same time, new research topics are emerging in the LS area, such as social justice. It is a globally popular topic that looks into the ethical and legal aspects of information and knowledge access, such as information equity for different gender, race, ethnicity, and social division.

Besides traditional research areas like IM, LS, and archival studies, three new areas are trending fast and are full of vitality. Digital humanities is an example, which was mentioned by 34.67% of all interviewed iSchools leaders. However, because it is a new research area, many iSchools leaders worried about the vagueness of its definition and features. Data science is another fast-developing area, focusing on the management of all kinds of data and data utilization methods and techniques. A new trend is the merging of informatics with other areas such as pedagogy (e-learning), government management (smart city), health and biomedicine, geography, and economy (e-economy). It can be noticed that informatics plays a central role in such a kind of merging. The applied areas are changing fast and can be treated as different scenarios for informatics. Thus, such new trend is named “informatics+ scenarios”.

Some iSchools leaders emphasized the technology features of their institutions. One of the leaders even defines their school as a computer science school, instead of an information school. Machine learning, artificial intelligence (AI), virtual reality (VR), information technology (IT), crowdsourcing, human-computer interaction (HCI) and human-technology interaction (HTI) are the key research focus for these technological institutions. However, the majority of the iSchools leaders mentioned the importance of combining the technological aspect and the humanistic aspect when managing institutional research focus.

Based on the above analysis, three features can be noticed in the current research focus of iSchools. First, the range of the research focus is relatively broad, ranging from very technological ones like AI and IT to more humanistic ones like social justice and heritage protection. Second, being interdisciplinary is the key attribute for new research growth points, especially by merging informatics with certain scenarios. Finally, the majority of iSchools tried to balance between traditional research strengths and newly emerged research topics. They keep the research groups for LS, archival studies and knowledge management and bring in new topics such as digital humanity and “informatics+ scenarios”.

**Comparison Between Regions**

Significant differences can be noticed in research focus among three iSchools regions. The EU region emphasizes information security and ethics more than the other two regions. More EU and AP iSchools treat information organization topics as their research focus than do the NA iSchools. For LS and archival studies, it is significant that more AP iSchools still carry out research in these fields than EU and NA iSchools. Public culture is a special topic in LS as emphasized by iSchools in China. More EU and AP iSchools emphasize digital humanities than NA iSchools. More EU and AP iSchools carry out research out about cultural heritage, while NA iSchools focus more on ethnic studies. Although all three regions treat data science as an important and growing area, their research focuses on different aspects. NA region focuses more on visual analytics, EU region focuses more on data applications, such as marketing and journalism, and AP region focuses more on data organization, such as data merging and extraction. For information technology, the NA region emphasizes more unique research topics than EU and AP regions, such as virtual reality, modeling system, and robotic control. For media studies, it is significant that more EU region iSchools carry out research in this field than other two regions. Differences in research focus between three regions can be recognized in the first two columns and the links among the research themes and research topics of Figure 1.
Contributions of iSchools to Society

Five aspects of contributions of iSchools’ research to society have been recognized. The most significant and fruitful one is the effect of research on social services (Oxford Languages, 2023) to benefiting the whole society. iSchools leaders discussed the contribution of LIS research to various aspects of their local society, such as economic development, industry evolvement, governmental issues (including policy and decision making), community impact and public library services. LIS research also focuses on many current social issues, such as misinformation, cyber-violence, privacy, refugee issues, and social justice. LIS research helps to mediate the conflicts between technology skills and ethical issues. The second aspect of contributions is the impact of research itself on the whole development of science, such as innovating IT, improving data management, the fusion of different knowledge, and the full coverage of iField. A third aspect is closely related to research about digital humanities. iSchools leaders pointed out that our discipline can bridge art, culture, and technology (ACT) with information. We serve as the stewards of digital memory and can make our own contribution to the protection of cultural heritage. The fourth aspect is the interdisciplinary advantage of LIS. It is possible for our research to organize around different areas and get involved in multidisciplinary research projects to produce new knowledge and make breakthroughs. The final contribution is to increase the social awareness and reputation of the whole discipline in society. Connections between regions, research focus, and contributions of iSchools are shown in Figure 1, which shows the frequency of codes by the thickness of boxes and the co-occurrence of codes and its frequency through links and the thicknesses.

**Figure 1. Connections Between iSchools’ Regions, Research and Contributions**

**CONCLUSION**

This study carried out a worldwide exploratory study about the current research focus of global iSchools and its contributions to society based on the insights of iSchools’ leaders. It designed a research management strategy for coordinating the data collection and analysis process, and for controlling research output quality. It can be used in conducting global research projects among international communities in the future. Information management was the dominant research area among iSchools, and they made great effort to balance traditional research scopes and newly blossoming topics. Digital humanity, data science, and “informatics+ scenarios” are some of the growth points. This study will benefit global iSchools for planning future research and strengthening the connection and contributions to society by comparing their research focus with other iSchools and targeting possible social impacts.
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Using Ontology to Organize Chinese Ancient Books in the Digital Age

**ABSTRACT**

The digitization, curation, and utilization of Chinese ancient books are crucial to the digital humanities. Despite progress in these areas, issues with data interoperability, data sharing, and data linkage persist due to a lack of standardized annotated ancient corpus and a general description framework for ancient books. To overcome these challenges, this paper proposes an ontology-based description framework that integrates catalogs of Chinese ancient books from various institutions, creating a standardized, interpretable, and researchable knowledge base. The framework combines general standards with unique ancient book characteristics, revealing complex relationships between books and books, books and people, and books and times, providing a more comprehensive understanding of the knowledge contained within ancient books. Additionally, this paper applied the framework to The National Rare Ancient Book Directory, a catalog containing 13,026 books from over 400 institutes, to develop an interactive system. The system is available at https://rarebib.pku.edu.cn/. Our results demonstrate that the framework standardizes data and provides a sophisticated and nuanced understanding of the knowledge within ancient books. This has noteworthy implications for individuals engaged in research, scholarship, and reading in the digital age.

**KEYWORDS**

knowledge organization; Chinese ancient book; ontology; system design; digital humanities.

**INTRODUCTION**

The creation, curation, and utilization of digital resources are central to the field of digital humanities (Roth, 2019). This significance extends to Chinese ancient book resources, which have been a longstanding concern in both international Chinese studies and digital humanities. Over the past three decades, substantial progress has been made in digitizing and making accessible a vast number of Chinese ancient books through databases provided by libraries and other institutions. Consequently, there has been a notable shift in ancient book organization, with a growing emphasis on knowledge processing and discovery, beyond the traditional priorities of permanent preservation and information retrieval (Zhao, 2021). This shift has led to the emergence of the knowledge base as the primary method for digitalizing and intellectualizing ancient books (Chen, 2022). However, the construction of the knowledge base for Chinese ancient books faces several challenges, with one major issue being the absence of standardized corpus and description schemes. The use of various standards by different institutions to develop ancient book databases makes sharing, linking, and interoperating digital resources difficult. Ancient book resources are essential components of library resources (Xiaohua Yan & Yao, 2021). Although they were organized by metadata and bibliographic control approaches and recorded as book catalogs, their granularity, target users, and usage scenarios vary, resulting in heterogeneity and making it difficult for libraries to perform cross-source operations and achieve resource sharing and interconnection.

A standardized descriptive framework is urgently needed to address the challenges faced in digitizing and intellectualizing ancient Chinese books. The framework should provide a common, universal, comprehensive, and normalized description of Chinese ancient books to cover different types and avoid data islands, which can assist personnel in protecting, describing, and organizing the original texts. Furthermore, it should be able to accommodate different research paradigms in digital humanities, such as 'data-driven' and 'knowledge-driven,' and support scholars in quantifying, associating, interpreting, and critiquing the information contained in ancient books. Additionally, besides serving as a tool, the descriptive framework should also help readers, especially ordinary readers, systematically understand ancient books. To ensure practicality and effectiveness, it is crucial to implement the framework in specific practices and demonstrate its interpretability and comprehensibility in data processing and publishing. By doing so, the framework can contribute to the standardization and collaboration among institutions, supporting humanities scholars in analysis and the general public in reading.

This article proposes an ontology-based framework for the description of ancient Chinese books. The framework aims to integrate Chinese ancient book catalogs from various institutions, creating a standardized, interpretable, and researchable knowledge base. Ontology is a formal and explicit specification of a shared conceptualization that can parse information resources into machine-understandable knowledge, enabling exchange and sharing in a networked environment during information system integration. Using ontology to organize ancient book catalogs enables better mining of information in bibliographic descriptions, characterizing structural knowledge, and revealing the objective knowledge world.
Furthermore, this paper uses *The National Rare Ancient Book Directory (The NRAB Directory)* as the data source to reconstruct, enrich, describe, and apply its content, to create a standard knowledge base and a user-friendly information system. *The NRAB Directory* is a catalog of extant ancient books in mainland China selected and evaluated over 20 years, containing 13,026 ancient books collected by 485 institutions and individuals. Adopting this as the data source allows us to apply China's recent achievements in ancient book preservation and organization, making the theoretical framework applicable in specific and representative ancient book organization work. Additionally, it provides a practical example of ancient book organization in the digital age, demonstrating the effectiveness of the proposed framework.

**RELATED WORK**

Ontology facilitates the identification and linkage of semantically related concepts by providing controlled vocabularies with precise and formal descriptions of relevant terminologies and classification schemes (Castañé et al., 2018; Bouyerbou et al., 2019). Some efforts have been made on building explicit ancient book ontologies. The Shanghai Library has designed an ancient book data model that covers all Chinese ancient books, including lost books, to support the evidence-based platform for the Chinese ancient book union catalogs (Shanghai Library, 2014). Although their data model consists of nine classes, including Resource, Work, Edition, Instance, Classification, Time, Place, Agent, and Annotation, the relationships among these classes are not emphasized enough, with most of the relations centering around the concept of Work. OuYang et al. proposed a Large-scale Chinese Ancient Books Framework based on web crawling or scraping data and constructed a knowledge graph (OuYang, 2016; Ouyang et al., 2021), with a focus on four classes: Work, Person, Version, and Place, along with the relations around Work. Additionally, there are some data model designed for particular types of books, like Tang Poetry (Zhou et al., 2019) and chronological biography(Wei et al., 2022), and their involved concepts are discussed by those two frameworks.

To conclude, ontology is a crucial method for representing information about Chinese ancient books and provides the foundation for knowledge bases and service-oriented information systems. While it is widely accepted that distinguishing the concept of an Ancient Book is a fundamental and effective approach, few studies have addressed what subclasses it has and how those subclasses are related. Despite numerous case studies demonstrating the potential and prospects of knowledge organization in the utilization of ancient texts, the lack of systematic data organization and supplementation of background knowledge makes it difficult to intuitively interpret the inherent logic of ancient texts, and thus inconvenient for ordinary users to understand and learn about ancient knowledge. Therefore, we need to focus on effectively utilizing knowledge organization technology, fully exploring the description of ancient texts, and constructing ancient text applications and learning platforms for the public.

Compared to other frameworks, the proposed framework in this paper provides a clearer hierarchical categorization of ancient book concepts, taking into account the layered relationships among them. Additionally, the framework's scope is well-defined, focusing on organizing existing ancient books that are included in *The National Rare Ancient Book Directory*, making it applicable to other authoritative ancient book organization efforts.

**AN ONTOLOGY-BASED DESCRIPTION FRAMEWORK**

**Objectives**

The framework has two aims. The first one is to build a knowledge representation of Chinese ancient books in the form of ontology. The framework needs to reflect the unique characteristics of ancient books, especially the rich variety of document types and detailed definitions of book editions. The second one is to integrate international common ontologies and domestic standards, which makes sure the framework can be used in more data sources.

**Key Concepts**

Based on these three design strategies, this paper developed an ontology-based description model consisting of two types of concepts: ancient book description concepts and general knowledge concepts, as depicted in Figure 1. The framework defines seven classes: Ancient Book, Classification, Seal, Appendix, Agent, Time, and Place.

Unlike modern books, an ancient book often has only a few physical objects in existence. Therefore, each state of the ancient book is important for information organization and humanities research. The framework defines them as subclasses of the Ancient Book, including Work, Edition, and Item. A Work represents an abstract notion that encompasses independent knowledge or artistic creation, transcending all forms of expression. In the context of ancient Chinese texts, a Work is typically defined by its title and author. An Edition of a Work pertains to its physical embodiment and generally represents all the physical objects with similar characteristics. It is typically determined by the publication date, publisher, and edition type. An Item refers to a specific physical existence of an edition, which is related to different collectors who have acquired it.

Differentiating among these components in the concept of the Ancient Book is essential for the effective processing of relationship data when describing ancient texts. Based on these three subclasses, other concepts can define their
scope and establish their hierarchy. For instance, the framework links actors (Agents), including individuals (People) and organizations, with those three subclasses to clarify the responsibility of each party and its corresponding behavior. This leads to the establishment of a relationship hierarchy, with the Work concept corresponding to the creative relationship, the Edition concept corresponding to the publishing relationship, and the Item concept corresponding to the circulation relationship (i.e. collection relationship). The Time and Place concepts can also be linked to these three subclasses. However, in practice, it can be challenging to determine the temporal and geographical details of the various activities involved in creating, publishing, and circulating ancient books. The Concept of Classification can be extended too, including the classification of the Work, the classification of the Edition, and the classification of the Item (related to the cultural relic grading). Moreover, based on the three subclasses, other concepts are clearer. The Appendix is a type of explanatory information about the Ancient Book, generally sourced from other data sources. The Seal is a concept related only to an Item, and each Seal also has its owner.

![Figure 1. The ontology-based description model for China’s ancient book](image)

**FRAMEWORK IN PRACTICE**

**From the dataset to the knowledge base**

The main research dataset of this paper is *The National Rare Ancient Book Directory (The NRAB Directory)*. Using *The NRAB Directory* as a foundation, this paper created a more comprehensive knowledge base that offers rich insights into ancient Chinese literature.

*The NRAB Directory* is a catalog of existing precious ancient books in China that has been approved by the China State Council and includes book descriptions and HD images. The book descriptions are provided in unstructured, typically comprising less than one hundred words. Despite their brevity, these descriptions contain a wealth of information, such as edition descriptions, responsible behavior records, and features of layout, as shown in Figure 2. However, without domain knowledge and external data, it is challenging to fully discover and present the rich information in *The NRAB Directory*. Therefore, this paper established uniform rules by the description framework, to handle vague book descriptions, like information about responsible behavior mainly including creation, publication, collection, and review. And we also referenced external databases during the construction of our dataset. For example, this paper adopted The China Biographical Database Project (Harvard University et al., 2022) to supplement temporal information of people (like the birth year and the death year), to further infer the time of book creation, publication, and collection.

![Figure 2. An example of a book entry in The NRAB Directory](image)
System Design: An Interactive System to Assist in Reading China's Ancient Books

To ensure the accessibility and readability of the knowledge base, it's necessary to develop an interactive information system that introduces the compilation process of the Catalog and restores the evolution of ancient books from various dimensions, showcasing Chinese culture's essence and the inheritance of Chinese classics to the public.

This paper addresses the needs of three types of users: personnel involved in the protection of ancient books who participate in The NRAB Directory’s application and approval process, ordinary readers interested in ancient books and traditional culture without professional backgrounds, and researchers with humanistic literacy and knowledge of ancient books. By combining the design objectives with user requirements, this paper summarizes three essential functional requirements.

Firstly, the system should comprehensively and systematically introduce The NRAB Directory. In this regard, a map showing the number of selected ancient books from all collecting institutions/individuals will be of significant reference value. It not only demonstrates the influence of The NRAB Directory but also provides a basic distribution of precious ancient books across the nation. Secondly, the system should provide a basic mapping from data to visualization by categorizing the collected books according to four typical categories: literature type, edition dynasty, edition type, and language. It should highlight the vast and diverse characteristics of Chinese culture, providing guidance and clues for the public to understand and learn about Chinese classics. Thirdly, the system needs to provide navigation and retrieval tools that support the exploration of those ancient books. This exploration tool should reproduce the creation, publication, and dissemination of existing ancient books and support the statistical analysis of relationships.

This paper adopted Vue3.js and D3.js technology for the first requirement to create the "Introduction" section. And this paper built an interactive system for the second and third requirements in the "Search" and "Analysis" sections with Express.js and MySQL.

The Introduction section of the system primarily presents textual descriptions and visualizations, supporting three main tasks. These tasks include an overview of The NRAB Directory based on statistics, a geographic display of the collection’s distribution based on a map, and a distribution of the book's publication periods based on river and scatter plots. Besides, users still require further guidance to fully comprehend the implications and unique features of The NRAB Directory. Enabling users to search and modify the visualizations according to their preferences can personalize their information-seeking experience. Therefore, the Search section incorporates a filtering bar to meet that requirement. The filtering bar can provide navigation based on the most important clues and visualize and narrow search results through interactive bar visualizations.

CONCLUSION

This article presents an ontology-based framework to integrate Chinese ancient book catalogs from various institutions, creating a standardized, interpretable, and researchable knowledge base. The framework defines seven classes, including Ancient Book, Classification, Seal, Appendix, Agent, Time, and Place. Noteworthy, the Ancient Book class can be split into three subclasses, Work, Edition, and Item. Based on these three subclasses, other concepts can define their scope and hierarchy, which is essential for the effective processing of relationship data. The framework enables us to better explore bibliographic information, represent structural knowledge, and reveal the appearance of the objective knowledge world. Additionally, this paper applied the framework to The National Rare Ancient Book Directory (The NRAB Directory), a catalog of existing precious ancient books in China approved by the China State Council. Using The NRAB Directory as a foundation and other knowledge bases as supplements, this paper created a more comprehensive knowledge base and developed an interactive system to make the NRAB Directory available. This system shows how our framework can provide a more sophisticated and nuanced understanding of the knowledge contained within ancient books, offering a valuable resource for researchers, scholars, and readers alike, which is available at https://rarebib.pkudh.org/.

This framework and knowledge have significant implications for scholars and researchers in digital humanities, as they can be used for quantitative analysis, correlation, interpretation, and critique of ancient books. The framework provides a clearer hierarchical categorization of ancient book concepts, taking into account the layered relationships between them, which offers a comprehensive guide for describing the relationship between books as well as between books and people. Additionally, the framework's domain is well-defined, focusing on organizing existing ancient books that are included in The NRAB Directory, making it applicable to other authoritative ancient book organization efforts.

The positive feedback and results from the current application confirm the effectiveness of our framework. Our next steps involve enhancing the framework for more resources, publishing the framework, and developing innovative functions for in-depth studies of historical records in ancient literature is crucial.
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REFERENCE
The Triple Helix Interactions among Universities, Industries and Governments: Case of Climate Change Field

Xiong, Wenjing  
School of Public Affairs, Zhejiang University, China | wenjing_xiong@zju.edu.cn

Song, Yijia  
School of Public Affairs, Zhejiang University, China | jnsyj818@outlook.com

Fu, Hui-zhen  
School of Public Affairs, Zhejiang University, China | fuhuiyizhen@zju.edu.cn

ABSTRACT

The Triple Helix interactions among different institutions have become increasingly important for science and technology development. In this study, we explore the synergic effect of the Triple Helix relationships of universities, industries, and governments in the field of climate change from the perspectives of vertical evolution and horizontal comparison. T indicators are utilized to measure the bilateral and trilateral institutional information transfer quantity based on the Web of Science core collection database from 2001 to 2021. The results indicated that the UIG collaborative innovation system of climate change is basically formed, but the synergic effect has been continuously eroded in recent years. In addition, we focus on a more detailed comparison among different topics and countries. Specifically, the bilateral and trilateral synergetic effects in the United States outperform that of other countries.

KEYWORDS

Triple Helix; Scientific collaboration; University-industry-government interactions; Climate change

INTRODUCTION

With the transition from the “small science” era dominated by independent scientific exploration to the “big science” era of collaborative innovation driven by multiple institutions (Vignieri et al., 2022), such as governments, enterprises, industries, universities, colleges, research institutions, governments, universities and institutions of society, scientific research collaboration has become an important approach to meeting the needs of national strategic development. The key to collaborative innovation lies in optimizing the cooperation system, leveraging the strength of different unites and effectively tackle complex challenges together (Walsh, Murphy, & Horan, 2020).

Climate change is a typical interdisciplinary research field with characteristics of complexity, variety, and comprehensiveness, requiring the integration of knowledge from social sciences, natural sciences, engineering, and technology (Bhaskar et al., 2010; Hellsten & Leydesdorff, 2016; McCright et al., 2013). It is also a global issue that affects the survival and development of humanity. Expanding the channels of interdisciplinary research cooperation and elevating the capacity for multilateral collaboration are contribute to promote the progress of interdisciplinary research on climate change (Rineau et al., 2016; Xu et al., 2016). We focus on the field of climate change, presenting a review of Triple Helix theory and relative literature in the second part, and the research method and data are discussed in the subsequent part. Then, by calculating the Triple Helix indicator, the study aims to analysis the evolution of collaborative processes among different institutions and compare the synergy effect of different research topics and countries. The main results and future research direction are summarized in the final part.

THEORY AND RELEVANT LITERATURE

The Triple Helix Theory, proposed by Henry Etzkowitz and Loet Leydesdorff (Etzkowitz & Leydesdorf, 1995), posits that innovation occur through the interaction and collaboration of three categories of entities: industry, government, and university. The theory emphasizes that it is the competition, collaboration and knowledge exchange among these institutions that drive innovation and growth (Etzkowitz, 1996; Etzkowitz, 2003; Etzkowitz & Leydesdorff, 2000). Loet Leydesdorff proposed the Triple Helix Algorithm based on the theory of information entropy, which quantitatively studied the nonlinear interactive relationship of Triple Helix innovation entities (Leydesdorff, 2003; Leydesdorff & Zhou, 2014). This method has attracted attention and has been widely used to measure the interaction relationships among different institutions. For instance, Kang (2019) measured the systemness of the triple helix relationships of universities, industries, and governments of Beijing and Shanghai, finding the synergy of university-industry cooperation and university-industry-government cooperation has decreased from 2008 to 2017. Similar trends also occurred in Japan, Brazil, Russia, India, China, South Africa, South Korea, and Netherlands (e.g., Leydesdorff & Sun, 2009; Ye et al., 2013; Leydesdorff, 2010; Xu et al., 2013). Zhang (2019) investigated the interactions among Chinese Academy of Sciences (CAS), industries and universities, indicating that bilateral and trilateral interactions not only improved the scientific performance but also the effects of research investments on that performance.

DATA AND METHOD

Data collection

In this research, the Science Citation Index Expanded (SCIE) and Social Science Citation Index (SSCI) are used to search for scientific publications in the WoS database. The keywords including "climate chang**", "climate
variability", "global warming", and "climate warming" present in the title or abstract are retrieved (Haunschild, Bornmann, & Marx, 2016; Li, Wang, & Ho, 2011; Wang et al., 2014). The time span of data is confined to 2001-2021, and the document types is limited to article and review. As a result, 194,954 publications are collected for analysis. The second step is to extract the information of the Institution and Country/Region by the ITG-Insight software (Wang, Zhang, & Liu, 2021). To reduce the impact of variations in institution names, such as "York Univ" and "Univ York", the text similarity calculation tool in the ITG-Insight is utilized, along with manual verification. The third step is to identify the nature of author’s institutions. With reference to the triple helix theory and relevant research (Leydesdorff, 2003, 2012; Choi, Yan, & Park, 2015), the institutions are classified into three categories: universities, industries and governments. Finally, a total of 50,403 institutions and their corresponding classifications are successfully identified.

**Method**

The previous studies have adopted the information transmission indicator, T value, to measure the amount of mutual information among different institutions (Park & Leydesdorff, 2010; Ivanova & Leydesdorff, 2014). In this way, the dynamic interactions among institutions can be characterized quantitatively (Yoon & Park, 2017). Shannon has defined the information entropy H as the thermodynamic entropy S, where $S = K_B \cdot H$, and $H = - \sum p_i \log_2 p_i$. $K_B$ is probability entropy, which can increase the uncertainty of the system. In terms of three sets of information $H_1$, $H_2$, and $H_3$, the overlapping part is labeled as $T_{123}$, the calculation formula is $T_{123} = H_1 + H_2 + H_3 - H_{12} - H_{23} - H_{13} + H_{123}$. When the interactions among the multiple sets is significantly enhanced, the uncertainty in the system will be reduced accordingly. The larger the absolute value of T, the tighter the relationships among them, and the stronger stability of the whole system will be (Shin, Lee, & Kim, 2012).

**RESULTS**

On the basis of the nature of author’s institution, publications are classified into 7 categories, including publications co-authored by the individual institutions (U, I, or G), bilateral collaboration (UI, UG, or IG,) and university-industry-government (UIG) cooperation.

**The dynamic synergic effect of the Triple Helix interactions**

The number of publications from different categories are shown in Figure 1. In terms of individual output, universities (U) can be regarded as the primary institutions of scientific research, exhibiting a significant exponential growth trend from 2001 to 2021. The number of publications published by governments or industries displayed the logarithmic growth trend and linear growth trend, respectively. From the perspective of cross-organizational border collaboration, it can be observed that collaborative publications between universities and industries (UI) and between universities and governments (UG) both exhibit exponential growth in the number of publications annually. By contrast, the collaborative output between the governments and industries has always been relatively low in terms of quantity. The number of publications jointly authored by the governments, industries, and universities has shown an exponential growth trend. From 2001 to 2021, the number of publications increased from 1,443 to 28,080, reflecting the increasing participation of governments, industries, and universities in collaboration system in the field of climate change.

![Figure 1. Trends of publications co-authored by various categories (2001–2021).](image)

The in-depth analysis on the bilateral and triple helix relationships of UIG can indicate the dynamic synergic effect of the Triple Helix interactions. As shown in Figure 2, the tightness of university-government bilateral cooperation was decreasing from 2006 to 2021. On the other side, UI and IG bilateral cooperation systems have remained stable in the past 20 years. The values of $T_{UIG}$ from 2001 to 2021 is negative, which shows that the UIG collaboration system of climate change is basically formed. In terms of the longitudinal trend, the tightness of the UIG relationships showed a downward trend, which implies that the synergies of UIG cooperation system eroded by the reduction of synergies in UIG cooperation system during this period.
The comparison research of Triple Helix interactions in different topics

The complexity of climate change issues has formed diversified research topics. NMF (Non-negative Matrix Factorization) topic modeling is utilized to analyze the distribution of research topics and scientific research cooperation in various topics (Seung & Lee, 2001). The publications in field of climate change focus on eight topics, including Climate simulation model, Climate technology, Biodiversity, Agriculture, Physical science basis, Paleoclimatology, Climate policy, and Vegetation. According to Figure 3, universities have a significant advantage in the number of publications. The average percentage of publications written by governments (G) is only 3.5%, while industries (I) only 0.49%, about one-seventh of the G. The number of publications co-authored by industries and governments (IG) is relatively low, accounting for only 0.11% of the literature in the Agricultural and 0.34% in the topic of Biodiversity. The percentage of UIG is relatively low, with an average percentage of 2.13%.

The governments, universities, and industries focus on different topics. Climate technology is highly associated with energy, emissions, and pollution. The majority of outputs come from universities, while the participation of governments is relatively low. However, industries have a higher enthusiasm for participating in scientific research in the Climate technology. In the Climate Simulation Model and Vegetation, the participation of governments is relatively higher than U and I, and the percentage of publications written by G, UG, IG, and UIG is larger than other topics, which indicates that more governments are willing to participate in research and analysis climate models and vegetation. The topic of Biodiversity has the highest percentage of publications co-authored by UIG than the other topics, indicating that the issues related to biological diversity have aroused widespread attention of government, industries, and universities. The studies focus on Paleoclimate mainly comes from cooperation between the governments and universities.

There are significant disparities in the T values of institutional collaborations among the eight topics. Figure 4 presents the sketch maps of the triple helix cooperation network and the evolution trends in various topics. The $T_{UI}$ values and $T_{IG}$ values of Vegetation and Paleoclimatology are higher than the others, while the $T_{UG}$ values of Agriculture are higher the others. Synergic effect of the triple helix relationships of Climate technology demonstrates a strong performance in the early stage (Figure 4). The trend of T values of paleoclimatology is stable, with a low three-dimensional information transfer quantity, which indicates to a certain extent that the efficient cooperation system has not yet formed. In addition, $T_{UG}$ values of Agriculture, Vegetation, Physical science basic, Climate technology and Biodiversity fluctuate within 180-50 mbits (millibits) of information in the early stage, but the synergy effect gradually weakened in the middle stages and recent years.

The comparison research of Triple Helix interactions in different countries

This section illustrates the research collaboration situation of the top eight countries in terms of publication quantity. The institutions with the highest publications in every country are universities, with a proportion ranging from 41.63% to 74.22%, among which China has the highest proportion of U publications. The proportion of publications published by governments (G) is higher than industries (I), indicating that universities and government agencies in various countries are more actively involved in producing research in the field of climate change compared to industries.
In terms of cross-organizational border cooperation, the publications of UG in France, Finland, Norway, Germany presents greater volatility in terms of TIG, with the lowest degree of Canada and Austria presented strongly integrated systems in terms of UG co-authorship relations in 2002 and 2005, triple helix relationships was promoted gradually. In recent years, UG, UI and UIG relations became less synergetic. depth and broaden cooperation with governments, strategic alliances were established, and the synergic effect of the Figure 5 allows us to focus on the different dynamics in different countries. In the United States, the dynamics changed profoundly during 2016-2021 is compared with 2001-2015. Universities were encouraged to conduct in- depth and broaden cooperation with governments, strategic alliances were established, and the synergic effect of the triple helix relationships was promoted gradually. In recent years, UG, UI and UIG relations became less synergetic. Canada and Austria presented strongly integrated systems in terms of UG co-authorship relations in 2002 and 2005, but rapidly decreased afterward. Germany presents greater volatility in terms of $T_{IG}$ with the lowest degree of trilateral synergetic effect. China has not yet reached a good level of coordination, even occurred positive in the early stage.

**CONCLUSION**

Faced with the global challenge of climate change, it is crucial for the governments, industries, and universities to form a collaborative innovation system, which can help to promote sustainable development of global scientific and technological innovation. Based on the Triple Helix theory, this study analyzed the fundamental characteristics of scientific research cooperation in the field of climate change, as well as the situations of scientific research the bilateral and trilateral collaboration. On the one hand, the trends of triple helix interactions among them are presented clearly by the longitudinal time-series analysis. On the other hand, we compared the synergic effects of the Triple Helix relationships from the perspectives of country and topic, respectively. The following results can be obtained:

First, in terms of individual output, universities are the most vital innovation units, thereby reflecting their importance as the main source of scientific knowledge production. Although independent knowledge innovation in the governments has developed rapidly, they are still at a disadvantage in terms of publications compared with the universities. Industries are more likely to focus on the application and protection of innovative outputs, resulting in insufficient attention on basic research. In terms of cross-organizational collaboration, the publications co-authored by different units have been stably increasing. The collaboration between the governments and universities is the most frequent, followed by UI and UIG. The number of collaborative publications co-authored by industries and governments is relatively few in recent two decades. Both $T_{UI}$ and $T_{UIG}$ represent the same trends of fluctuating decline, while $T_{UG}$ and $T_{IG}$ remain stable.

Second, after comparing the UIG bilateral and trilateral collaborative networks of eight topics, we find industries are more focused on Climate technology, while universities pay more attention to Paleoclimatology. UIG scientific collaboration system is pay more attention to Climate policy and Biodiversity. In terms of vertical time series analysis, the $T_{UG}$ values of almost all topics show the trends of climbing in the early stage and descending subsequently, except for Physical science basis. $T_{UG}$ values have not yet reached a good level, even occurred positive in the early stage.

Third, the synergic effect of most countries shows a long-term trend of weakening. Specifically, the United States has the highest number of publications and frequency of collaborations in the field of climate change, with a high level of the university-government relationship, which is resulted from the encouragements about conducting in-depth and broaden cooperation among different institutions (Kang et al., 2019). Canada and Austria presented strongly integrated systems in terms of UG co-authorship relations in the early stage, but rapidly decreased afterward.

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>U(%)</th>
<th>I(%)</th>
<th>G(%)</th>
<th>UG(%)</th>
<th>UIG(%)</th>
<th>UI(%)</th>
<th>UIG(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>58,851</td>
<td>62.32</td>
<td>0.59</td>
<td>2.86</td>
<td>4.19</td>
<td>25.77</td>
<td>0.42</td>
<td>3.86</td>
</tr>
<tr>
<td>China</td>
<td>31,276</td>
<td>74.24</td>
<td>0.06</td>
<td>0.72</td>
<td>2.72</td>
<td>20.79</td>
<td>0.04</td>
<td>1.42</td>
</tr>
<tr>
<td>UK</td>
<td>25,623</td>
<td>60.71</td>
<td>0.68</td>
<td>2.03</td>
<td>5.94</td>
<td>25.15</td>
<td>0.2</td>
<td>5.29</td>
</tr>
<tr>
<td>Australia</td>
<td>16,319</td>
<td>64.85</td>
<td>0.15</td>
<td>1.65</td>
<td>3.65</td>
<td>25.31</td>
<td>0.06</td>
<td>4.32</td>
</tr>
<tr>
<td>Germany</td>
<td>18,622</td>
<td>59.47</td>
<td>0.59</td>
<td>1.67</td>
<td>4.43</td>
<td>28.32</td>
<td>0.15</td>
<td>5.37</td>
</tr>
<tr>
<td>Canada</td>
<td>15,219</td>
<td>57.68</td>
<td>0.24</td>
<td>4.23</td>
<td>3.11</td>
<td>30.01</td>
<td>0.24</td>
<td>4.4</td>
</tr>
<tr>
<td>France</td>
<td>12,190</td>
<td>42.3</td>
<td>0.29</td>
<td>4.61</td>
<td>2.66</td>
<td>43.43</td>
<td>0.28</td>
<td>6.44</td>
</tr>
<tr>
<td>Spain</td>
<td>10,382</td>
<td>54.79</td>
<td>0.16</td>
<td>2.85</td>
<td>3.71</td>
<td>33.16</td>
<td>0.16</td>
<td>5.33</td>
</tr>
</tbody>
</table>

Table 1. Publications Co-authored by Various Categories in Eight Countries.

![Figure 5. The triple helix cooperation network and the longitudinal trends of T values for eight countries.](Image 323x602 to 529x737)
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Exploring the Information Cues of Danmaku Comments to Stimulate Users' Affective Generation in Reaction Videos

Ye, Xujie
Nanjing University of Science & Technology, China | yxj77896@163.com
Zhao, Yuxiang (Chris)
Nanjing University of Science & Technology, China | yxzhao@vip.163.com
Li, Jinhao
City University of Hong Kong, Hong Kong | lionel_fjh@163.com
Zhang, Yan
Nanjing University, China | strawberries_z@163.com
Hansen, Preben
Stockholm University, Sweden | preben@dsv.su.se

ABSTRACT
Reaction video, a new form of online video that records users' instant reactions to a particular thing, has emerged on social media in recent years. Its unique content composition and hedonic and emotional characteristics make the information cues that influence the affective generation in danmaku comments quite different from those in traditional videos. To explore the information cues of danmaku comments to stimulate users’ affective generation in reaction videos, we conduct thematic coding using the content analysis method by selecting the danmaku resources, video content, and reactors’ responses from 11 popular videos in different categories as samples to identify information cues that influence user affects in danmaku comments. The preliminary findings show that there are three main types of information cues in the reaction videos: the content of the original video, reactors’ reaction and danmaku comments, which could trigger danmaku users’ affect in reaction videos from the perspective of orientation type, parasocial interaction, and peer influence, respectively.

KEYWORDS
Reaction video; Danmaku; Information cues; Affective generation; Content analysis

INTRODUCTION
Reaction video is a new type of video that has become popular on the internet in recent years, which is described as a genre of user-generated content dependent on the perceived authenticity of a highly charged emotional response (Warren-Crow, 2016). Since this type of video epitomizes emotional rather than logical descriptions (Rowe, 2018), they are not scientific but have more hedonic properties. Because of its emotional characteristic, it could significantly stimulate the viewers’ affects. The research on the reaction video is still in the early stage. Most prior studies focused on the content features of the reaction video itself and users' motivation to watch and create (e.g., Hudson, 2014; Oh, 2017; Rhee & Yang, 2014; Warren-Crow, 2016). To the best of our knowledge, very few studies have been conducted on the affects generated by viewers while viewing reaction videos.

Danmakus are scrolling marquee comments overlaid directly on the video and synchronized to specific playback times (He et al., 2017). Given its vast differences from traditional comments, it has drawn the attention of academics. Existing research mainly focused on the motivations for user danmaku commenting behavior and the analysis of emotional polarity and intensity in danmaku comments (e.g., Chen et al., 2017; Li & Guo, 2021; Wang & Huang, 2021; Yin et al., 2020; Zhao & Tang, 2016). In the reaction video, the instantaneous, participatory, interactive and feedback characteristics of danmaku allow viewers to instantly share their affects and moods during viewing (Wu et al., 2018; Zhang & Cassany, 2020). Consequently, danmaku comments contain plenty of users' affects and further investigation of the antecedents of the generation of viewer affects in danmaku commenting behavior in the reaction video is worthwhile.

The exploration of user affects in the danmaku comments of reaction videos could contribute to a better understanding of the emotional characteristics of reaction videos and danmaku commenting behavior. So far, little literature has explored the stimulus for viewers’ affective generation in reaction videos. To bridge the research gap, we aim to investigate the information cues of danmaku comments to stimulate users' affective generation in reaction videos based on the danmaku resources, video content, and reactors’ responses from 11 popular videos of different categories in Chinese danmaku video website via content analysis. The research findings contribute to the literature on the reaction video and user danmaku commenting behavior in hedonic and emotional contexts and indicate some practical implications for optimizing human-information interaction in social media.

METHOD
Bilibili is a Chinese danmaku video website with many reaction videos. After taking into account the number of video views and danmakus, we selected 11 popular reaction videos of different categories on bilibili.com and chose the danmaku comments, original video content, and reactors' responses from these videos as data sources. Based on the Scrappy crawler framework (Yang et al., 2017), 25,482 danmaku comments were initially aggregated. To ensure
the representative of samples, three native Mandarin-speaking coders reviewed the danmaku comments to identify those that contain affective elements. Finally, a total of 3,119 danmaku comments were chosen for analysis.

We applied the method of content analysis (Holsti, 1969) to explore users’ affect expressed in reaction video danmaku comments and sources of the information cues from which these affects are generated. Based on the circumplex model of affect proposed by Russell (1980), we conducted the priori coding (Stemler, 2000) with danmaku data to identify users’ affects expressed there. Meanwhile, we adopted the emergent coding (Stemler, 2000) to danmaku comments, video content and reactor’s responses to distinguish the information cues related to users’ affective generation. Three native Mandarin-speaking coders coded the data individually and reached a consensus on their codes through two rounds of discussion. This paper selects Cohen's Kappa coefficient (Smeeton, 1985) as a reliability indicator to test the coding results. We continuously adjusted the categories in coding until the reliability level was acceptable (a score of $K=0.85$).

Affect is an umbrella term for a set of more specific concepts that includes emotions, attitudes, and feelings (Bagozzi et al., 1999; Brave & Nass, 2007; Liljander & Mattsson, 2002; Russell, 2003). In reaction videos, users’ affects in the danmaku comments contain the users’ subjective feelings or affective evaluation of a particular object and behavior. Using content analysis for coding, we derived eight types of affects: pleasure, excitement, arousal, distress, misery, depression, sleepiness and contentment. Besides, we summarized seven subcategories distributed across three main categories, as shown in Table 1 below. Based on the coding results, an integrated model of information cues of danmaku comments to stimulate users' affective generation in reaction videos is proposed (see Figure 1 below).

**PRELIMINARY RESULTS AND DISCUSSION**

As is shown in Figure 1, in the reaction video danmaku commenting behavior, users’ affects are influenced by content of the original video, reactor’s reaction and danmaku comments. Specifically, the content of the original video includes two aspects: entertainment-oriented content and interest-oriented content, the reactors’ reaction consists of three aspects: interactive comments, facial expression and body language, while the danmaku comments include two aspects: positive danmaku and negative danmaku. Overall, our study has some preliminary findings. First, we found that viewers are more likely to resonate positively with the reactor in reactor videos where the reactor selected the original video with an entertainment-oriented purpose. Besides, the reactor engages in parasocial interaction (Horton & Whol, 1956) with the viewers through facial and body language in addition to verbal expression, which could trigger viewers’ affective responses, such as resonance and perceived similarity to a greater extent. In addition, the danmaku comments of other users could also have a peer influence on the viewer’s affects, the positive or negative affects expressed by other viewers in danmaku comments could have a reinforcing effect on the similar affect of the viewer.

![Figure 1. An Integrated Model of Information Cues of Danmaku Comments to Stimulate Users’ Affective Generation in Reaction Videos](image-url)
Table 1. The Information Cues of Danmaku Comments to Stimulate Users' Affective Generation in Reaction Videos

<table>
<thead>
<tr>
<th>Main Category</th>
<th>Subcategory</th>
<th>Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content of the original video</td>
<td>Entertainment-oriented content</td>
<td>Dance, Music, Fashion, Animal, Sport, Life</td>
</tr>
<tr>
<td>Interest-oriented content</td>
<td></td>
<td>Game, Animation, Culture</td>
</tr>
<tr>
<td>Reactors' reaction</td>
<td>Interactive comments</td>
<td>Affective feedback, Cognitive sharing,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interaction with viewers</td>
</tr>
<tr>
<td>Danmaku comments</td>
<td>Facial expression</td>
<td>Sad, Happy, Surprise, Fear, Disgust, Angry</td>
</tr>
<tr>
<td></td>
<td>Body language</td>
<td>Head movement, Gesture</td>
</tr>
<tr>
<td></td>
<td>Positive danmaku</td>
<td>Positive affective feedback</td>
</tr>
<tr>
<td></td>
<td>Negative danmaku</td>
<td>Negative affective feedback</td>
</tr>
</tbody>
</table>

In the following section, we will explain the categories of information cues and how they influence the affective generation in reaction videos, respectively.

**Content of the original video**
The content of the original video is part of the reaction video and refers to the object to which the reactor reacts. Depending on the reactor's motivation in selecting the original video, the content of the original video can be divided into two types: entertainment-oriented and interest-oriented.

**Entertainment-oriented content**
Entertainment-oriented videos are those original videos chosen by reactors for public entertainment and amusement (Zhao et al., 2012), including videos with music, dance, fashion, etc., as the main content. Our study revealed that when the reactor chooses original videos for entertainment-oriented purposes, users' affects flowing in danmaku comments are more relaxed and positive, such as generating more happiness, satisfaction, excitement, etc., and resonate positively with the reactor. For example, in the reaction video titled “Practice room reaction: boys watching male groups”, the danmaku comments “hahaha, the expressions of these guys are too funny!” and “Mr. Wang is perfect! hahaha” (Reaction video 1) are representative of our viewpoint.

**Interest-oriented content**
Interest-oriented videos refer to those original videos chosen by reactors for sharing interests and information (Zhao et al., 2012), involving some original videos related to game, culture, etc. In this study, we found that when reactors select the original video for interest-oriented purposes, danmaku users could have more affective responses to the reactor. For instance, in the reaction video with the title of “Genshin Impact reaction- MurderofBirds emotional outburst”, the danmaku comments “Awesome!MurderofBirds” and “He is worthy of being an Genshin Impact expert!” (Reaction video 11) are pertinent comments to our finding.

**Reactors' reaction**
Reactors’ reaction refers to the various responses, including interactive comments, facial expressions and body language, that the reactor displays while watching the original video. Horton and Whol (1956) described para-social interaction as a “simulacrum of conversational give and take” between users and mass media performers. The Para-social Interaction Scale contains empathy, perceived similarity, and physical attraction (Rubin et al., 1985). Hurtmann and Goldhoorn (2011) pointed out that viewers could have a more intense para-social experience if the TV performer addresses them on both a bodily and a verbal level. In the reaction videos the reactor always engages in para-social interaction with the viewers through facial and body language in addition to verbal expression, which could trigger viewers’ affective responses, such as resonance and perceived similarity, to a greater extent.

**Interactive comments**
Interactive comments are the views and opinions expressed by the reactor while watching the original video, including affective feedback, cognitive sharing, and interaction with viewers. According to the data of danmaku and reactors’ interactive comments, we found that the reactor's affective feedback was mainly positive. These positive affects often resonated with the viewer, e.g., “Totally agree! Fantastic music!” (Reaction video 2). When the reactor engaged in cognitive sharing, the affects generated in response to these comments were more complex due to differences in the viewer's subjective values, e.g., “Don't be ridiculous! This is naked plagiarism!” (Reaction video 5).
Facial expression

Facial expression is the affective state shown by the reactor's facial muscles while viewing the original video. The coding of reactor expressions is based on the six basic human emotions corresponding to facial change features proposed by Ekman and Friesen (1971). For example, when a reactor shows a facial change in which the eyebrows are raised, the eyes are widened and the mouth is opened, the coder gives it the initial concept of 'surprise'. Our study revealed that the reactors’ angry, happy and sad affects could easily arouse the emotional resonance of danmaku users, that is, if the reactor shows angry, happy or sad facial expressions during their reactions, the danmaku users could sometimes be infected and express similar affects. For example, sometimes danmakus with the content "hahahaha" (Reaction video 3) float over the video when the reactor expresses happiness by laughing.

Body language

While watching the original video, the reactor expresses affects and opinions through comments, facial expressions, and body language, such as head movements and gestures, to express affects more exaggeratedly. This exaggerated expression of affects, especially gestures, often appears in the reactor's affective ups and downs, when the reactor's affects particularly easy to mobilize the audience's emotions, and trigger the audience's emotional resonance. For instance, when the reactor swings his head with the rhythm of the music in the original content, many danmaku comments such as “It's mesmerizing!” and “Awesome!” (Reaction video 2) float over the video.

Danmaku Comments

Danmaku Comments are instant remarks generated by other viewers during viewing the reaction video, which contains positive or negative affective feedback. In social media, social activities between individuals based on shared social identities or perceived equal interpersonal relationships with others are a form of peer-to-peer social interaction (Bapna & Umyarov, 2015) in which, the affects, opinions, and behaviors among individuals are more contagious (Brechwald & Prinstein, 2011). In the reaction video, the relationship between viewers constitutes peer-to-peer social interaction and their affects influence each other due to the presence of peer influence, which means positive or negative affects expressed by other viewers in danmaku comments could have a reinforcing effect on similar affects of the viewer, e.g. “The previous one is right! We can't let others steal our traditional culture!” (Reaction video 7).

IMPLICATIONS AND FUTURE WORK

As part of an ongoing project, this paper investigates the affects of reaction video users’ danmaku comments and the information cues that influence their generation. By employing content analysis, this paper concluded seven subcategories from three categories: the content of the original video, reactors’ reaction and danmaku comments, and constructed an integrated model of information cues of danmaku comments to stimulate users' affective generation in reaction videos. Exploring the information cues of danmaku comments to stimulate users' affective generation can help to gain insight into the user danmaku commenting behavior, and the designers of danmaku video websites may use the preliminary findings to identify the areas that can be effective in stimulating users’ affective responses to draw users into the interaction and further optimize the danmaku information interaction mode, thus effectively achieving the purpose of optimizing human-information interaction experience and improving information service quality, which could indicate some practical implications for optimizing human-information interaction in social media. In addition, the integrated model of information cues of danmaku comments to stimulate users' affective generation in reaction videos may be used to study affect-related issues in other aspects of social media, for example, whether affect should be further divided into more refined affective concepts such as emotion or attitude for in-depth study. Finally, the study contributes to the literature on the reaction video, user danmaku commenting behavior and contextualized exploration of the circumplex model of affect in hedonic and emotional contexts.

This study has several limitations. First, affect is an umbrella term for a set of more specific concepts, but due to space limitation, we did not subdivide these affective concepts in this study. Second, some viewers of the reaction videos may not express their affects by sending danmaku comments. Hence, this paper lacks an exploration of the affective reactions of this group of users. In our future work, we will further understand the influence of cognitive and individual traits on affective generation based on the affective response model (Zhang, 2013), differentiate various affective concepts and conduct in-depth interviews to construct the generation mechanism of viewers' affects in reaction videos. Moreover, we will conduct eye-tracking experiments (Holmqvist et al., 2011) to explore users’ attention mechanisms in reaction videos and what content will likely trigger users’ affective fluctuations.

ACKNOWLEDGMENTS

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How Are Policy Document Mentions to Academic Papers Accumulated?

Yu, Houqiang  
School of Information Management, Sun Yat-sen University, China | yuhq8@mail.sysu.edu.cn

Yao, Renfeng  
School of Information Management, Sun Yat-sen University, China | yaorf@mail2.sysu.edu.cn

ABSTRACT
This article investigates the lengths of time that publications with different numbers of policy document mentions take to receive their first mention (the beginning stage), and then compares the lengths of time to receive two or more mentions after receiving the first mention (the accumulative stage) based on complete policy document dataset from Altmetric database. We find that in response time distribution, i.e., from zero to one policy document mention, highly and mediumly mentioned papers exhibit obviously different lengths of time compared with lowly mentioned papers. In accumulative time distribution, i.e., from one to N policy document mentions, highly mentioned papers begin to receive mentions much more rapidly than medium- and low-mentioned papers. However, as N increases, the difference in receiving new mentions among high-, medium-, and low-mentioned publications does not increase quite significantly.

KEYWORDS
Altmetrics; Policy Document Mention; Accumulation Pattern; Policy Document Altmetrics

INTRODUCTION
Altmetrics has provided a novel way of measuring the broader impact of scholar outputs. Policy document mentions are extremely relevant in revealing the impact of academic papers on policymaking (Yu, Cao, Xiao, & Yang, 2020; Bornmann, Haunschild, & Marx, 2016). Velocity is an important feature of altmetrics indicators. It measures the dissemination and accumulation pattern of papers to receive attention.

Accumulative pattern is well studied in citation analysis. To name a few, Schubert and Glänzel (1986) calculated the time difference between the publication date and first citation date, and proposed mean response time indicator to measure the citation speed of journals. Huang, Bu, Ding and Lu (2019) used response time and cumulative time investigate the accumulative pattern of papers with different levels of citations.

In altmetrics field, several studies have tapped into the accumulation pattern. Fang and Costas (2020) adopted velocity index, altmetric half-life and altmetric time delay to measure the accumulation speed of 12 different data sources tracked by Altmetric.com, and explored the influence of document type and research topics on the accumulation pattern. Fang and Wang (2019) specifically explored the accumulation speed of Twitter mentions to academic papers and revealed the influence of user types.

The temporal process of papers’ receiving policy document mention has not been explored, especially as regards the differences in the periods required to receive one or more policy document mention between papers that receive different number of mentions. The research question of the study is: how are policy document mentions to academic papers accumulated over time?

METHODOLOGY

Data collection
All policy document altmetrics data from Altmetric database were downloaded on January 28th 2023. In total, there were 3,125,441 records of policy document mentions. Each record contains publication date, mention date, DOI, mention URL and the other types of data. In order to improve the accuracy of data analysis, it is crucial to correctly identify the date and frequency of policy document mentions. The dataset was processed with the following procedures. (1) Records with empty publication date were removed. This step removed 36,253 records. (2) Records of which the mention date was prior to the publication date were removed. It was possible that the mention date was earlier than publication date due to the preprint or online first publication model. But for this research, this does not make sense. This step removed 184,388 records. (3) Records with empty DOI field were removed. The step removed 140,481 records. (4) Previous study (Yu, Xiao, Wang, & Qiu, 2017) showed that around 80% of policy document mentions occurred within 8 years after publication. Therefore, the time window of 8 years was adopted for the publication to accumulate enough policy document mentions. Academic papers of which the publication date was from January 1st 1985 to December 31st 2014 were filtered out for analysis. After the above processing, 2,032,505 policy document mentions of 1,050,410 academic papers were harvested.

Division of different groups
The academic papers were classified into three groups, namely the highly mentioned, the mediumly mentioned, and the lowly mentioned group. Figure 1 plotted the distribution of policy document mentions. The blue dots represent
academic papers. The red line is the fitting line under log coordinates. Dots of two areas are deviating from the fitting line, suggesting that they have different mechanism behind them. To achieve the exact thresholds, different numbers were tested by taking into consideration the distribution of mentions. Therefore, in the up left corner, blue dots of which the number of policy document mentions are below or equal to 14 represent the lowly mentioned academic papers. In the bottom right corner, blue dots of which the number of policy document mentions are above or equal to 160 represent the highly mentioned academic papers. Meanwhile, frequency between 14 and 160 represent the mediumly mentioned academic papers.

Figure 1. Distribution of number of policy document mentions over 1985-2014

Figure 2. Descriptive result of highly, mediumly, and lowly mentioned papers (1985-2014)

Figure 2 showed the distribution of academic papers of each group. Lowly mentioned academic papers are dominant of which the percentage was 99.353%. Within this group academic papers with no more than 3 policy document mentions have occupied over 90%. In contrast, the mediumly mentioned and the highly mentioned academic papers have taken respectively 0.644% and 0.003% of total papers. This is in accordance with previous study (Yu, Xiao, Wang, & Qiu, 2017) that distribution of policy document mentions is relatively even and at low level. Therefore, mediumly and lowly mentioned papers were randomly sampled to do comparison with highly mentioned papers. From the dataset 1000 lowly mentioned and 1000 mediumly mentioned papers were randomly selected. The temporal distribution of sampled papers is in accordance with that of the whole dataset. Therefore, the further analysis could be conducted based on the sample dataset.

Process of analysis

Response time (labeled as $Y_1$) refers to the time span from the publication date to the first mention date. It reflects the difficulty that a paper encounters in the beginning period to receive policy document mention. Shorter response time indicates that policymakers have been aware of the impact brought by the paper to the policy document more quickly. Accumulative time (labeled as $Y_2$) refers to the time span from the publication date to the number i mention date. It reflects the ongoing attraction of the paper to policymakers. These two indicators are calculated as follows.

Suppose papers that was published in $y_0$ had been mentioned by policy document with the sequence $m_1$, $m_2$, $m_3$, ..., $m_n$. $m_1$ refers to the first policy document mention in year $y_1$, $m_i$ refers to the number i policy document mention in year $y_i$, $m_n$ refers to the last time policy document mention in year $y_n$ ($y_n \geq y_i \geq y_0, 1 \leq i \leq n$). Then the below formulas are proposed.

\[
\text{Response time} \quad Y_1 = y_1 - y_0 \quad (1)
\]
\[
\text{Accumulative time} \quad Y_2 = y_i - y_0 \quad (2)
\]

The probability distribution (short as PD) and cumulative distribution (short as CD) of response time (i.e., time span from publication date to $m_1$) are used to reveal the extent to which academic papers can attract policy document mention. The probability distribution and cumulative distribution of accumulative time are used to reveal the extent to which academic papers can accumulate more policy document mentions. $m_2$ and $m_4$ were used because the mean number of policy document mentions for lowly mentioned papers was 2 and proportion of papers with number of policy document mentions no less than 4 was around 10%.
RESULTS
Response time distribution of policy document mentions
Figure 3 shows the probability distribution and cumulative distribution of response time for each group of academic papers. It is also compared the average time when 80% of the papers receive their first policy document mention.

As regards probability distribution, both mediumly mentioned group and highly mentioned group have rapid decrease in the first 5 years. 42% of mediumly mentioned and 46% of highly mentioned papers receive their first policy document mention within the first year. In comparison, the PD curve of lowly mentioned papers is quite different. There is a small increase in the first 2 years followed by a slow decrease. 17% of lowly mentioned papers would receive the first policy document mention within the first year. All highly mentioned papers have received the first policy document mention in 8 years, while for mediumly and lowly mentioned papers it is 29 years and 36 years respectively.

As regards cumulative distribution, curves for mediumly mentioned and highly mentioned academic papers are quite similar. In the beginning years the curves are steep with a relatively high starting point, indicating that most of papers quickly attract attention from policy documents. In contrast, the curve of lowly mentioned papers is gentle with relatively low starting point. To be specific, the accumulate percentage of mentioned papers in the first 3 years are 82%, 75% and 27% for highly mentioned, mediumly mentioned, and lowly mentioned papers respectively. In the first 7 years, curves of mediumly and highly mentioned papers are highly overlapped, indicating that they share similar response time in attracting policy document mentions.

To further clarify the difference of response time of three groups, we have compared the average time when 80% papers in the group have receive the first policy document mention. As shown in Figure 3(c), it takes 5 years for the lowly mentioned group to get 80% papers mentioned, while for mediumly mentioned and highly mentioned groups, the time is 1 year and 0.5 year respectively. This suggest that for lowly mentioned papers, they encounter much more difficulty in receiving their first policy document mention.

Accumulative time distribution of policy document mentions
Figure 4 and Figure 5 shows the probability distribution and cumulative distribution of $m_2$ and $m_4$ policy document mentions, accompanied with the average time of 80% papers.

Figure 3. Distribution of response time of different groups

Figure 4. Accumulation time distribution of different groups from $m_1$ to $m_2$
In probability distribution, curves of three groups present quite different characteristics. Highly mentioned papers quickly attracted the second policy document mention in the first year (39%) and second year (25%). For mediumly mentioned papers, it is slower that 22% of papers successfully received the second policy document mention in the first year. In contrast, the probability distribution of lowly mentioned papers is quite dispersed. In the first year only 3% of papers received the second policy mention. The percentage is highest in the fifth year but still the percentage is no higher than 10%. This suggests that highly mentioned papers are likely to accumulate the second policy document mention in the first 2 years while the probability is very low for lowly mentioned papers. Consider the m4 situation, we observed a greater fluctuation in the curves of three groups. The accumulative distribution become more even. The percentage of highly mentioned papers that receive the fourth policy document mention has dropped to 29% while for mediumly mentioned papers it is 8%.

In cumulative distribution, within the same group the curve of m2 and m4 are quite similar, suggesting that cumulative pattern exist for certain group of papers. Curve of the highly mention papers has steep slope in the beginning period while the other two curves endure much longer period. For highly mentioned group, it takes 9 years and 11 years respectively to accumulate the second and fourth policy document mention. In contrast, it would take over 30 years for the other two groups. For m2, the accumulative percentage for highly, mediumly, and lowly mentioned papers are 79%, 59% and 15% respectively. For m4, the percentage is 71%, 41% and 9% respectively. Comparing m2 and m4 situation, the starting point of each group has moved down, indicating that more challenges are met during the process of attracting more policy document mentions.

The difference of different groups at the same accumulative level are also presented in Figure 4(c) and Figure 5(c). For 80% of papers to accumulate the second policy document, the average time is 1 year, 2 years and 6 years for highly, mediumly and lowly mentioned group. When it comes to accumulate the fourth policy document, the number has increased to be 1.5 years, 3 years, and 6.5 years. The time lag between highly mentioned and lowly mentioned groups is 5 years.

**CONCLUSIONS**

Policy document mentions to academic papers play an important role in altmetrics studies. However, the temporal process of papers’ receiving policy document mention has not been explored, especially as regards the differences in the periods required to receive one or more policy document mention between papers that receive different number of mentions. Based on complete dataset of policy document mentions by Altmetric database, this article investigated the accumulative performance of highly, mediumly, and lowly mentioned papers. The major findings are: (1) In response time distribution, i.e., from zero to one policy document mention, highly and mediumly mentioned papers exhibit obviously different lengths of time compared with lowly mentioned papers. (2) In accumulative time distribution, i.e., from one to N policy document mentions, highly mentioned papers begin to receive mentions much more rapidly than medium- and low-mentioned papers. However, as N increases, the difference in receiving new mentions among high-, medium-, and low-mentioned publications does not increase quite significantly. This study contributes to the understanding of how fast number of policy document mentions could be accumulated, and has distinguished three basic categories of scholarly paper that show different accumulation patterns. In practice, proper time window can be selected when conducting different kind of research about policy document mentions. Furthermore, the future study can try to capture and predict what kind of paper could have the corresponding accumulation pattern.
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Al-Based Research Tool for Large Genealogical Corpora: The Case of Jewish Communities Worldwide

Zhitomirsky-Geffet, Maayan  Bar Ilan University, Dept. of Information Science, Israel | maayan.zhitomirsky-geffet@biu.ac.il
Suissa, Omri  Bar Ilan University, Dept. of Information Science, Israel | omrishsu@gmail.com

ABSTRACT
This paper presents a new methodology for AI-based research and exploration of large genealogical corpora. The proposed approach is based on an automatic quantitative question-answering (QA) system that enables researchers to ask questions in natural language and learn about trends related to individuals, families, and communities in the corpus of the study. The proposed methodology includes: 1) an automatic method for training dataset generation, 2) a transformer-based table selection method, and 3) an optimized transformer-based quantitative QA model. The findings indicate that the proposed architecture outperforms the state-of-the-art models by achieving 87% accuracy on the large corpus of Jewish genealogical data. This study may have practical implications for genealogical information centers and museums, making genealogical data research easy and scalable for experts as well as the general public.

KEYWORDS
Question-answering; genealogical data; digital humanities; deep learning; cultural heritage.

INTRODUCTION
Exploration of large cultural heritage corpora is one of the fundamental research practices in digital humanities and social sciences. However, many humanities and social sciences scholars do not have sufficient technological and mathematical training and skills to conduct such an analysis (Suissa et al., 2022). Thus, there is a need for AI-based tools that enable easy and user-friendly exploration of large textual corpora. One of the key AI-based techniques for textual corpora exploration is natural language question-answering (QA). Unlike keyword-based search engines, QA algorithms receive and process natural language questions and produce precise answers rather than long lists of documents that need to be manually scanned (Suissa et al., 2021). While factual question-answering models aim to answer a question about one (or few) piece(s) of information (e.g., about a specific individual), quantitative question-answering models aim to answer quantitative questions about a substantial subset of the dataset (e.g., a community or a country) (Suissa et al., 2023). Quantitative QA is a more computationally challenging task, but it is extremely valuable as it enables scholars to gain a “big picture” of the corpus under study and discover global and local trends in the data. This paper proposes and implements a new approach for investigation of large genealogical corpora based on quantitative QA. The proposed methodology was applied and validated on the genealogical data of Jewish communities in the 19th and 20th centuries.

METHOD
Genealogical data is usually stored in GEDCOM format. In GEDCOM, every individual in the family tree is represented as a node containing predefined attributes (e.g., name, birth date and place, death date and place [Gellatly, 2015]). Every individual is a “spouse” or a “child” within a family node. The QA system was developed for answering aggregative research questions on genealogical data, such as “What was the life expectancy of Jewish men in Germany between 1800 and 1825?” or “What was the most popular profession of Jewish women in Poland in the 19th century?”). Table 1 presents some examples of questions.

A quantitative QA DNN (question answering deep neural network) model (extending and improving the state-of-the-art TaPas model presented in Herzig et al. (2020)) was trained on the generated set of genealogy-oriented questions and answers dataset. The developed QA model is based on the weak supervision implementation of the state-of-the-art TaPas model (Herzig et al., 2020), a BERT (Devlin et al., 2018) encoder model adapted to the quantitative QA over tables. TaPas has been designed to answer open-domain questions with three types of quantifiers: “count”, “sum”, and “average”. The model uses a question and a single flattened table as input; a table is flattened into a sequence of word pieces (tokens) and concatenated with the question tokens. The encoder model is added with two classification layers for selecting table cells and quantifiers that operate on the cells. The cell selection classification layer determines whether (i.e., the probability of) a given cell should be used for the quantifier operation or not. The quantifier layer selects the numerical operation needed to answer the question. As the original TaPas model trained on the open domain dataset of questions, answers and tables produced poor results for the genealogical domain, we defined a methodology for automatically generating a training dataset for TaPas derived from genealogical data. The proposed methodology comprises the following main steps summarized in Figure 1:
1. A CIDOC-CRM-based ontology is constructed for the genealogical corpus (Koch et al., 2019).

2. A comprehensive set of quantitative question patterns is systematically defined based on the CIDOC-CRM-based ontology constructed for the corpus, such as some constant terms conveying the type of the quantifier in the question (“average”, “count”, “max”, “min”, “portion”) and other parameter components whose values are taken from the classes in the ontology (e.g., for “gender” parameter – the values can be “male” and “female”) (see Table 1).

3. An extensive dataset of questions for the genealogical domain, GenAgg, is created based on populating the patterns with values from the ontology. Paraphrase generation DNN is used to generate more questions with the same meaning to increase the lexical variability of the questions (Table 1). Question paraphrasing was done using PEGASUS (Zhang et al., 2020), which was trained on the Quora dataset (Aghaebrahimian, 2017). This step ensures that the system is not limited to a certain formulation of questions and can answer a wide variety of natural language quantitative questions related to the genealogical data.

Next, the GEDCOM data was converted into a multi-table structure, and, as shown in Figure 2, for each question type in the above-generated question dataset, the DNN QA tool was trained to select the relevant tables from the corpus using fine-tuned SBERT model (Reimers & Gurevych, 2019) and to select tables’ cells relevant for the question using the extended multi-table TaPas model. The table selection model allows overcoming the input length limit of the TaPas model and “focusing” the model on the most relevant data to the question. The developed QA system was also adapted to answer additional types of quantitative questions that were not supported by the original TaPas model, e.g. the “portion” questions (“What is the percentage of women in Berlin who got married under the age of 20?”). This was performed by “breaking” the question into two questions and calculating the “main” question’s answer divided by the question’s population (e.g., for the question above ” the model will calculate \( \frac{\text{women married under 20 in Berlin}}{\text{married women in Berlin}} \)). Technical details of the model implementation are described in Suissa et al.(2023).

To use the developed QA tool, a researcher asks quantitative research questions relevant to the genealogical data. The QA tool classifies the questions according to the quantifiers, selects the relevant tables and cells, and calculates the answer for the identified quantifier based on the selected relevant cells’ data.

![Figure 1. The GenAgg dataset generation process.](image-url)
RESULTS

The method described above was applied to the Douglas E. Goldman Jewish Genealogy Center dataset in the Anu Museum and found some fascinating trends just by asking the right questions and visualizing the results. The dataset contains 1,847,224 Jewish individuals from 617,669 families written in English. A set of research questions about Jewish communities worldwide was defined by the researchers and used as input to the model. The model was validated using accuracy metrics measuring the model’s ability to answer the research questions on the dataset. The average accuracy of the developed multi-table QA DNN model trained on the genealogical question dataset was 87%, which is sufficient for trend detection and distant reading analysis. The data was much higher than that of the original state-of-the-art single-table TaPas model (87% vs. 21%). A detailed description of the model and experiments is presented in Suissa et al., (2023).

To illustrate the tool’s effectiveness for corpus investigation and global and local trend discovery, we visualized the tool’s answers to two types of questions: the questions on the life expectancy and average number of children in the family across countries and periods. As shown in Figure 3, the life expectancy of people from the top European countries born between 1800 and 1925 in the dataset drops over time and is at its lowest point for people born from 1900-1925 (and in the Netherlands even sooner). This could be the result of two world wars that happened between 1914 to 1945 (i.e., people born between 1900-1925 were of military age). Moreover, there is a significant variance in life expectancy between countries. For example, between 1825 and 1849, the Jewish people who lived in Denmark reached the age of 79.88, while in Andora, the Jewish people lived only for 58.85 years on average. On the other hand, while there is a decrease in life expectancy over time in non-European countries, there is no dramatic drop like in Europe, except for Turkey, Argentina, and Canada.

<table>
<thead>
<tr>
<th>Quantifier</th>
<th>Pattern-based rule example</th>
<th>Parameter's values</th>
<th>Result</th>
<th>DNN model paraphrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNT</td>
<td>How many [POPULATION DESCRIPTOR] were [CONDITION 1] ... [and/or/between] [CONDITION N]</td>
<td>population descriptor: women condition 1: born in Romania condition 2: worked as a nurse condition 3: between 1900 to 1950</td>
<td>How many women were born in Romania and worked as a nurse between 1900 to 1950?</td>
<td>Between the year 1900 and the year 1950, what was the number of women that held a nurse job and lived in Romania?</td>
</tr>
<tr>
<td>MAX</td>
<td>What is the [COLUMN 1] with the maximum number of [COLUMN 2]s [were/in] [CONDITION 1] ... [and/or/between] [CONDITION N]</td>
<td>column 1: year column 2: deaths condition 2: in Turkey</td>
<td>What is the year with the maximum number of deaths in Turkey?</td>
<td>Which is the deadliest year in Turkey?</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>What is the average [COLUMNN] of [POPULATION DESCRIPTOR] that were [CONDITION 1] ... [and/or/between] [CONDITION N]</td>
<td>column: age population descriptor: men condition 1: born in Montenegro condition 2: worked as a hat maker condition 3: between 1850 to 1950</td>
<td>What is the average age of men that were born in Montenegro and worked as a hat maker between 1850 to 1950?</td>
<td>What is the life expectancy for hat makers men from 1850 to 1950 in Montenegro?</td>
</tr>
</tbody>
</table>

Table 1. Pattern examples for question generation in the genealogical domain.
Furthermore, Figure 4 presents a global decreasing trend in the number of children in Jewish families. While in the 1800s, there was a high variance between counties (both European and non-European), at the beginning of the 1900s, the variance in the number of children reduced dramatically. For example, between 1825 and 1850, the average number of children in a Jewish family living in the Czech Republic was 3.85, while in the same period, the average number of children in a Jewish family living in Andorra was 8.24. At the beginning of the 20th century, the average number of children was between 2 and 3 in most countries.

This paper demonstrates the effectiveness of AI-based models for researching and investigating genealogical corpora based on natural language quantitative questions. This approach can be utilized as an aid for scholars in different humanities and social sciences domains who can further explore and explain the discovered phenomena and trends.

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Making a Difference: Translating Information Research into Practice, Policy, and Action

Albright, Kendra S. Kent State University, USA | kalbrig7@kent.edu
Black, Kimberly Chicago State University, USA | kblack21@csu.edu
Chu, Clara M. University of Illinois at Urbana-Champaign, USA | cmchu@illinois.edu
Du, Jia Tina University of South Australia, Australia | tina.du@unisa.edu.au
Edgar, Bill Kent State University, USA | wedgar2@kent.edu
Jaber, Baheya S. University of Alabama, USA | bsjaber@crimson.ua.edu
Mehra, Bharat University of Alabama, USA | bmehra@ua.edu
Turner, Christina Kent State University, USA | ctturne44@kent.edu

ABSTRACT
This panel presents information research cases translating impact into practice, policy, and action that make a difference in varied contexts of study. Initiatives of collective impact are applied and/or proposed, and the following models of research and research studies, exemplifying critical collective impact and making a difference IN research and WITH communities, are discussed in the following three panel presentations: 1. Towards a Critical Approach to Community-engaged Information Research and Shared Knowledge; 2. From Research to Strategic Planning to Collective Action: A Logic Model Using Theory of Change to Further Civic Engagement for Racial Justice in Public Libraries; 3. Building a Smart City Portal for a Sustainable Future Through a Collective Impact Approach.

The presentations are followed by critical engagement with the audience in the session to interrogate making a difference, what contributes to effective community engagement and translatable results, that is, difference in making (process) and making a difference (impact). Panelists represent both practice-based and academic settings who report on their research, projects, and reflections on applying collective impact in making a difference.

KEYWORDS
collective impact, community-engaged information behavior, community portal, logic model, racial justice, research translation, smart city, Theory of Change

INTRODUCTION
Making a difference in information research is when the researchers engage in a transparent/meaningful process with the communities of study, said communities have agency in the research, and the findings are of benefit to said communities and enhance knowledge in the field. That is, the engagement is articulated, the results are translated into action, and relevant entities are involved, who complement the process, and connect researchers and communities. Making a social difference in information research occurs when collective impact is applied. Introduced by Kania and Kramer (2011), collective impact (CI) is “the commitment of a group of important actors from different sectors to a common agenda for solving a specific social problem.” This model strengthens the capacity to tackle complex social issues, such as violence, gender inequity, hunger, poverty, education, health, and the environment (i.e., the United Nations Sustainable Development Goals (UN SDGs)), which involve many different factors, and organizations to draw from their different expertise and respective resources to develop solutions in a coordinated and intentional manner. Organizations, working in isolation and single-handedly, recognize that they have not significantly tackled complex issues, which the research community has been addressing through interdisciplinary collaborations and convergence research.

Based on a recent review of the 19 peer-reviewed research articles on the use of CI framework, Ennis and Tofa (2020) identified four themes in research: a need to adapt CI to the specific context, its technical nature, the importance of relationships, and concerns about power and equity. The authors concluded that the literature on the CI framework is in its nascent stage and focuses on model development or capability building. In the library and information science (LIS) field, CI has been applied in the professional community more than in research. Identified by the ALA’s Center for the Future of Libraries as a trend relevant to the library field, public libraries began using the CI approach in the mid-2010s (Mattei, Tashjian & Carrigan, 2017). By engaging a CI model, the possibility increases to bring about large-scale social change through better cross-sector coordination which leverages the collective resources of organizations, removing duplication and competition, while increasing trust and impact (Kania & Kramer, 2011). Researchers engaged in collective impact enhance their capacity to effect considerable social change.

MAKING A DIFFERENCE WITH COLLECTIVE IMPACT: REAL-WORLD CASES
This panel will present cases where collective impact was applied and/or is proposed, that is followed by critical engagement with the audience in the session to interrogate making a difference, what contributes to effective
community engagement and translatable results, that is, difference in making (process) and making a difference (impact). Panelists are from both practice-based and academic settings who will report on their research, initiatives, and thoughts on applying collective impact in making a difference. The following models of research and research studies, exemplifying critical collective impact and making a difference IN research and WITH communities, will be discussed in the panel presentations:

1. **Towards a Critical Approach to Community-engaged Information Research and Shared Knowledge** (Jia Tina Du and Clara M. Chu): Taking the concept of community engagement as its central focus, Du and Chu (2022) reviewed its proximal use in information behavior research and argued its potential as an integrative process that can restore and reposition the community-researcher relationship in the information behavior field. This repositioning is found in their proposed Community-Engaged Information Behavior (CEIB) methodological framework (Du & Chu 2022) to study human-information interactions and guide information behavior researchers to practice community-engaged inquiry. It is grounded in five principles that serve as the foundation for how CEIB research is approached and conducted. Applying the principles, research is jointly negotiated, where researcher and community understand their roles, define the research objectives, and anticipate outcomes and impacts. It is asset-based and considers principles, roles, research methods, and community-researcher impacts. The CEIB methodological framework will be presented followed by research examples to demonstrate how CEIB is applied to achieve collective impact through working with underrepresented communities.

2. **From Research to Strategic Planning to Collective Action: A Logic Model Using Theory of Change to Further Civic Engagement for Racial Justice in Public Libraries** (Bharat Mehra, Kimberly Black, and Baheya S. Jaber): This presentation highlights conceptualization and implementation of key elements in a logic model based on Theory of Change (ToC) being applied in a grant entitled Civic Engagement for Racial Justice in Public Libraries (RJ@PL) that was recently funded by the Institute of Museum and Library Services (August 2022 - July 2025) (Mehra & Black, 2022). It traces the relationship between research to strategic planning to collective action via the use of the logic model using ToC to further civic engagement for racial justice in public libraries. Public libraries have the potential to serve as community catalysts and create, develop, and advance racial justice in their communities (Mehra, 2022). This includes furthering racially just library collections, spaces, programs and services in support of their communities. It also means that libraries as workplaces need to become more racially just. Data collected from this research is developing contextually relevant strategic information tools of collective action (e.g., roadmap, action plan, taxonomic framework of information responses) for civic engagement that public libraries can use to overcome problems related to racism in their communities. ToC is used to develop the community engagement frameworks and strategic action plans. ToC is an approach to creating change that emerged from the efforts of philanthropic associations that funded comprehensive community change initiatives; it was developed as a way to measure philanthropically funded projects’ progress and determine their efficacy in meeting their goals (Andrews, 1995; Reinholz and Andrews, 2020; Weiss, 2005).

3. **Building a Smart City Portal for a Sustainable Future Through a Collective Impact Approach** (Kendra S. Albright, Bill Edgar, Christina Turner): The overall goal of this project is to improve the quality of life for the citizens of Cleveland. Smart city projects often share commonalities using a phased approach to implementation. Our definition of a smart city follows this phased approach, focusing on the areas of: 1) governance, 2) broadband and networking, 3) energy, and 4) transportation, in that order. This panel will focus on the first two aspects of governance and networking through development of a knowledge sharing portal for citizens of Cleveland. Several unique features differentiate our approach to these first two phases. First, the network will be hosted and governed by a recently established Cooperative (NEOhio.us), a democratic entity controlled by its members, rather than by local governments or corporations. Second, public libraries will guide the development and application of a portal that serves as a knowledge hub, connecting resources, and people in the community. This aligns with the expanding mission of public libraries to focus on serving as a community hub for intellectual content including vital data that is constantly generated by and affecting the community. Third, this approach will lead to a potentially replicable and sustainable model of a smart network directed through a cooperative governance structure, served by public libraries, for other smart cities and regions throughout the United States. Using a collective impact approach of interviewing people across different sectors and organizations, the result will inform the design of the community portal. The findings of these interviews will be presented.

**PANELISTS AND EXPERIENCE IN RESEARCH TRANSLATION**

Panelists are experienced in translating information research into practice, policy and action. They will contribute unique perspectives and content to the session.
- **Kendra S. Albright** is the Goodyear Endowed Professor in Knowledge Management in the School of Information at Kent State University. Her research interests focus on the ways in which users understand and use information to facilitate positive change and solve organizational problems within the knowledge economy. Her current work focuses on two areas: 1) researching the information needs of citizens in Cleveland to improve the quality of life through smart technologies, and 2) investigating and comparing worldwide KM educational competencies and programs.

- **Kimberly Black** is an Associate Professor in the Department of Computing, Information, and Mathematical Sciences and Technologies at Chicago State University (CSU). She is a Co-founder of CSU’s Center for Information and Security, Education and Research, an Intelligence Community Center for Academic Excellence. She serves as a member of the executive advisory board for the Gwendolyn Brooks Center for Black Literature and Creative Writing.

- **Clara M. Chu** is Director and Mortenson Distinguished Professor at the Mortenson Center for International Library Programs in University of Illinois at Urbana-Champaign. Her international work in English and Spanish has focused on library and information science (LIS) education, diversity, equity and inclusion in LIS, strategic planning, and emerging technologies and trends, among other topics. Her research on diversity issues engages the voices of underrepresented communities, and aims to remove barriers to hinder their access to information and center their identity and representation.

- **Jia Tina Du** is Professorial Lead and Associate Professor of Information Studies and Director of Information and Innovation Laboratory in the UniSA STEM, University of South Australia. Her research interests are in applied and interdisciplinary studies related to information behavior, interactive information retrieval, marginalized communities, and social impact of digital technologies. By integrating her information and technology expertise with a passion for community engagement and equality, she works with people from marginalized groups (e.g., Aboriginal, migrant and older communities) to overcome their challenges with technology and use it in their everyday lives.

- **Bill Edgar** is Knowledge Management consultant and adjunct professor at Kent State University. He is providing KM consulting to a major project to develop Cleveland and Northeast Ohio into smart communities. He currently teaches Knowledge Management at Kent State University and has published on Knowledge Management.

- **Bharat Mehra** is EBSCO Endowed Chair in Social Justice and Professor in the School of Library and Information Studies at the University of Alabama. His research focuses on diversity and social justice in library and information science and community informatics or the use of information and communication technologies to empower minority and underserved populations to make changes in their everyday lives. He has applied action research while partnering with racial/ethnic groups, international diaspora, sexual minorities, rural communities, low-income families, small businesses, and others, to represent their experiences and perspectives in the design of community-based information services.

- **Baheya S. Jaber** is a Doctoral Candidate in the College of Communication & Information Sciences at the University of Alabama. Her work focuses on intercultural communication, community engagement, and social justice. Her dissertation focuses on applying critical race theory, feminist theory, and intersectionality to engage in strategic planning and social justice actions with immigrant women from the Middle East and North Africa (MENA) and public library stakeholders in Texas, which is the state with the largest number of immigrants in the United States coming from the MENA region.

- **Christina Turner** is a User Experience Design Graduate Student at Kent State University. She has nearly 20 years of public library experience, which she utilizes together with her experience in the arts community in Cleveland to inform the design of a portal that enables smarter regional networking.

### PANEL FORMAT
This will be a 90-minute panel that involves presentations to contextualize collective impact (i.e., making a difference), followed by breakout group discussions to relate the topic and their experiences and perspectives.

- Overview and Introduction [3 minutes]
- Panelists’ Presentations [50 minutes: 15 Minutes per presentation; 5 minutes Q&A at the end]
- Breakout Group Discussions [22 minutes]
- Report back [12 minutes]
- Wrap up [3 minutes]

### Breakout Group Discussions Questions
Panelists will facilitate the group discussions focused on the following questions:

1. What elements of collective impact contribute to effective community engagement and translatable results? Discuss elements in the process and impact of research.
2. What elements of collective impact do you see in or would like to integrate into your own research, practice, policy, and action?

3. What challenges do you foresee in integrating a collective impact approach in your own research, practice, policy, and action, or generally in information work and research?

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Global Perspectives on Inclusive Curricula: Places, Practices and Pedagogy

Batool, Syeda Hina
University of the Punjab, Pakistan | hina.im@pu.edu.pk

Bullard, Julia
The University of British Columbia, Canada | julia.bullard@ubc.ca

Campbell-Meier, Jennifer
Te Herenga Waka - Victoria University of Wellington, Aotearoa New Zealand | jennifer.campbell-meier@vuw.ac.nz

Fourie, Ina
The University of Pretoria, South Africa | ina.fourie@up.ac.za

Jimenez, Andrea
The University of Sheffield, UK | a.jimenez@sheffield.ac.uk

Rutter, Sophie
The University of Sheffield, UK | s.rutter@sheffield.ac.uk

ABSTRACT
Many universities are now developing inclusive curricula with the intention that all students have an equal opportunity to achieve learning outcomes. But what in practice is an inclusive curriculum? This panel organized by the European and South Asia ASIS&T chapters will explore understandings of inclusive curricula by engaging with academics from different regions including Canada, New Zealand, South Africa, Pakistan and the UK. By gathering a multiplicity of practices and perspectives from panel members and the audience, we seek to create a shared understanding of the challenges and opportunities in developing inclusive curricula.

KEYWORDS
Inclusion; Education; Curricula; Curriculum Transformation

INTRODUCTION
We are living in unprecedented times, characterized by interconnected global concerns. These challenges range from the current environmental crisis to growth in inequalities, an increasing recognition of structural racism, and more (Reiter 2018). Scholars have argued that a significant portion of these crises are the result of the imposition of economic, social, and political systems that get replicated across the world (Escobar 2016). As a result, they suggest that there is a necessity to recognize the plurality of the world and acknowledge local sensitivity rather than adopting a model that is universally applicable (ibid).

Universities, schools, and colleges all around the world are currently grappling with how to incorporate these realities into their curriculum. There has recently been a surge of interest in developing inclusive curricula for educational institutions, which serve as spaces for the production, preservation, and reproduction of knowledge (Bunbury 2020). This interest aims to ensure that all students, regardless of their background or other immutable characteristics, have an equal opportunity to achieve learning outcomes (Morgan & Houghton 2011). The term "inclusive curriculum" refers to a “a multidimensional concept that includes the celebration and valuing of difference and diversity and consideration of human rights, social justice and equity issues, as well as the social model of disability” (Hornby 2014 p.1). This approach requires care in efforts to promote inclusion and equity within educational systems, as these must be relevant to the local context (Ainscow 2020).

The field of information studies encompasses a variety of subfields and areas of study (Figuerola, García Marco & Pinto, 2017). Although some topics might be more easily able to embed inclusivity (e.g. libraries, information for development (Jimenez et al. 2022)), others, such as technical topics, present a greater challenge. Most importantly, adopting an inclusive information studies curriculum will vary depending on the local context. This panel will explore the challenges and opportunities associated with developing inclusive curricula for information science and technology-related fields of study. Our panelists come from various geographic contexts where debates about inclusive curricula differ. We will discuss what it means to create inclusive curricula and how this can lead to more inclusive teaching and learning.

PANEL ORGANISATION (90 MINUTES)
This panel organized by the South Asia and European ASIS&T chapters brings together academics from different regions to discuss their experiences of designing inclusive curricula and what inclusion means to them. Sophie Rutter will introduce the panelists and moderate the discussion.

Canadian context. Julia Bullard (8 minutes)
Canada presents an awkward and contradictory position with regards to inclusivity. The official policy of multiculturalism and its actions in immigration and resettlement contribute to the benevolent image Canada projects to the world. The findings of the Truth and Reconciliation Commission (Truth and Reconciliation Commission of Canada, 2015) have disrupted this self-image for many non-Indigenous Canadians. Since the work of the TRC began in 2008 and since the publication of its final report and calls to action in 2015, more Canadians and Canadian...
institutions are growing to understand the historic and ongoing violence of settler colonialism and its impact on Inuit, Metis, and First Nations Peoples. In Vancouver, British Columbia, and at the University of British Columbia, the global diversity of the population means that many residents and students lack knowledge of Canada’s history. For this reason, inclusive teaching often means bridging the experience of students with lived experience of racism and anti-Indigeneity in Canada with that of students (both domestic and international) reckoning with their false image of Canadian benevolence.

Julia will discuss how this context impacts teaching at the graduate level in the School of Information and how a self-assessment process across the department’s instructors has helped to identify points of strengths and weakness in inclusive teaching. The project included a survey to instructors reporting on their own practices and course design relative to an inventory of inclusive teaching practices (Mac, 2019), consultation with students on their prioritization of these practices, and the development of an internal, peer-to-peer resource on syllabus language, assignment design, and other factors. This project surfaced needs for inclusivity in multiple aspects of teaching: within the course content (objectives, topics, readings), in course design (assignment formats, accessibility), and in course implementation (inclusive language, flexibility, support for student experience). Julia found that the elements students reported having the biggest impact on their experience of inclusion in the course are those that are the most labor-intensive on the instructor’s part: including theories and models from systematically marginalized perspectives, reading lists featuring the same, and flexibility in assignment format; partially due to others being common amongst the instructors: gender-neutral and respectful language in instructor’s materials and assignments that invite students to apply their own lived experience.

**Pakistan context.** Syeda Hina Batool (8 minutes)

In Pakistan, the development of ‘inclusive culture’ in the education system is very disappointing. Unfortunately, the understanding of equality, social justice and inclusion has been well documented in government policies rather than practiced. The country committed to provide quality education to all children by 2015 (Caceres, et. al., 2010) during the world education forum. The representatives from the Asia Pacific region developed consensus that the education system should be flexible to individual needs (child, youth, adults) and in nature (formal and informal). It was generally agreed that efforts should be made to provide equal opportunities to excluded and unreached children. The Asia Pacific members defined inclusive education as “All must have the opportunity to receive a basic education of good quality that focuses on the ‘whole’ person, including health, nutrition and cognitive and psycho-social development” (UNESCO, 2000, p.58). The reality is that special schools and postgraduate institutions are rare in Pakistan. It is less likely in rural areas that girls, children of economically unstable families, children subject to abuse, and children with disabilities will attend school. The position is better in urban areas with regard to girls' attendance in schools. With respect to gender discrimination, a content analysis of English language textbooks of grade 9 and 10 revealed that women as a character and in images have been given less representation than male characters. Women's invisibility in textbooks at school level determined the message that women are insignificant in the society (Shah, 2012).

Syeda will highlight the scenario of challenges faced by a developing country (Pakistan) which may contrast the ground realities of developed nations. Syeda will also reflect on the efforts made by the international organizations in Pakistan on the provision of ‘inclusive education’ for example, a USAID project (ENGAGE). Moreover, Syeda will mention the recommendations made by the researchers on the possibilities of inclusive education in Pakistan.

**Aotearoa New Zealand context.** Jennifer Campbell-Meier (8 minutes)

In Aoteroa New Zealand, the Te Tiriti o Waitangi - The Treaty of Waitangi (1840) has become the cornerstone for Crown agencies and institutions to acknowledge their obligations and apply the principles of the treaty in policies and protocols. The Treaty principles include “the duty to act in good faith, reasonably and/or honorably; principle of partnership; and the principle of protection or active protection” between the Crown and the indigenous Māori people (Morrison & Huygens, 2019). These principles have been applied by the Library and Information Association of New Zealand Aotearoa (LIANZA) through their body of knowledge (BOK) which includes an element that focuses on mātauranga Māori (Māori knowledge systems) (LIANZA, n.d.). Inclusivity for the Information Studies Programme at Te Herenga Waka - Victoria University of Wellington, has focused on integrating mātauranga Māori into the curriculum to align with the LIANZA BOK and to meet the obligations that Te Herenga Waka - Victoria University of Wellington has to the Māori people.

Jennifer will discuss how the Information Studies Programme team have integrated mātauranga Māori into the curriculum, as well as how they enable students to engage with information services and systems that support biculturalism. Oxborrow (2020) identified the importance of learning about and engaging with mātauranga Māori within the information professions, to better support our communities and our Māori colleagues. Jennifer will also discuss how our non-Māori faculty members are developing their own skills and knowledge of mātauranga Māori and opportunities for further integration of mātauranga Māori and Indigenous knowledge within the curriculum.
South Africa context. Ina Fourie (8 minutes)
Ina will give a high-level discussion on reported concerns and practices in South Africa with specific reference to initiatives at the University of Pretoria and the Department of Information Science. South Africa’s deeply troubled past and Apartheid Policy, ethnic and language diversity impacted on education. Since the 1994 elections, the ANC taking over Government, and attempts to redress the past there has been many calls for transformation, equity, inclusion and decolonization (Asante, 2020). Universities have policies of equity adherence in appointments and student intake and many institutions, including the University of Pretoria, have formed Committees for Transformation and for Curriculum Transformation. Interpretations of inclusivity, inclusive curricula and transformation and Africanization are blurred (Baron, 2018; De Beer & Kriek, 2021; Knoetze, 2021; Themane, 2021). South African universities host students from different indigenous ethnic groups, including Ndebele, Xhosa, Zulu, a strong South African Indian cohort, white people including Afrikaans and English-speaking South Africans and people of color, in addition to strong Asian communities and many students from other African countries, including Zimbabwe, Lesotho, Uganda and Nigeria. Cultural, language and traditional differences are vast. Inclusivity goes beyond ethnic, racial, gender and cultural respect and inclusion. It extends to disabilities (physical and learning problems), gender preferences and religion and stigmatized diseases such as HIV/AIDS (Soudien, 2016). The Faculty of Engineering, Built Environment and Information Technology (EBIT) Committee for Curriculum Transformation has been making attempts to address curriculum transformation; some examples will be mentioned. Attempts in the Department of Information Science will also be explained e.g. an undergraduate module on indigenous knowledge and the start of a project on creating a Third Space for discussions between Faculty and students based on work by Hansen, Fourie and Meyer (2021).

UK context. Andrea Jimenez (8 minutes)
The growing emphasis on inclusive curricula in Higher Education (HE) in the United Kingdom is informed by a combination of increased student diversity, legislative changes, and a broader recognition of universities' role in perpetuating inequalities (Batty & Reilly 2022; Bhambra et al. 2019). Scholars have begun to question how, for example, Universities in the UK are too prone to focus on educating elites in the image of the European white man (Gopal, 2021). This has resulted in an increase in efforts within universities to decolonize curriculum and incorporate intersectional feminist agendas into teaching. Although encouraging, scholars and activists are concerned about the term’s uncritical adoption by institutions, co-option into neoliberal agendas, moving away from its radical origins, limiting its focus to diversifying reading lists and public messaging (Jimenez et al. 2022; Moosavi, 2020). Others have noted that many of these initiatives serve as tick boxes and tokenistic exercises on behalf of the university rather than true transformation (Loyola and Gosal 2022).

Andrea will discuss how this background motivated the design of a project to co-design an inclusive at the University of Sheffield’s Information School. The Information School is undertaking continuous efforts to innovate our teaching to better respond to the challenges of the 21st century (e.g. decolonizing our curriculum, embedding Education for Sustainable Development and embedding EDI in teaching spaces design). Andrea will describe these experiences and an ongoing participatory project for the design of inclusive curricula across all Information School programs. These experiences will be discussed to reflect on challenges and opportunities of an inclusive curriculum in the context of an Information School in a UK university.

Engagement with the audience (50 minutes)
After the presentations, Sophie Rutter as moderator will facilitate a discussion between the panelists and members of the audience. The audience will be asked to share their experiences and perspectives. Example discussion questions include:

1) What does the term "inclusive curriculum" mean to you?
2) Why are inclusive curricula important?
3) Are there initiatives at your institution you would like to share?
4) What opportunities and challenges do you see in developing inclusive information science and technology curricula?

EXPECTED OUTCOMES
The growing diversity of the students in the educational institutions raise the concern to debate about ‘inclusion’ as a belief system. It is crucial for educators and practitioners to address the issues related to language, culture, gender, religion and multiple disabilities at international forums. Therefore, the overall aim of the panel is to develop the basic understanding about ‘inclusive curriculum practices’ as situated in different cultures and situations. The panelists will highlight the meanings, significance, practices and challenges as grounded in their own contexts. The discussion on inclusive curriculum from different perspectives will inform the practice of professionals. Additionally, the panelists’ talk will broaden the landscapes on how ‘inclusive curricula’ can be helpful in assisting
the progress of socially, economically and culturally deprived communities. Moreover, a key takeaway of this panel would be the knowledge sharing on ‘inclusive curriculum’ global collaborative efforts and pedagogies.

**PANEL MEMBERS**

**Syeda Hina Batool** is a postdoc research fellow and visiting professor at the UBC School of Information, Canada. On a permanent position, she is an Assistant Professor at the Institute of Information Management, University of the Punjab, New Campus, Lahore, Pakistan. Her research interests focus on examining information literacy instruction and related literacies (health, digital, workplace, visual, media etc.), through a qualitative research lens. Her recent projects focus on investigating ‘social justice within public libraries’ and ‘provision of library services to special users’.

**Julia Bullard** is an Assistant Professor at the University of British Columbia’s School of Information where she examines how communities instanciate their values in infrastructure, particularly through the design of knowledge organization systems. Her current work focuses on how catalogs can more fully represent LGBT2QIA+ communities and how traditional cataloging represents Indigenous topics. She has worked on the UBC iSchool’s Equity and Diversity since founding it as a task force in 2018. Currently, she is leading a department-wide initiative to incorporate more inclusive practices into Masters courses.

**Jennifer Campbell-Meier** is a Senior Lecturer at Te Herenga Waka - Victoria University of Wellington. Her research focuses on 3 primary areas: Digital Inclusion, Information Behavior, and LIS Professional Development. Her research is unified by her commitment to develop LIS professionals capable of engaging with communities and instilling life-long information literacy practices to support critical evaluation of information.

**Ina Fourie** is a Full Professor, Head of the Department of Information Science, and Chair of the School of Information Technology, University of Pretoria, South Africa. She is a Steering Committee member of the African Centre of Excellence for Information Ethics (ACEIE) at that Department and holds leadership positions in ASIS&T Board and the European Region of the iSchool organization. She is an experienced information behavior researcher and is currently working on marginalized communities in everyday life contexts.

**Andrea Jimenez** is a lecturer in Information Management at the University of Sheffield's Information School. Her study focuses on the influence of digital innovation, social innovation, and entrepreneurship on socioeconomic growth. Her method is influenced by critical viewpoints like intersectional feminism, decolonial methods, and data justice. In addition, Andrea oversees the internationalization and decolonization of the Department's curriculum and is currently a PI on the Information School’s inclusive curriculum project. Andrea is a member of the University committee working on the race equality charter application.

**Sophie Rutter** is a senior lecturer in Information Management at the Information School, University of Sheffield, UK. She is the current chair of the ASIS&T European Chapter (2022-2023). Her research aims to develop knowledge on how people use information, to inform communication strategies and technology development. She is also interested in inclusive user research and is working on a project that aims to embed equality, diversity and inclusion in usability testing. Sophie is also a co-I on the Information School’s inclusive curriculum project.

**CONCLUSION**

The formation of this panel and interaction with ASIS&T participants promises to broaden perspectives on designing inclusivity and to generate connections among practitioners and instructors working in different contexts. The panelists’ work in specific initiatives will help connect abstract ideals of inclusivity to on-the-ground work, while the diversity of their experiences means that their specific challenges and priorities will resonate with different attendees. We hope this discussion can further the ongoing conversation in this community on how to make information science an inclusive field for students of all backgrounds.

**ACKNOWLEDGMENTS**

Panel members would like to thank their students for the insights they have shared that have informed their thinking. Much of the work the panel members are reporting on was conducted through committee work and with formal and informal support from colleagues.

**REFERENCES**


The Role of Theory in Information Science Scholarship

Bilal, Dania
University of Tennessee-Knoxville, USA | dania@utk.edu

Julien, Heidi
University at Buffalo, USA | heidijul@buffalo.edu

Sonnenwald, Diane H.
University College Dublin, Ireland | diane.sonnenwald@ucd.ie

Ngulube, Patrick
University of South Africa, South Africa | Ngulup@unisa.ac.za

Sawyer, Steve
Syracuse University, USA | ssawyer@syr.edu

Abbas, June
University of Oklahoma, USA | jmabbas@ou.edu

ABSTRACT
The roles and values of theory, theoretical frameworks, and theory building in library and information science (LIS) research have been the focus of attention of many scholars for decades. However, current practices in scholarly publishing have undermined these roles and values, creating a paradox in scholarly publishing and raising questions regarding a. whether research should be theoretically grounded, b. the impact of these practices on theory use and theory building; c. the roles of scholarly journals in encouraging the use of theory, d. the adequate preparation of LIS doctoral graduates to use and develop theory, and e. the roles theory play in the master’s level of LIS curricula. This panel of researchers and experts will share their work and map out their perspectives on the roles of theory, theorizing, theory building, and theoretical frameworks in scholarly publications. Attendees will share insights with the panelists about their experiences in using theory in research.

KEYWORDS
Theory, theoretical frameworks, Theorizing, Research, Scholarship.

INTRODUCTION
“Errors are inseparable from research” (Ngulube, 2020) and are essential for framing research, guiding research design, interpreting findings, and explaining an observed phenomenon. Research that examined theory use and theory building in library and information science (LIS) has revealed gaps in using grounding research in theoretical frameworks (e.g., Bilal, 2022; Julien et al., 2011; Vakkari, 2008). Traditionally, information sciences “are better known for borrowing theory from other disciplines than for introducing new theories.” (Sonnenwald, 2016, p. 2).

Information Science (IS) scholars have advocated for theory building from within IS (Pettigrew & McKechnie, 2001) to reduce “dependency on borrowed theories from other fields” (Ngulube, 2020). The ongoing discussions of theory use, theoretical frameworks, and theorizing among information science scholars (e.g., Vanscoy et al., 2022; Bilal, 2022; Ngulube et al., 2021; Sonnenwald, 2016; Julien et al., 2011; Vakkari, 2008; McKechnie et al., 2008) aim to build better awareness of the importance of theoretically grounded research; that is, research is “based on a coherent and explicit framework of assumptions, definitions, and propositions” (Julien, 1996, p. 56). However, we observe that some current practices in scholarly publications contradict these efforts, creating a paradox. This panel will present four researchers and experts who will discuss their work on theory and theorizing in scholarly research.

BACKGROUND
The concept of “theory” is perhaps one of the most difficult for researchers to apply to their research. As defined by Babbie (2016), a theory is “a systematic explanation for the observations that relate to a particular aspect of life” (p. 146). Theories may also be described as generalizations that seek to explain relationships between phenomena” (Grover & Glazier, 2002, p. 319). Another difficult concept is “theoretical framework,” which has been defined as “any empirical or quasi-empirical theory of social and/or psychological processes, at a variety of levels (e.g., grand, midrange, explanatory), that can be applied to the understanding of phenomena” (Anfara & Mertz, 2015, p. 15).

Theoretical frameworks are the “structure, the scaffolding, or frame of your study.” (Merriam, 1998, p. 45), shaping and directing it in ways consistent with the theory, from the design to the interpretation of the findings (Anfara & Mertz, 2015, p. 231).

Theoretical frameworks are the basis of sound research (Simk, et al., 2022). These frameworks support the research methodology, which is an essential pillar that forms the cornerstone of valid research and is critical to the advancement of knowledge (Lim et al., 2013; Ngulube, 2020). The absence of a theory in a scholarly piece of research can lead to the creation of bad science (Kaplan et al., 2011). Hence, “neither scientific nor practical results can be expected without adequate development of the theoretical aspect of the work” (Lewin, 1945, p. 132).

Scholars have called upon information science educators, researchers, and editors of scholarly journals to pay more attention to the role of theory and theoretical frameworks in research. However, what may often be missing from scholarly articles and perhaps research in general, is the inclusion of the theory the researcher used to ground their study. This omission makes it difficult for others to fully understand the researcher's perspective or what influenced

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the study’s development, implementation, and analysis. Without this understanding, we lose the thread that ties our research together; without a full understanding of the theory and theoretical framework that guided the study, it is difficult to apply the research to our own.

Current scholarly journal practices have underestimated the role of theory in knowledge production in information science, creating a paradox and raising many questions, including but not limited to 1. Should all research be theoretically grounded? 2. For what reasons is the use of theory and theoretical frameworks in scholarly journals not given attention? 3. What impact do such practices have on theory use, theory generation, and theory building, as well as on advancing the information science discipline?

The topic of this panel is grounded in beliefs about the roles and values of theory and theoretical frameworks in information science research. The panelists, all of whom have significant experience as individual scholars and in scholarly publishing as authors, reviewers, members of journal editorial boards, and journal editors, will map out their perspectives on the role of theory in research, share their views on using theory and theoretical frameworks in scholarly publications, and discuss challenges in developing sound theoretical frameworks for grounding research.

PANEL FORMAT (90 MINUTES)
Session Introduction (10 minutes)
The moderators will introduce the panelists and briefly discuss the panel topic.

Panel Discussion (50 minutes)
Each panelist will have 10 minutes to discuss their views of the roles and values of theory in research. These discussions will cover these topics: The omission of theory from scholarly research and its effect on knowledge production in information sciences; stages of developing new theories, challenges, and successes; the need for more theorizing versus generating new theories; and theories as essential for grounding quality research. The discussion will explore the panelists’ viewpoints on applying theories in scholarly research and the implications for education and future practice (40 minutes). There will be 10 minutes for Q and A afterward. Attendees will also engage in a small group activity (see below).

Group Activity (25 minutes)
Attendees will be divided into small groups and will be asked by the moderators to discuss the questions arising from the panelists’ topic presentations (5 minutes). Afterward, each group will choose a spokesperson to present its ideas before the panelists and audience (5 minutes per group, totaling 20 minutes). The moderators will facilitate the discussions.

Proposed Questions for Discussion

1. Should all research be theoretically grounded?
2. What is the impact of current scholarship practices on theory use and theory building in LIS?
3. What are the roles of scholarly journals in encouraging the use of theory?
4. Do we adequately prepare information science doctoral graduates to use and develop theory?
5. What roles does theory play in the master’s level curriculum?

Wrap-up (5 minutes)
The moderators will summarize the panel discussions, thank the panelists and attendees, and close the session.

PANEL MEMBERS
Dania Bilal, Organizer and Moderator. Professor at the School of Information Sciences, The University of Tennessee-Knoxville
Heidi Julien, Organizer and Moderator. Professor at the Department of Information Science at the University at Buffalo, State University of New York (SUNY)
Diane H. Sonnenwald. Emerita Professor and Emerita Head of School at University College Dublin, Ireland
Given the broad span of information science, it is perhaps not surprising that there is no consensus regarding the purposes of theory, the types of theory, or how one goes about theorizing or developing new theories. In this presentation, Sonnenwald will first discuss 5 types of theory (Gregor, 2006), each with a different purpose, and provide examples of these types in information science. Building on this discussion, Sonnenwald will present her approach to teaching Ph.D. students skills to both theorize and develop theory. Her approach incorporates learning by doing using a scaffolding strategy and has been used to teach students in 4 countries.

Patrick Ngulube. Professor at the School of Interdisciplinary Research and Postgraduate Studies, University of South Africa
Many scholarly journals in library and information science do not account for the use of theory and theoretical frameworks. In some cases, scholarly journals fail to recognize the importance of these conceptualization tools for
the research design and activity to the detriment of knowledge production and theory building. The scientific method
on which knowledge production is based is cumulative. Knowledge exists in relation to other knowledge(s). That
recognition can manifest itself through adapting or borrowing theories and combining various concepts from the
theories to develop new theories (Oswick et al., 2011; Ukwoma & Ngulube, 2021). The absence of a theory in a
scholarly piece of research can lead to the creation of bad science (Kaplan et al., 2011). Hence, “much is gained,
[however,] if one realizes that neither scientific nor practical results can be expected without adequate development
of the theoretical aspect of the work” (Lewin, 1945, p. 132). The exclusion of theory and theoretical frameworks
from the criteria for evaluating manuscripts is problematic. In this presentation, Ngulube will share reasons for such
practices based on his experience as a journal editor, reviewer, mentor, and facilitator of building research capacity
among post-graduate students and their supervisors, as well as a seasoned researcher.

Steve Sawyer. Professor at the School of Information Studies at Syracuse University

Sawyer’s focus is on what Weick (1995) calls theorizing. Weick’s premise is that theories do not emerge fully
formed: they are developed, adjusted, tested, refined, and incremental. Building from concepts central to his work
on senssemaking, Weick’s theorizing is constructive and reflects an interaction among the precepts of existing theory,
deep knowledge of the phenomena of interest, and attention to the descriptive, analytic, and predictive goals of the
scientific effort – characteristics of what Merton has labeled “theories of the middle range.” Seen this way,
theorizing is active use and adaptation. This active engagement stands in contrast to the formulaic uses of theory.
These uses are often made visible with simplified - not parsimonious – diagrams containing a few boxes and some
arrows. Useful theoretical engagement may require diagrams or other representations. It requires careful depictions
of conceptual and empirical boundaries - building on what is known; thoughtful – if not thorough – articulations of
the phenomena of interest; and, attention to the ways in which the data or evidence drawn into the discussion fit or
adjust what is theorized. Sawyer, Editor-in-Chief of the Journal of the Association for Information Science and
Technology, will share and discuss his view of theory: We do not seek more theory, we seek more theorizing.

June Abbas. Interim Director and Professor in the School of Library and Information Studies at the
University of Oklahoma

The concept of “theory” is perhaps one of the most difficult for researchers to apply to their research. As defined by
Babbie (2016), a theory is “a systematic explanation for the observations that relate to a particular aspect of life” (p.
146). Theories should be “simple, testable, novel, supportive of other theories, internally consistent, and predictive.”
(Agniew & Pike 1969). Anfara & Mertz, (2015, p. 5) perhaps said it best, “a useful theory is one that tells an
enlightening story about some phenomena. It is a story that gives you new insights and broadens your understanding
of the phenomena.” Another difficult concept is “theoretical framework,” which assists the researcher in the process
of sorting through these data, of knowing how the pieces drawn from the various data relate and where they fit, and
“frames” every aspect of the study. What may often be missing from scholarly articles and perhaps research in
general, is the inclusion of the theory the researcher used to ground their study. This omission makes it difficult for
others to fully understand the researcher's perspective or what influenced the study's development, implementation,
and analysis. Abbas will provide her perspectives on the role of theory and theoretical frameworks in research as the
editor-in-chief of the Library and Information Science Research journal and as a seasoned researcher.

CONCLUSION

The panel will highlight the role of theory in information science scholarship and the challenges in applying
theoretical frameworks, developing new theories, and theorizing in research. It brings various schools of thought
regarding how crucial it is to base research on theory. The panel addresses the paradox in current practices in theory
use and applications in scholarly publishing, building awareness among doctoral students, master’s students, as well
as junior and senior scholars of the critical role of using theory and grounding research in theoretical frameworks to
advance research and knowledge production in information science. We anticipate the panel will augment future
cdiscussions and applications of theory in scholarly research and scholarly publishing.

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Spiritual and Religious Information Practices: Lessons from the Field

Caidi, Nadia
University of Toronto, Canada | nadia.caidi@utoronto.ca
Nangia, Pranay
University of Strathclyde, UK | pranay.nangia@strath.ac.uk
Ekmeckioglu, Cansu
University of Toronto, Canada | cansu.ekmeckioglu@utoronto.ca
Samson, Hugh
University of Western Ontario, Canada | hugh.samson@uwo.ca
Olsson, Michael
University of the Philippines, Philippines | michael@whitegauntlet.com.au

ABSTRACT
This panel centers on presentations that address examples of spiritual and/or religious experiences through an information lens. The panelists will initiate a timely conversation about the ways in which individuals and communities make sense of their information worlds post pandemic and in contexts of high uncertainty (e.g., climate anxiety, increased polarization, AI developments, etc.). In examining coping strategies of the spiritual and/or religious kinds, the panel brings together scholars in a range of information fields to address several of the conference’s themes, including new theoretical conceptualizations of the cultural, social, cognitive, affective, and situational aspects of information needs, searching, use, and sharing. As well, the session’s examined contexts of everyday lived religion and spirituality can enrich our understanding of the intersections between health and well-being, socio-technical arrangements, and evolving and diverse information practices.

The short presentations and interactive engagement bring together an international group of emerging and established scholars into conversation and will coalesce into the formulation of a research agenda on this topic. Speakers’ interventions will revolve around three connected questions:

1. How can religious and spiritual experiences be theoretically contextualized within Information Science?
2. What research approaches are most suitable for exploring spirituality/religion in our digital networked world?
3. What ethical challenges do researchers encounter in undertaking this type of research (especially during a pandemic) and how can they be effectively addressed?

KEYWORDS
Spirituality and religion, resilience, place, technology, community-building

INTRODUCTION
The panel brings together scholars that will discuss their diverse theoretical, empirical and methodological work around spiritual and/or religious experiences through an information lens. Each panelist will provide an overview of their empirical research projects, will discuss pertinent findings, and will also discuss overarching questions of resilience and sustainability during a world-wide crisis, particularly focusing on coping strategies linked to spirituality and religious rituals or beliefs.

PANEL DESCRIPTION
Despite its prevalence in the everyday lives of communities around the world, research on spiritual and religious experiences (whether of the institutionalized or non-institutionalized kinds) has not received enough attention. Information science, along with HCI and CSCW scholars have begun to explore these rich information contexts, as well as the relationships of technologies with religion and spirituality (Bell, 2006; Caidi, 2019; Caidi & Karim, 2021; Gorichanaz, 2016; Latham et al., 2020; Wyche & Grinter, 2009). Recent studies have explored the dynamics within online activities during the COVID-19 pandemic: for instance, Ganiel (2021) examined the role of Christian online ministries and the ways in which the clergy used digital channels to sustain its presence in the lives of individuals, and also retain its significance. Büssing (2022) and Büssing et al. (2021) examine trust formation, and the extent to which mediated approach to religiosity and engagement leads to a decrease in religious authority in a post-pandemic world. There is much that our field can add to these developments.

Religion and spirituality-related information can also become important for many people during acutely distressing or uncertain life periods, such as during personal loss, health-related crises or relationship breakdowns (Ruthven, 2022). Feelings of meaninglessness and despair during these periods may trigger reorientations in people’s global meaning structures, causing them to appraise and reevaluate their everyday practices and lifestyles through spiritual or religious meaning-making processes (Park, 2013; Ruthven, 2019).

Pranay Nangia will discuss the role of information during such religious and spiritual meaning-making journeys. He will begin by outlining how scholars have researched spiritual, religious and contemplative information practices within information and communication studies, museum studies and library research. Following this, he will present...
insights from his PhD work focusing on individuals’ personal narratives, information-seeking patterns and librarian attitudes (towards spiritual/religious information provision) in contemporary spirituality and non-institutionalised religious settings (Nangia & Ruthven, 2022a, 2022b, 2022). This segment will review & consolidate current understandings and stimulate discussion to help engage the audience later in thinking about possible agendas for future research into religion and spirituality-related meaning-making and information experience.

Nadia Caidi and Cansu Ekmekcioglu will share findings from a qualitative study on the practices of young Muslims during the fasting months of Ramadan that occurred during the Covid-19 pandemic. Their semi-structured interviews with 22 observing Muslims shed light on the techno-religious practices adopted and adapted by the individuals over the two Ramadan under pandemic. The findings point to the ways in which the individuals make sense of their religious obligations and balance these with health concerns for themselves and their families. The findings also examine several tensions, such as making sense of the pandemic and the role that their faith (and associated practices) play in their lives; reconciling the communal nature of Ramadan with the social isolation mandates that were in place; and adapting their spiritual or religious practices to an increasingly digitized environment (as well as refusal to use technology altogether) during those Ramadan months. Nadia Caidi will discuss the importance of ethically examining diverse information groups (in this case, a vulnerable group that has been stigmatized and is thus hard to recruit and engage) and diverse lived experiences (i.e., the institutionalized religious context of Islam is examined through the individuals’ diverse everyday practices). Cansu Ekmekcioglu will address this notion of lived religion through the lens of socio-temporal rhythms (Southerton, 2006) and discuss how analyzing the rhythmic patterns of religious activities enables us to capture socio-temporal organization of everyday life for young Muslims and their engagement with information and social media during Covid-19 pandemic.

Hugh Samson will offer an overview of his research exploring the integration of contemplative programs, services, spaces, and technologies within information environments (a timely concern given the global COVID-19 pandemic that continues to unfold). He will first begin by discussing his investigation of a mindfulness meditation and yoga resource hub comprised of approximately fifty interconnected digital, physical, and textual tools as well as its associated guided mindfulness meditation and yoga sessions within a university learning commons (Samson, 2021a, 2021b). He will next share preliminary insights from his current Ph.D. work studying the development and implementation of an asynchronous, voluntary mindfulness meditation program within a university online learning management system. Drawing upon literature at the intersection of information and contemplation (Levy, 2016; Pyati, 2019; Gorichanaz, 2020) and literature regarding information infrastructure (Star, 1999; Bowker et al., 2016), his contribution casts both of these complementary initiatives as instances of contemplative infrastructure, or infrastructure concerned with the contemplative dimensions of life and with the attainment and maintenance of informational balance.

Michael Olsson will share findings from his work with Pethigamage Perera studying the information practices of a diasporic Buddhist temple community in Sydney, Australia. The data for this insider/outsider study were collected through interviews with 10 monks and 15 devotees, participant observation, analysis of the Temple’s websites and associated online media. The study has made three contributions to the field of information studies. Firstly, it has demonstrated that it is possible to gain insights into the temple community’s information practices, using a range of conceptual lenses drawn from the broader social sciences including Bourdieu’s approach that capital is the outcome of practice (Bourdieu, 1977; 1986), Castell’s (1996; 1999; 2010) space of flows, and Schatzki’s threefold conceptualisation to site (Schatzki, 2002). Secondly, it has shown the potential shortcomings of applying concepts developed in Western cultural contexts in non-Western settings. Thirdly, its findings on the importance of the future-oriented merit as an outcome of practices, including information practices, is at odds with the commonly accepted exclusion of future-oriented statements of action from definitions of outcomes in information behaviour.

PANEL LOGISTICS & ENGAGEMENT
For this panel session, we request a 90-min session. We will start with a brief 10-min overview by each panelist, followed by a Q/A after which we will have an interactive engagement exercise (in small break-out groups, depending on attendance). The ultimate purpose is to build a community around this research area, and collaboratively define an agenda of research:

(5 min.) – Introduction of session and speakers
(10 min.) – Each presenter speaks for 10 mins in sequence (x 5)
(10 min.) – Q/A with the audience
(20 min.) – Discussion questions in small break-out groups; Reporting
(5 min.) – Concluding remarks & Wrap-Up.
To engage the audience, the panelists will lead attendee discussion groups on questions surrounding research on spiritual resilience in a time of crisis. Examples of discussion questions are:

1. How can religious and spiritual experiences be theoretically contextualized within Information Science?
2. What research approaches are most suitable for exploring spirituality/religion in our digital networked world?
3. What ethical challenges do researchers encounter in undertaking this type of research during the pandemic and how can they be effectively addressed?

**PANEL MEMBERS**

**Nadia Caidi** is a Professor at the Faculty of Information, University of Toronto, Canada. Her research focuses on human information behavior (in the context of global migration, and in spiritual/religious contexts). She has also examined the changing conceptions of diversity, equity and inclusion in the LIS fields. Her book, "Humanizing LIS Education and Practice: Diversity by Design" (with Keren Dali), was published by Routledge in 2021. Dr. Caidi was the 2011 President of the Canadian Association for Information Science (CAIS), and the 2016 President of ASIS&T. In 2019, ALISE awarded her the Pratt-Severn Faculty Innovation Award.

**Pranay (Ray) Nangia** is a doctoral candidate at the University of Strathclyde, United Kingdom. His research aims to explain human information behaviour in domains that do not neatly fall into work-related problem-solving or everyday life. His PhD work looks at information phenomena in contemporary spirituality and examines the role that modern information institutions play in facilitating contemplative outcomes.

**Cansu Ekmekcioglu** is a doctoral candidate at the Faculty of Information, University of Toronto, Canada. Her research investigates the role of emerging technologies in humanitarian and immigrant settlement contexts in Canada. Her studies encompass human-computer interaction, public policy, information science, critical data studies, and migration studies. She is the recipient of an ASIS&T New Leader Award for 2023.

**Hugh Samson** is a doctoral candidate at the Faculty of Information an Media Studies, University of Western Ontario, Canada. His research explores the integration of contemplative initiatives, programs, services, spaces, and technologies within information environments. His Master’s thesis, Contemplating Infrastructure: An Ethnographic Study of the University of Toronto Faculty of Information InForm’s iRelax Mindfulness Resource Area, introduces the term contemplative infrastructure to refer to infrastructure that is concerned with the contemplative dimensions of life (Samson, 2021). He is the administrator and a founding member of the Information and Contemplation Salon.

**Michael Olsson** is a Professor in the School of Library and Information Studies, University of the Philippines Diliman. He is an active information practices researcher with a strong interest in expanding the horizons of information research through a stronger focus on cultural, discursive, affective, and embodied aspects of how we make sense of the world.

**REFERENCES**


Challenging Book Challenges: Understanding the Background, Examining “Astroturfing” as a Current Political Strategy, and Finding Ways Forward

Charbonneau, Deborah H. Wayne State University, USA | dcharbon@wayne.edu
Hawamdeh, Suliman University of North Texas, USA | Suliman.Hawamdeh@unt.edu
Oltmann, Shannon M. University of Kentucky, USA | shannon.oltmann@uky.edu
Winberry, Joseph University of North Carolina, USA | jwinber@unc.edu
Yeon, Jieun Syracuse University, USA | jiyeon@syr.edu
Zalot, Andrew University of Illinois, USA | azalot2@illinois.edu

ABSTRACT
Challenges to books in libraries have sharply escalated from 2021—present. While currently concentrated in the U.S., book bans are becoming widespread globally; these challenges often adapt strategies honed in the U.S., such as astroturfing. In this context, astroturfing refers to an illusion of grassroots organizing, in which national, elite-led organizations covertly coordinate local actions. Astroturfing is another manifestation of mis- and disinformation which ends up stoking fires of partisanship and discontent. In this panel, we will examine book bans, astroturfing, and solutions to these challenges, from several distinct yet interrelated perspectives.

KEYWORDS
Censorship; astroturfing; politics; intellectual freedom; disinformation

INTRODUCTION
The rate of challenges to books and other library materials has escalated sharply from 2021-present. These challenges have occurred globally and across the U.S. Challenges in the past two years appear to have been organized campaigns and have primarily targeted books with authors, themes, or protagonists who are Black, Indigenous, or people of color (BIPOC) and/or lesbian, gay, bisexual, transgender, and/or queer/questioning (LGBTQ+). Most challenges in the U.S. occur in school curriculum or school and public libraries. Challenges come from parents, grandparents, state/local elected officials, and community members. Sometimes, people who don’t even have children or grandchildren in a particular school district challenge items; likewise, some public libraries have faced challenges from people who are not active patrons or do not even have library cards. If these individuals are not encountering the challenged items in their own (or their children’s) reading pursuits, how do they even have awareness of particular books? To answer this question, we must consider political movements that urge local chapters to become active in schools and libraries. While these local groups may appear to be grassroots movements, they are actually a form of astroturfing. Grassroots political activities are organic, originating from individual citizens coming together; they are independent of political or cultural elites (and sometimes even in opposition to elites). These are true “bottom-up” instead of “top down” movements. In contrast, astroturfing as a political concept refers to the illusion of grassroots organizing. Astroturfing organizations use grassroots aesthetics to garner support from individuals for coordinated, deliberate actions. National groups that use an astroturf approach with respect to book challenges include Moms for Liberty, No Left Turn in Education, and Parents Defending Education.

Astroturfing can be seen as another manifestation of the vast deployment of mis- and disinformation across the current political landscape. It is a premeditated, purposeful attempt to mislead and misinform people about the content of particular books, the collection development in particular libraries, the purpose behind particular curriculum or educational strategies, the use of certain theoretical social justice approaches, and the impact of exposure to new ideas. Further, there is misinformation about the First Amendment of the U.S. Constitution, the legal protections of freedom of speech, and the definitions of obscenity and pornography. These deliberate moves to misinform certain individuals and groups lead to rage, fear, and (sometimes violent) reactions, further stoking the fires of partisanship and discontent in the U.S. We see these movements spreading globally, as well, as more nations report similar book challenges in their local contexts. Campaigns in other nations are adopting and adapting the U.S.-honored astroturfing approach to spread disinformation, sow fear, and reduce access to certain topics and books.

Librarian and information professionals face multiple obstacles as they face this rising tide of book challenges:

- How should they view the sudden rise of book challenges in their community?
- How should they respond to one or more challenges?
- What is the background or historical context to these challenges?
• What approaches might help them better understand and respond to this escalation?
• How can library and information science be used to craft responses to these challenges?

In this panel, we will address these and related questions. Each panelist brings a unique perspective to contribute. The panel will be for 90 minutes (if possible), with each panelist speaking for 7-10 minutes, leaving time for questions and discussion at the end. Panelists are listed in alphabetical order. This panel specifically addresses how to research applied questions, and how to take our research and apply it to complex questions of information access.

Deborah H. Charbonneau
Libraries have a longstanding commitment to protect intellectual freedom and support the health and wellness of their communities. The rise in calls for banning library materials, such as books, movies, magazines, and digital content sheds light on the threat of censorship in libraries. Book challenges around health have attempted to suppress topics and the voices of those traditionally excluded from conversations, and banning these library materials will remove access for all members of the community. I will explore book challenges around health topics and share relevant examples. I will examine how libraries can apply evidence-based approaches when working with various stakeholders to address book challenges, including library boards, community members, and the media. Overall, the goal of this presentation is to empower library and information professionals with evidence-based strategies to communicate scientific evidence as a way to combat health misinformation and book challenges.

Deborah H. Charbonneau is an associate professor in the school of information sciences at Wayne State University in Detroit, Michigan, USA. Deborah completed her Ph.D. in sociology at Wayne State University. Prior to joining the faculty, she worked as a health sciences librarian. Her articles have appeared in Library & Information Science Research, Library Quarterly, Journal of the Medical Library Association, Health Information and Libraries Journal, Library Trends, and Reference & User Services Quarterly. Her research interests include health literacy, accessibility, and scholarly communication issues. She currently teaches courses in library management, health informatics, research methods, and information policy.

Suliman Hawamdeh
Human development through history and the transformation of society from agrarian to industrial to information to knowledge society were driven by advances in science and technology. Knowledge creation is a cumulative process where knowledge transfer and knowledge sharing activities are critical components. The invention of papers, the printing press and computers revolutionized the way we create, use, and disseminate information. The book as a form of media played a critical role in facilitating knowledge sharing and knowledge transfer. However, the book is just a container of information and banning or destroying it does not stop people from finding alternative ways to access the information. It is interesting that where books are not the medium, different methods are used to distort information or provide alternative facts. In this presentation we will discuss book challenges in relation to astroturfing, ideological polarization, and cultural wars. It is important to see this issue in the context of social transformation and human development.

Suliman Hawamdeh is a Regents Professor in the Department of Information Science, College of Information, University of North Texas. He is a leading authority in the field of knowledge management and the editor in chief of the Journal of Information and Knowledge Management (JIKM). He founded and directed several academic programs including the first Master of Science in Knowledge Management in Asia in the School of Communication and Information at Nanyang Technological University in Singapore and the Master of Science in Data Science at University of North Texas. He served as Department chair and director of the interdisciplinary Ph.D. program in Information Science from 2010-2018. Dr. Hawamdeh has authored and edited several books in the areas of knowledge management, information science, data analytics, cybersecurity, and knowledge governance. In 2020, he received the ALISE Award for Professional Contribution to Library and Information Science Education.

Shannon M. Oltmann
U.S. librarianship has established norms and models to respond to book challenges, developed by the American Library Association’s Office for Intellectual Freedom. These practices include: have an existing reconsideration policy; require a form to be completed for each individual item challenged; create a committee to consider the challenge; ask the committee to consider the item in its entirety as well as relevant professional reviews; share the committee’s decision; formulate an appeals process; and keep the item in the collection while it is being challenged. While these practices have been sufficient in years past, with the change in book challenges (both in quantity and in the approach taken by challengers), the standard stance may no longer be workable. I will explore how librarians have responded to challenges, ways they could revise and improve their responses, and consider what librarians owe to their communities when individual citizens are actively hostile to libraries.

Shannon M. Oltmann is an Associate Professor in the School of Information Science at the University of Kentucky. She obtained her Ph.D. from Indiana University. Her research interests include information ethics, censorship,
intellectual freedom, public libraries, privacy, and qualitative research methods. Oltmann is an Associate Editor of *Library Quarterly*. She recently published a book, *Practicing Intellectual Freedom in Libraries*, and her most recent book, *The Fight Against Book Bans: Perspectives from the Field*, will be released in 2023. Oltmann’s work has been funded by the American Library Association and the Institute of Museum & Library Services. She has presented her research at numerous academic conferences and published widely.

Joseph Winberry

While astroturfing organizations may be able to provide funding, infrastructure, and talking points in support of censorship, the greatest strength of any public library is its embeddedness in its community. This is not to say that the support and involvement of national organizations such as the American Library Association is not wanted or needed in local fights against book bans. But it does mean that while library staff must work within their professional ethical guidelines, they must borrow from their store of homegrown relationships, values, and goodwill to make the case against book banning to their community members. One vehicle for accomplishing this goal is one that already exists for many public libraries: friends of the library (FOTL) organizations. As separate non-profit organizations, FOTLs often consist of library advocates who help raise money for their local public libraries. I argue that these organizations are well positioned to be effective, local responders to astroturfing organizations. In my presentation, I will briefly describe lessons learned from combating information marginalization in East Tennessee and how those lessons may transfer to FOTLs in their local fights against book banning.

Joseph Winberry is an assistant professor in the University of North Carolina at Chapel Hill’s School of Information and Library Science. His research examines critical library practice and impact. Ongoing projects consider: the role of the library in an aging society, partnerships that extend the library’s role in promoting social justice, and community organizing for minimizing information marginalization. Winberry’s research has been published in various venues such as *The Library Quarterly, The Journal of Documentation*, and *The International Journal of Information, Diversity, and Inclusion*. Winberry earned his Ph.D. in the University of Tennessee at Knoxville’s College of Communication & Information.

Jieun Yeon

All public libraries are local. Even when material challenges are sparked by national-level organizations, the ultimate decision regarding public libraries is highly dependent on the community in which the library resides. Material challenges often expose conflicting opinions within a local community, which eventually leads to public controversy surrounding the challenges. Public library governance, which indicates the process of solving social issues through the interaction of various participants, is a key process where diverse actors interact to reach a resolution for a material challenge by mobilizing their resources. For example, some community members organize protests or make public comments in board meetings, while other community members become library trustees. Librarians, in the meantime, frequently seek assistance from the larger librarian community. In this presentation, I will focus on exploring how various actors, such as community members, library board members, library staff, and local politicians, mobilize resources to influence the controversy surrounding material challenges. Furthermore, I will demonstrate how the resources mobilized by each actor are unevenly distributed in relation to public library governance structures.

Jieun Yeon is a Ph.D. candidate in Syracuse University's School of Information Studies. As a member of the Library and Information Investigative Team (LIIT), her research interests are in social justice in librarianship and public library governance. Currently, her dissertation project focuses on how power is related to the process of controversy in a local public library system.

Andrew Zalot

Social media has been heralded as an innovative communication technology that enables discourse across physical boundaries. Within the context of book bans, social media provides a means for those experiencing book challenges to publicize the event and garner support outside of their local community. Conversely, social media has provided challengers with an avenue to issue mass challenges to libraries and schools. Whereas in the past, book challenges at library and school sites came from residents of those towns, social media has allowed challengers avenues to push for bans beyond the confines of their own local spaces. Through coordination on social media platforms, individuals can attempt to influence the book selection process in towns hundreds of miles from them. I argue that social media has altered the landscape of book bans by enabling book challenges to spread en masse through coordinated efforts by astroturfing organizations and staff at the school and library sites must be prepared to address engagement from those outside their communities.

Andrew Zalot is a doctoral student at the University of Illinois Urbana-Champaign’s School of Information Sciences. His research focuses on censorship and specifically the intersections between local and online communities during a book ban.
Achieving Academic Success in Information Science: A Multi-Faceted Approach

Chen, Hsin-liang
Philadelphia College of Osteopathic Medicine, USA | hsinliach@pcom.edu
Liu, Ying-Hsang
Uppsala University, Sweden | ying-hsang.liu@abm.uu.se
Hirsh, Sandra
San José State University, USA | sandy.hirsh@sjsu.edu
Makri, Stepanhann
City, University of London, UK | stephann@city.ac.uk
Mawire, Blessing
Integra Professional Solutions, South Africa | bmawire@integra-ps.co.za

ABSTRACT
As we recovering from this pandemic with changing workforces and work environments, we need to reimagine career development in Information Science from the lenses of a multiple-role journey toward success. The purpose of this panel is to discuss the following areas proposed by the ASIS&T Member Match Program: Research Advancement, Research Collaboration, Professional Networking, Career Advancement, and Leadership Skills Development. This panel is presented by 5 international LIS professionals from 3 continents (Africa, Europe and North America), 4 different countries (South Africa, UK, Germany, and USA). Each panelist has unique and diverse academic and career experience to interact with the audience on the above five discussion areas.

KEYWORDS
Professional development, mentoring, career development, professionalism, diversity, equity and inclusion

INTRODUCTION
The COVID-19 pandemic has had a significant impact on the professional workforce since remote work arrangements have been widely adopted. However, many workers have experienced the feelings of burnout and other mental health impacts; professional development has been proposed as one of the key recommendations to address these issues (Schlak, Rosa, Rushton, Poghosyan, Root, & McHugh, 2022). Various professional development models and methods have been established to address this global challenge. For example, Bergdahl (2022) introduced the Blended Learning Adoption framework to support Swedish school teachers to develop online teaching skills during pandemic. Association for Information Science & Technology (ASIS&T) launched the Member Match Program in 2022 to support its senior and newer members for research, career and professional advancement (ASIS&T, 2022). As we recovering from this pandemic with changing workforces and work environments, we need to reimagine career development in Information Science from the lenses of a multiple-role journey toward success.

For working professionals, Irby, Lynch, Boswell, and Hewitt (2017) emphasized the importance of mentoring in the professional development programs. Mentoring can retain professionals at work; improve productivity and performance of the professionals; increase commitment to and comfort with the work; and effectively integrate new professionals at work. Furthermore, Elman, Illfelder-Kaye, and Robiner (2005) identified key components of professional development competencies in the psychology field: communication, responsibility and accountability, time management/stress management/self-care, self-understanding/self-reflection, awareness of personal identity, development of professional identity, and critical thinking and analysis. Therefore, we need to consider how to provide and receive mentoring in our changing work environments with an equitable, inclusive and coordinated approach for our diverse workers in the profession.

Lunsford, Crisp, Dolan, and Wuetherick (2017) presented a compressive higher education mentoring framework, which covered undergraduates, graduate students and faculty members in the United States, Australia, Canada, New Zealand, South Africa and the United Kingdom. This panel builds on their key recommendations to prepare information science professionals to succeed in their professional and career endeavors (Lunsford, Crisp, Dolan, and Wuetherick, 2017, p. 327).

In addition to those factors proposed by Lunsford, Crisp, Dolan, and Wuetherickin in Table 1, the panelists will elaborate on practicing professionals and the strategies to advance their career through innovation, industry partnerships and collaborations, and professional linkages for sustainability.

The purpose of this panel is to discuss the following areas proposed by the ASIS&T Member Match Program:

- Research Advancement
- Research Collaboration
- Professional Networking
- Career Advancement
- Leadership Skills Development
<table>
<thead>
<tr>
<th>Purpose</th>
<th>Types of mentoring</th>
<th>Outcomes</th>
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</table>
| Undergrad students | • Increase degree persistence  
• Ease academic transitions  
• Prepare for challenging experiences  
• Support underrepresented students | • Comprehensive  
• E-mentoring  
• Peer  
• Research  
• Natural/Informal | • Grade point average  
• Persistence in higher education  
• Leadership skills  
• Cognitive and socio-emotional growth |
| Graduate students | • Academic development  
• Career development  
• Personal development | • Professional persistence  
• Peer  
• Informal | • Socialization  
• Academic support  
• Program/advisor satisfaction  
• Scholarly productivity |
| Faculty | • Increase job knowledge and satisfaction  
• Increase retention | • Early career  
• Peer  
• Networks | • Career satisfaction  
• Promotion and retention  
• Job knowledge/skills |

Table 1. Purpose, types and outcomes of mentoring for undergraduates, graduate students and faculty members (Lunsford, Crisp, Dolan, and Wuetherick, 2017, p. 327)

This panel is presented by 5 international LIS professionals from 3 continents (Africa, Europe and North America), 4 different countries (South Africa, UK, Germany, and USA). Each panelist has unique and diverse academic and career experience to interact with the audience on the above five discussion areas.

PANELISTS
Connecting the dots: Learning from success and failure to advance your career
Dr. Chen was an LIS faculty member for 17 years at UW Milwaukee, UT Austin, University of Missouri, Indiana University Indianapolis, and Long Island University. He is Chief Library Services Officer and Professor at Philadelphia College of Osteopathic Medicine (PCOM). Previously, he was Dean of the Library at the Missouri University of Science and Technology, and Associate Dean of the Library at the University of Massachusetts Boston, respectively. His teaching and research experience also helped him in planning various professional development activities in the library, on campus and at ASIS&T. Dr. Chen was Vice Chair and Chair of the ASIS&T’s Professional Development Committee. His current research interests lie in the areas of research data management, academic libraries, open science, and scholarly communication. Dr. Chen is interested in sharing his career path through success and failure in teaching, learning, and university/professional services. He will also discuss key factors during career-change and job-hunting in the US higher education ecosystem. Dr. Chen is a member of the ASIS&T Member Match Program and is collaborating with two graduate students.

Fostering collaborative and impactful research across disciplinary, geographical and domain boundaries
Dr. Liu is an interdisciplinary Information Science educator and researcher, who has studied and worked in six countries (Taiwan, USA, Australia, Denmark, Norway and Sweden) across four continents. After receiving his PhD from Rutgers University, he took a faculty position at Charles Sturt University in Australia and then conducted collaborative research projects at The Australian National University for a decade. During Covid-19, he took a research and teaching position at the University of Southern Denmark and has recently worked on research projects in Norway and Sweden. His research program lies at the intersections of information retrieval, knowledge organization, and human information behavior, with particular emphasis on the design and evaluation of interactive information retrieval systems. His recent research has focused on the human-centered data science, with a particular interest in the development of cognitive and computational models for user-adaptive interfaces. Dr. Liu will share his collaborative research experiences across disciplinary and geographical boundaries and engaging with industry and professional partners. Dr. Liu has provided mentorship to students at iConference, chaired the DCMI 2022 Student Forum, served on the ASIS&T Research Engagement Committee and chaired several ASIS&T research awards committees.

Leadership skills and professional networking: Developing key skills that can be used across work environments
Dr. Hirsh is Associate Dean for Academics in the College of Professional and Global Education at San José State University (SJSU). She previously served as Professor and Director of the SJSU School of Information and worked in the Silicon Valley at HP Labs, Microsoft, and LinkedIn. She is Past President of the Association for Library and
Information Science Education (ALISE) and the Association for Information Science & Technology (ASIS&T), is an ASIS&T Distinguished Member, and also holds leadership roles in the American Library Association (ALA) and in the International Federation of Library Associations and Institutions (IFLA). Within these organizations, Dr. Hirsh has served in a range of mentorship roles, such as through the ASIS&T Early Career Mentorship Program and Doctoral Colloquium, as well as the IFLA Coaching Initiative. She published a book entitled Blockchain, as book 3 in the ALA Library Futures Series (2020) and an introductory textbook entitled Information Services Today: An Introduction (3rd edition, 2022). She is currently working on a new book, Library 2035: Imaging the Next Generation of Libraries, which will be published by Rowman & Littlefield in 2024. She co-founded and co-chairs the global virtual Library 2.0 conference series (https://www.library20.com/). Dr. Hirsh will discuss her professional experiences which have spanned multiple industries - from academia to research & development to product development. She will discuss the importance of leadership skills development and professional networking for career advancement.

The ‘3Ss’ of advancing your academic career: Support through mentorship, self-care and serendipity
Dr. Makri is the chair of ASIS&T’s Research Engagement Committee and has supported the implementation and evaluation of ASIS&T’s Early Career Mentorship scheme. He is also the self-proclaimed ‘prince of Serendip,’ having extensively researched the role of serendipity in information environments (and in everyday life). He will discuss 3 Ss’ of advancing your academic career: support through mentorship, self-care and serendipity. First, he will discuss the importance of gaining support through mentorship for career advancement and fulfillment, covering issues including how to make mentorship most effective, how to implement mentorship as a mutually-beneficial dialogue (rather than one-way advice stream) and how to make the most of mentorship throughout your academic career. Then, he will discuss the importance of self-care in an academic system that is potentially ‘primed for self-abuse,’ covering self-regulation and balance strategies for motivated researchers who want to advance their academic careers, while minimizing potentially negative outcomes such as stress and burnout. Finally, he will discuss the importance of serendipity in advancing academic careers, telling a brief ‘serendipity story’ about his own career advancement and providing advice on how to ‘make your own luck’ in the research collaborations that often drive career advancement.

Evolving professional development for impact and sustainability: Practicing professionals in information and knowledge management
Mrs. Mawire is the Director and Senior Consultant at Integra Professional Solutions where she leads the development and implementation of projects with a focus on information and knowledge management, many which include continued capacity building of researchers, librarians and others working in the profession in Sub-Saharan Africa. Over her career, Blessing has led the implementation of multi-country/regional projects across Sub-Saharan Africa and worked with diverse global partners from community-based organizations, research institutions, governments and United Nations agencies. Ms Mawire has strong experience in designing information and knowledge management approaches tailor-made for low resourced communities with a focus on sustainable impacts.

For several years she led the capacity building of library professionals and researchers across Sub-Saharan Africa as Deputy Director - Training and Research at ITOCA. She led the development of the graduate programme at the National Library of South Africa as Project Director, a programme that is still ongoing. Her other roles over the years have included, ELS – Training Coordinator (Country Coordinator), UNOPS and WHO, Project Manager (Content, Programmes and Internationalization) - Thabo Mbeki Presidential Library, Knowledge Management Specialist - Pan American Health Organisation (PAHO). Currently she is managing the Research4Life Country Connectors Project (World Health Organisation – WHO) where she manages and mentors information professionals who lead the work at national level in 11 countries.

Blessing is chair-elect for the ASIS&T Africa Chapter and leads capacity development for IFLA’s Evidence for Global Disaster and Health SIG.

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Digital Humanities and Information Science: Making A Difference?

de Fremery, Wayne
Dominican University of California | wayne.defremery@dominican.edu

Mostafa, Javed
University of North Carolina, Chapel Hill | jm@unc.edu

Pennington, Diane M. Rasmussen
Edinburgh Napier University | d.pennington@napier.ac.uk

Terra, Ana Lúcia
University of Coimbra | anaterra@fl.uc.pt

Cha, Javier
Hong Kong University | javiercha@hku.hk

Oh, Sam
Sungkyunkwan University | samoh@g.skku.edu

ABSTRACT
In a 2012 ASIS&T panel titled “Humanistic Information Science,” Melanie Feinberg, Jens-Erik Mai, Jonathan Furner, and Joseph Tennis argued that information science as a field “could be richer” if it were to embrace “humanistic approaches to information science” (Feinberg, Furner, Mai, Tennis, 2012). Approximately a decade later, this panel returns to foundational questions about science, the humanities, and information as a field of study to consider the relationship between the digital humanities and information science. How are information science and the digital humanities different? How are they similar? How might work done in one field make a difference in the other? What might digital humanists and information scientists have to say about translation and the transposition of disciplinary knowledge to and from each respective field? How might the translation and transposition of disciplinary knowledge in the humanities and information science inform practice, policy, and action in both and beyond? This panel will provide a forum for attendees of ASIS&T’s 86th Annual Meeting to debate answers with leading information scientists and digital humanists from around the world.

KEYWORDS
Science; Humanities; Information Science; Digital Humanities; Bibliography

INTRODUCTION
A decade after “Humanistic Information Science” was proposed, it is appropriate to explore how humanistic approaches in information science have made a difference and might inform the ways that information scientists think about ways to make a difference. The more forceful emergence of the digital humanities provides an opportunity to productively revisit the relationship between the humanities and information science.

The English novelist and physical chemist Charles Percy Snow (1959) famously used the term “two cultures” to describe “literary intellectuals” and “scientists” as “two groups—comparable in intelligence, identical in race, not grossly different in social origin, earning about the same incomes, who had almost ceased to communicate at all” (2). The cultural assumptions of Snow’s pronouncement are as awkward and unsettling as his statement itself. This panel asks if our ongoing reality is equally awkward and unsettling. Do we inhabit a reality in which humanists and information scientists have “so little in common” that they have “almost ceased to communicate”? Or do we inhabit a reality in which the definitional frameworks of culture suggested by Snow can themselves be reconsidered from perspectives in information science and the humanities simultaneously? Can humanists and information scientists communicate in ways that usefully form and formulate discourse about human and artificial intelligence, race, social origin, and income? Might they already communicate and share an intellectual culture?

We return to the arguments of ASIS&T panelists from a decade ago to ask if “a primary goal” of information science should be “to understand the culturally-specific roles that conceptions of information play in the fundamental everyday-life practices of representation, interpretation, meaning-making, classification, storytelling, remembering, [and] forgetting” (Feinberg, Furner, Mai, Tennis, 2012). We reconsider how closely aligned fields such as rhetoric, cultural studies, genre theory, narratology, philosophy of language, semiotics, and media theory” (Feinberg, Furner, Mai, Tennis, 2012) might be to information science by juxtaposing theories of information and modes of practice in information science with theories of the humanistic inquiry and methods of practice at “a nexus of fields within which scholars use computing technologies to investigate the kinds of questions that are traditional to the humanities, …[and] ask traditional kinds of humanities-oriented questions about computing technologies” (Fitzpatrick, 2012).

To explore similarities and distinctions between information science and the digital humanities and how work done in one field may make a difference in the another, the panel utilizes definitions of the digital humanities such as Fitzpatrick’s (above) to explore and contextualize widely cited definitions of information science, such as Tefko Saracevic’s (2018): “The domain of information science is the transmission of the universe of human knowledge in recorded form, centering on manipulation (representation, organization, and retrieval) of information, rather than knowing information” (2216).
To explore what digital humanists and information scientists have to say about translation and the transposition of disciplinary knowledge to and from each respective field, the panel also addresses assertions by scholars such as Furner (2015) who suggest that “information science is neither” a science nor about information. If “information science is neither” what might it be? How is knowledge produced by the field to be translated? How might the translation and transposition of disciplinary knowledge in information science and the humanities inform practice, policy, and action in both and beyond if information science is not a science and the humanities are, as has been widely reported for decades, in crisis.

THE PANEL

As it did a decade ago, the 90-minute panel will provide an opportunity for the audience to engage in discussions about the past, present, and the future of information science, especially the field’s history as it has engaged humanistic modes of inquiry and the ways that they have shaped its current and future formulations. Panelists will address foundational questions about the field in presentations of 10-15 minutes in length. The presentations will be followed by a moderated discussion with audience members that will last approximately 30 minutes. Key questions about how information science and the humanities have impacted one another and the ways that insights from both are relevant to practice, policy, and action will be addressed. Important questions from a decade ago will be asked again in slightly different forms to understand how much thinking and practice in information science and the humanities, in crisis or not, have changed: What makes a field of inquiry a “humanistic” one? What makes a field of inquiry a “scientific” one? How might a humanistic information science be conceived/reconceived, particularly in relation to the digital humanities? Should information science as a field strive to be humanistic, particularly if the humanities are understood to be in crisis?

To address questions such as these, **Javier Cha**, in a presentation titled "The humanities in the zettabyte era," will provide an overview of the research conducted at the Big Data Studies Lab at the University of Hong Kong. The Big Data Studies Lab conducts research aiming to rethink humanistic inquiries involving vast and distributed sources found across millions of servers and addresses various critical questions that arise in this context. Cha will discuss the role of cultural analytics as a browsing and searching mechanism, the energy required to preserve and retrieve large data, and the growing prevalence of binary large objects such as audiovisual content, 3D point clouds, and holograms. By delving into the humanities in the zettabyte era, Cha will begin to answer some of these questions and provide a way to think about the relationship between the humanities and information science.

**Javed Mostafa** will present “Stylometry and storytelling,” which will focus on storytelling and how advanced NLP and text-mining methods can be utilized to detect, interpret, and analyze stories (and components of stories) embedded in literature and history. Stylometry and its wide application in support of literary and historical scholarship will be highlighted to demonstrate the many positive ways technology can promote and expand engagements with the humanities. The presentation will suggest that deeper engagements with information technologies on the part of humanists may provide a way to address the crisis in the humanities, provide information scientists a means of sustained engagement with humanistic methods, and a way to impactfully address the negative influences caused by unfettered technology adoption.

**Diane M. Rasmussen Pennington** will address “The societal consequences of digital humanities: A social informatics epistemological perspective.” Social informatics is an interdisciplinary approach to research that “examines social aspects of computerization” (Rob Kling Center for Social Informatics, 2023). As humans are fundamentally social beings, this epistemology is ideal for questioning the role of and designs for digital humanities within information science. For example, how can both individual and societal information needs be studied and then applied to invaluable online resources such as digitized cultural heritage applications? How do outside forces such as Google and social media influence whether people discover and then effectively interact with these resources?

In “Beyond the algorithm: reimagining knowledge organization and visualization in information science through a digital humanities lens,” **Ana Lúcia Terra** will explore the role of humanistic approaches in knowledge organization and visualization. She will examine the ways that information science can support digital humanities approaches and describe the benefits of incorporating humanistic perspectives when organizing information for diverse users in distinct social and cultural contexts. Some innovative projects pushing the boundaries of what is possible when it comes to knowledge organization and visualization will be highlighted.

**Wayne de Fremery** will describe bibliography as a set of practices integral to both information scientific and humanistic modes of knowledge production. In a presentation titled “Bibliography as a generative science of accounting for difference,” he will suggest that bibliographical work formulates and enforces difference through acts of transposition and translation. He will propose that bibliographical acts of transposition and translation matter and make a difference to culturally specific formulations of information in everyday practices of “representation, interpretation, meaning-making, classification, storytelling, remembering, [and] forgetting.”
PANELISTS

Javier Cha is a medievalist, digital historian, and technologist. His areas of expertise include Korean Neo-Confucianism, medieval literary criticism, patronage culture, and data-assisted historical methods. Cha is currently an Assistant Professor of Digital Humanities in the Department of History at the University of Hong Kong, where he teaches in the new Bachelor of Arts in Humanities and Digital Technologies program. He earned his BA and MA in Asian Studies from the University of British Columbia and his PhD in East Asian Languages and Civilizations from Harvard University. Previously, Javier worked as an Associate Professor in the College of Liberal Studies at Seoul National University, where he was a recipient of the prestigious Innovative and Pioneering Young Researchers Scheme. In 2019, Javier established the Big Data Studies Lab, a research group that investigates data centers and global telecommunication infrastructure through methodologies inspired by book historians exploring manuscripts and libraries. Cha is an editorial board member of the *International Journal of Humanities and Arts Computing* and serves on the international nominations committee for Digital Humanities Awards.

Javed Mostafa received his PhD in information science from the University of Texas at Austin in 1994 for work that focused on developing information query models and search interfaces for video information. Javed has been a university teacher and administrator for about 30 years. Along the way, he served as an Associate Dean of Research, an Associate Dean of Academics, the founding leader of an interdiscipliary PhD and Postdoc informatics training program (chip.unc.edu), and an Editor-in-Chief of a major journal in his field (www.asist.org/publications/jasist/). Currently, Javed is a Professor of Information Science and a Program Director at the University of North Carolina at Chapel Hill, USA. Javed received numerous grants from for-profit and non-profit organizations, such as the U.S. National Institutes of Health (NIH) and the National Science Foundation (NSF). Javed directs a research laboratory and a training program with about 30 staff and students and has active projects that focus on developing novel applications of machine learning, data visualization, and equitable information services. In addition to research and training, Javed is passionate about translatable technologies. In the last decade he co-founded two companies, KeonaHealth (keonahealth.com) and Cymantix (cymantix.com). Both companies received multiple stages of government and private-sector investment and they currently operate in the USA.

Diane M. Rasmussen Pennington is Professor of Social Informatics, Research Lead for the Applied Informatics Subject Group, and Director of the Social Informatics Research Group in the iSchool at Edinburgh Napier University in Edinburgh, Scotland. Previously, Diane was a Senior Lecturer in Information Science at the University of Strathclyde in Glasgow, Scotland. Her research broadly examines the relationships among individuals, society, information, and technology. Her current areas of focus are ethical metadata, non-textual metadata, new research methods for social media analysis, and online health information provision. She has delivered over 150 peer-reviewed and invited presentations, and she has published more than 40 articles in journals such as *Journal of Documentation, Library & Information Science Research, Knowledge Organization, Journal of the Medical Library Association*, and *Journal of Information Science*. Diane is currently Chair of the Metadata and Discovery Group in the Chartered Institute of Library and Information Professionals (CILIP), the 2023 Vice President/President-Elect of CILIP Scotland, a Standing Committee Member of IFLA’s Training & Education Section (SET), and a Co-Chair of the iSchools Women’s Coalition. She is a Past Chair of ASIS&T’s European Chapter, SIG VIS, and SIG CR, as well as a Past President of the Canadian Association for Information Science (CAIS/ACSI).

Ana Lúcia Terra is an Assistant Professor in the Department of Philosophy, Communication and Information, Faculty of Arts, University of Coimbra, where she is the director of the Degree in Information Science. She teaches on the MA and PhD in Information Science. Previously, she was an Adjunct Professor at the Polytechnic Institute of Porto (2002 to 2020), where she was the Coordinator of the Degree in Documentation and Information Sciences and Technologies, Director of the Master Degree in Business Information, among other management positions. She has been the elected Chair of the Spain-Portugal Chapter of ISKO (International Society for Knowledge Organization) since November 2019 and a board member of the Bobcatsss Association since January 2021. In 2009, she received the Raul Proença Prize, sponsored by the Portuguese Directorate-General for Books and Libraries. Her main research interests include information behavior and knowledge organization. Recent works are related to knowledge organization in institutional repositories, metadata quality in repositories, and research methodologies in knowledge organization. Her work has appeared most recently in the *Journal of Academic Librarianship* (2021), *Education for Information* (2023), *Knowledge Organization* (2016), and *Education Sciences* (2022).

Wayne de Fremery is Professor of Information Science and Entrepreneurship at Dominican University of California, where he also directs the Françoise O. Lepage Center for Global Innovation. Previously, he was an associate professor of Korean Studies in the School of Media, Arts, and Science at Sogang University in South Korea. He currently represents the Korean National Body at ISO as Convener of a working group on document description, processing languages, and semantic metadata (ISO/IEC JTC 1/SC 34 WG 9). His recent research projects have concerned “Designing a Virtual Reality Environment for Reading Literature” (*The Materiality of Reading*, Aarhus University Press 2020), “Monitoring the Online Antiquarian Book Trade: The Public Good and...

Sam Oh (Moderator) is Professor Emeritus at Sungkyunkwan University, Seoul Korea, and an Affiliate Professor at University of Washington (UW) iSchool. His expertise includes data modeling, metadata, and ontology design. He has consulted widely for industry and the government in Korea. He is a past Chair and Current Ambassador of iSchools, Inc. He is also the Executive Director of Dublin Core Metadata Initiative (DCMI) and Chair of ISO/TC46/SC4 (Technical Interoperability). He chaired TC46/SC9 (Identification & Description) for six years and ISO/IEC JTC1 SC34 (Document Description and Processing Languages) for nine years. He has taught at iSchools such as Sungkyunkwan University, Syracuse, Pittsburgh, and University of North Carolina at Chapel Hill. He currently serves as an advisor to the Center for Digital Humanities and Computational Social Sciences at KAIST (Korea Advanced Institute for Science & Technology).

CONCLUSION
This panel returns to foundational questions about the sciences, the humanities, and information as a field of study to consider the relationship between the digital humanities and information science. It will suggest some of the ways that information science and the digital humanities are similar and distinct, as well as how work done in one field might make a difference in the other. It will explore what digital humanists and information scientists have to say about translation and the transposition of disciplinary knowledge to and from each respective field and the ways that such translations and transpositions can inform practice, policy, and action in both and beyond.

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Building a Bigger Table: Food Research, Methods, Policy, and Action in Library and Information Science

Du, Xiaotong
Rutgers University, USA | xd103@rutgers.edu
Polkinghorne, Sarah
RMIT University, Australia | sarah.polkinghorne@rmit.edu.au
Ocepek, Melissa
University of Illinois Urbana-Champaign, USA | mgocepek@illinois.edu
Costello, Kaitlin
Rutgers University, USA | k.costello@rutgers.edu

ABSTRACT
Growing global concerns over food safety, food price inflation, and climate change demand urgent attention in scientific fields. Food information behavior and practice have been a vibrant and growing research area in library and information science, following the user-centered paradigm shift and everyday life information needs, seeking, and use research since the 1970s. Research has shown that people engage with informal and embodied information to guide food practices (e.g., shopping, cooking, eating, and sustainability transitions). Food and health research challenge research methods and approaches in everyday information behavior and inform everyday practices, technological services, policies, and actions. In this panel, following a brief introduction, each panelist will share their research approaches and/or findings about food, health, and information research. We aim to invite and foster an open discussion with audiences to explore research opportunities, challenges, and approaches to studying food in library and information science.

KEYWORDS
Embodiment; everyday information behaviors; information practices; food; serious leisure.

INTRODUCTION
Growing global concerns over food safety, food price inflation, and climate shocks demand urgent attention in scientific fields. Information plays a vital role in guiding consumers and food practitioners (e.g., policy makers, grocers, restauranteurs, and farmers) to make food-related decisions. Various disciplines, including nutrition science, consumer studies, environmental studies, and social sciences, have taken up questions about food and information. In library and information science (LIS), food-related information behaviors and practices have started to draw more attention over the past decade. This area is particularly fruitful for connecting research to practice, policy, and action, as food and eating are a part of everyday life. This panel aims to explore how everyday information behaviors and practices inform food-related research, policy, and action in LIS. The panelists will discuss different methods and approaches to studying food information behavior and explore research opportunities and challenges that inform practices, services, policies, and actions.

BACKGROUND
Everyday life or nonwork-related information needs, seeking, and use research emerged in LIS in the 1970s. The shift from work-oriented to everyday life context builds upon a paradigm shift from a system-centered to a user-centered approach (Dervin & Nilan, 1986). Since then, the interested population and context have kept expanding in LIS, from information seeking of teachers and workers in everyday life (Savolainen, 1995) to information activities of cooking hobbyists in serious leisure (Hartel, 2003). Hartel's works draw upon the theory of serious leisure that was first coined by social scientist Robert Stebbins in 1982 (Stebbins, 2001), which inspired information scholars to study information behaviors in the context of hobbies and everyday mundane life. Hartel's research set the foundations for food-related information behavior and practice research in everyday life. Understanding people's everyday information behaviors and practices is a particularly productive avenue for translational research in LIS. For instance, United Nations’ policies indicate that information access, information sharing, database building, and information literacy are important topics to investigate in achieving the UNs’ Sustainable Development Goals (SDGs) (Chowdhury & Koya, 2017). Food labeling, especially ecolabels or green labels (e.g., organic, local), effectively bridges the information gaps between consumers, food providers, and policy makers (Howard & Allen, 2010).

Food information behaviors and practices have been a vibrant and growing research area in LIS over the past decade. Food is not only an essential human need, contributing to health and wellness, but it also helps people form social and cultural identities and bonds; some have argued that food and eating are social acts that make us human (Mol, 2021). Information is often intertwined with individuals' food practices, including acquisition, eating, and cooking. Food-related information also shapes organizational and institutional food practices, such as policies and actions at local and national levels. Food-related research in LIS is mostly focused on everyday life food practices. It reveals not only dynamic food-related practices, such as grocery shopping (Ocepek, 2018), planning and cooking (Hartel, 2006), eating (Polkinghorne, 2021), and ethical consumption behaviors (Polkinghorne, 2021; Du, 2022), but also corresponding sophisticated information practices, including the selection of information sources, information...
embodiment, and other information activities. For instance, everyday food consumers encounter and use sensory and embodied information sources to make food choices (Ocepek, 2018), get informed of future cooking and eating practices (Polkinghorne, 2021), or transition to sustainable consumption (Du, 2022). Cooking hobbyists may engage in information activities, such as managing personal collections and creating recipes and action plans at home (Hartel, 2003, 2010). However, how food information behaviors and practices may inform food marketing strategies, formal and informal education, policies, and regulations in everyday life is still implicit. As such, in this panel discussion, we aim to address how research in food information behavior and practices can inform food policies and actions in LIS and invite open discussion on research opportunities, challenges, methods, and approaches to studying food in LIS.

**PANEL AGENDA**

We will address the following topics in this panel:

- Food information and embodiment
- Methodological considerations for studying food in LIS
- Approaches to US food policy and information practices
- Research partnerships in food and LIS

This 90-minute panel discussion will be organized as follows:

1. The moderator, Xiaotong Du, will introduce the need to explore food information behaviors and practices in library and information science (5 minutes).
2. Each panelist, Sarah Polkinghorne, Melissa Ocepek, Kaitlin Costello, and Xiaotong Du, will present for 10-12 minutes to share their research experience, insights, and how their research, methods, and approaches inform food-related practice, policy, or action (50 minutes).
3. An open discussion, including questions prepared by panelists as a starting point and any questions raised by the audience, for a full discussion with shared audience perspectives (35 minutes).

The prompt questions for open discussion include:

1. How can we address some global food concerns across the entire food system, from production to consumption, through research in library and information science?
2. How can researchers build a bigger table to expand the translational reach of library and information science research, especially to inform policymaking around food?
3. Are there additional approaches to consider when studying food information practices?

**PANELISTS AND GOALS**

**Xiaotong Du, Panelist/Moderator**

Xiaotong Du, MA, is a PhD candidate at Rutgers University in the School of Communication & Information. Her research interest lies at the intersection of human information behavior, food, and social and environmental sustainability. Her recent research examines the information behavior and practice of sustainable food consumers in everyday life and food context, including information acquisition to get informed of sustainability-related topics and information practices to guide everyday food acquisition and sustainability transitions. She is a member of the Dining Services and Food Vendors Climate Action Group at Rutgers University. This group aims to reduce indirect carbon emissions from food-related procedures and waste by at least 30% by 2030 at University's food and dining services.

On this panel, Xiaotong will discuss findings from her recent research that may inform food-related practices and actions. She will also discuss her membership in University's climate action group, actions that communities have already taken, and challenges and opportunities to bridge the gap between food-related research findings and actions at the local level.

**Sarah Polkinghorne, Panelist**

Sarah Polkinghorne, PhD, is a Research Fellow in Social Change at RMIT University in Melbourne, Australia. Her research explores human information practices, with the goal of better understanding how people become informed. In her current work, Dr. Polkinghorne documents people’s information practices and technology use as they cope with the rising cost of food. Escalating food costs are central to the global cost-of-living crisis. In its 2022 report on the Sustainable Development Goals (SDGs), the United Nations reports that the COVID-19 pandemic and concurrent challenges have erased four years of progress toward the eradication of poverty (p. 8). It has become commonplace for media organizations to report on people’s coping strategies, including skipping meals (“1 in 4,” 2022; Wood, 2022).

People use a range of additional strategies to cope with the cost of food, such as buying cheaper brands and spending less on restaurant meals (Kalaitzandonakes, Coppess, & Ellison, 2022). However, the research evidence on these
strategies is primarily quantitative in nature. Food is intertwined with every aspect of life, including family traditions, geographies and cultures, health needs, sense of self and belonging, and technology use. This means that the information behavior surrounding individual financial and nutritional activities, while important, is not the complete picture. Dr. Polkinghorne uses interpretivist, qualitative approaches in order to generate critical understanding of the lived experiences of the people behind the statistics on skipping meals, foregoing restaurants, and choosing between utilities and groceries.

On this panel, Dr. Polkinghorne will share emerging results from her current phase of research. She will also touch on food’s rich potential as a site for exploring current information science concerns such as misinformation, algorithmic bias, and embodiment. Dr. Polkinghorne will raise key initial considerations for information researchers who may be interested in investigating people’s food lives.

**Melissa Ocepek, Panelist**

Melissa Ocepek, PhD, is an Assistant Professor at the University of Illinois Urbana-Champaign in the School of Information Sciences. Her research draws on ethnographic methods and institutional ethnography to explore how individuals use information throughout their everyday lives. Her research has largely addressed the intersection of food, information and culture including work that examines how shoppers navigate the information environment of the grocery store and why an online grocery shopping platform failed. Dr. Ocepek has published two books related to this work Food in the Internet Age and Formal and Informal Approaches to Food Policy (both with William Aspray and George Royer). Dr. Ocepek received her Ph.D. at the University of Texas at Austin in the School of Information.

On this panel, Melissa will draw from her many food related projects to share the opportunities for information science through studying food including: tangible material’s place in digital culture, studying sensory-based information sources, food’s relationship to crisis informatics, and how information can help in feeding the family.

**Kaitlin Costello, Panelist**

Kaitlin Costello, MSLIS, PhD, is an associate professor at Rutgers University in the School of Communication & Information, where they study health information practices. Their research has included explorations of how people with chronic illnesses find and use online health information in their everyday lives, the use and critique of self-tracking technologies for health, and theory development in library and information science. Dr. Costello’s work often questions the assumption that individualized technologies are a net good.

In some contexts, food behaviors, like information behaviors, have been understood through individualized models, and food behavior changes are often framed as individual choices that can be made possible through technology and policy (Schifferstein, 2020). Such models obfuscate that these behaviors are inherently social and collective practices embedded within complex arrangements that are shaped by economic forces like neoliberalism. In this panel, Dr. Costello will discuss the intersections between food, health, and information as commodified devices inscribed in complex assemblages of people, technologies, infrastructures, and geopolitical realities (e.g. Tsing, 2015). They will then suggest considerations for following the “red thread of information” (Bates, 1999) in food information assemblages to an actionable social power analysis that focuses on visible, hidden, and invisible forms of power (Worth, 2022). Understanding the presence, absence, and movement of information and power, as well as the information structures and systems that maintain that power, allows us to strategize for more just futures (Ballester, 2019, Floegel & Costello, 2022). Dr. Costello will draw from their research and the existing literature to explore what an agenda disentangled from neoliberalism could look like for everyday information practices research, and why food is a productive and necessary context in which to situate that work.

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Online Incivility and Contextual Factors: Data-Driven Detection and Analysis

Dumas, Catherine  
University at Albany, State University of New York, USA | cdumas@albany.edu

Ghosh, Souvick  
San Jose State University, USA | souvick.ghosh@sjsu.edu

Hong, Lingzi  
University of North Texas, USA | lingzi.hong@unt.edu

Karami, Amir  
University of Alabama at Birmingham, USA | karami@uab.edu

Vaidya, Priya  
Aligarh Muslim University | India | vaidyapriya26@gmail.com

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ABSTRACT
Uncivil behaviors like rude or hate speech have been a persistent problem on social media, which could lead to negative user experience or even affect the psychological well-being of users. Automatic detection and moderation of such behaviors are critical to creating a supportive online community for effective user communication and positive user experience. In this tutorial, we propose methods to study online incivility, which includes data collection from a social media platform, i.e., Reddit, automatic detection of incivility with pretrained deep learning classifiers, and statistical and visual analytical methods to investigate the combination of community characteristics and users’ interactive patterns that relate to the occurrences of incivility. Similar methods can be applied to understand other information misbehaviors online, such as misinformation, dissemination of rumors, and cyberstalking. This panel is sponsored by SIG SM.

KEYWORDS
social media; social media analysis; data analysis; data visualization; data collection.

INTRODUCTION
Uncivil behaviors online include a continuum from milder forms, such as rude and name-calling, to more serious forms, such as bullying, harassment, hate speech, and threats. Uncivil behaviors are significantly seen on social media and forums due to anonymity and deindividuation in online interaction. Online incivility may lead to emotional distress and psychological harm to users, driving users away from discussions, which may exacerbate divides and conflicts among people (Ring, 2013). It is critical to address the rising issues of online incivility, empower users for effective responses to incivility, and create user interaction design that can help individual users navigate online interactions in a more civil manner. A lot of existing studies have focused on the detection of incivility, such as hate speech (Davidson et al., 2017) and toxicity (Founta et al., 2019), based on the linguistics of social media posts or comments. A previous study showed context matters in the detection of incivility (Yu et al., 2022). However, not much has been done to investigate uncivil behaviors from a user interaction perspective, i.e., how the power dynamics in online conversations and characteristics of online communities relates to the occurrences or mitigation of incivility. In this tutorial, we will introduce existing methods for the detection of uncivil posts on social media. Based on the detection results, we will explore analytical perspectives to unveil characteristics of online communities and user interactions that are related to the occurrences of uncivil behaviors.

The 90-minute panel session will consist of two subsessions: (1) The panelists will provide a presentation and hands-on experience on a selected topic of data collection, analysis, and modeling (each takes 15-25 minutes). Figure 1 shows the steps involved in this session; and (2) Interactive discussion and question-answering. We will use #asist_sm2023 to advertise the session throughout the ASIS&T community on social media before the panel and continue the conversations with researchers who are interested in this topic.

STRUCTURE OF THE TUTORIAL
The 60-minute tutorial will provide general guidelines in terms of the collection of social media data using different search conditions, automatic analysis of social media posts using pre-train deep learning models, and statistical and visual analysis methods for modeling user behaviors. The set of methods can be applied for the understanding of other phenomena on social networks, for example, the spreading of misinformation or rumor, hate speech and hate groups, and information campaigns driven by bots.

Presenters are experts in social media, natural language processing, computational social science, user behavior modeling, and public health. The presenters will use open-source platforms such as Jupyter Notebook or Google Colab for data collection and analysis.
**Figure 1: Flowchart of the Steps Involved**

**Step 1: Data Collection and Cleaning**
We choose one of the social media platforms, Reddit, for our data collection. PRAW, the Python Reddit API Wrapper, will be used for data collection. The API makes it possible to retrieve posts and comments from certain subreddits. It also provides functions to retrieve user information. To understand how community characteristics and power dynamics in user interactions are related to uncivil behaviors, we choose to use a community-based sampling method instead of searching data by keywords. We identified 10 subreddits that belong to three categories for initial data collection. The subreddits include media-sharing communities, e.g., r/worldnews, r/conspiracy, r/politics, identity communities, r/india, r/Feminism, r/sino, and r/conservative, discussion communities, e.g., r/changemyview, r/PurplePillDebate, and r/antiwork. For the posts and comments that have been retrieved, we can further retrieve user information based on the user’s id on Reddit.

**Learning Outcomes**
1. Introduce learners to the basic concepts of incivility online.
2. Provide participants with practical methods and techniques they can apply for the collecting of social media data through APIs.

**Packages Used**
PRAW, NLTK, TextBlob, and Klib

**Presenters**
Souvick Ghosh, Lingzi Hong, and Priya Vaidya

**Step 2: Data Analysis**
For the posts and comments collected, we will use machine learning classifiers to automatically identify content that is uncivil. The definition of incivility includes name-calling, abusive language, and hate speech (Sadeque et al.,...
Using a pre-trained model by Liu et al. (2019), we fine-tune the model with the corpus by Qian et al. (2019), Davidson et al. (2017), and Vidgen et al. (2021), we will obtain three classifiers. We feed the Reddit comments data to the three classifiers for outputs of uncivil behaviors.

**Learning Outcomes**
1. Prepare participants with the installation of required packages for deep learning models.
2. Provide participants with skills and techniques to run pretrained deep learning models.
3. Provide additional resources and recommendations for further study.

**Packages Used**
- Pytorch

**Presenters**
- Lingzi Hong and Souvick Ghosh

**Step 3: Data Visualization and Modeling**
After the identification of the incivility of comments in conversations, we further conduct statistical and visual analysis to understand how community characteristics and user-level factors are related to the occurrences of incivility. We will conduct an exemplary analysis for the following two questions: (1) the normative or orderly behavior in different online communities varies. Users may post uncivil posts or incorporate toxic language in interactions according to the shared norms. In the first question, we would like to visualize temporal occurrences of incivility in different online communities. (2) what are the characteristics of users engaging in uncivil behaviors more? For this question, we will extract user features such as verified email or not, a moderator or not, and ages of account and conduct statistical tests to identify the relations between such features and the frequency of uncivil behaviors.

**Learning Outcomes**
1. Introduce participants with a set of statistical and visualization methods for the analysis of heterogeneous data.
2. Engage participants to collaborate and explore analytical perspectives.
3. Provide additional resources and recommendations for further study.

**Packages Used**
- Python: Seaborn, Matplotlib, Plotly, Pandas, WordCloud, Numpy

**Presenters**
- Priya Vaidya and Amir Karami

**INTERACTIVE DISCUSSION SESSION**
In the second half of the session (30 minutes), we will have an interactive discussion session that will allow participants to ask follow-up questions, discuss research on social media incivility, and build potential collaborative relations. The interactive discussions will be driven by the following questions:

1. What other analytical perspectives can be looked into to characterize an online environment that breeds or is conducive to uncivil behaviors?
2. How could data-driven insights help us identify effective measures, moderations, or human-computer interaction designs that may prevent incivility?
3. What other research topics may benefit from using the data-driven methods proposed?
4. What are the limitations of using data-driven methods to study online misbehaviors?

**ATTENDANCE**
We expect to involve 20-35 participants with a maximum of 40.

**PRESENTERS**
The presenters are scholars in information and data science who have been teaching courses in Data Science, Information Visualization, and Machine Learning in their respective universities. They are also the current board members of the Special Interest Group (SIG) in Social Media.

**Presenter 1: Souvick Ghosh**
Dr. Souvick “Vic” Ghosh is an Assistant Professor at the School of Information at San Jose State University. He is the Academic Coordinator for the undergraduate degree program (BS) in Information Science and Data Analytics and the Director of the Intelligent Conversational Agents and Neural Networks Lab (ICANN) at SJSU. Ghosh also serves as the AI Consultant for the InterPARES Trust AI and the Chair for the ASIS&T IDEA Artificial Intelligence Institute. Prior to joining SJSU, he completed his Ph.D. in Information Science from Rutgers University in 2020. He is a mixed methods researcher who combines interdisciplinary concepts from artificial intelligence, machine learning, and human-computer interaction (HCI) to improve voice-based assistants and design systems for the social good. He
developed automated AI solutions for complex socio-technical problems such as cyberbullying, fake news, community question-answering, and PII (personally identifiable information) disclosure. He will help with this proposal to develop materials for data collection and data analysis.

**Presenter 2: Lingzi Hong**

Dr. Lingzi Hong is an Assistant Professor in Data Science at the University of North Texas College of Information. She earned her Ph.D. in Information Science from the University of Maryland College Park in 2019. Her research interest focuses on computational social science and crisis informatics, thus using data science methods to investigate big data for fair and efficient decision-making. Her interdisciplinary research has been published in conferences and journals such as NAACL, ACM Web Science, ASIS&T, and EPJ Data Science. She will help with this proposal to develop materials for data collection, data analysis, and visualization.

**Presenter 3: Priya Vaidya**

Ms. Priya Vaidya is a Senior Research Fellow in the Department of LIS, Aligarh Muslim University, Aligarh. She has submitted her Ph.D. thesis on “Assessment of Library Service Quality of Indian Central Universities” at the DLISc, AMU. Her research interest focuses on quantitative and qualitative analysis research methods in social sciences and sentiment analysis using machine learning techniques. She has contributed her research publications in different peer-reviewed journals and international conferences such as JoLIS, Serials Librarian, DILIT, and KELPRO Bulletin. Prior to her Ph.D. tenure, she automated the library system of the Department of Petroleum Studies, ZHCET, and AMU and oriented the PostGraduate Students of Agricultural Sciences regarding the library & Information Science Subjects. She will help this proposal to develop material in data retrieval from prominent social media applications (i.e., Twitter) without using API keys, data analysis, and data visualization.

**Presenter 4: Amir Karami**

Amir Karami is an Associate Professor of Quantitative Methods/Business Analytics in the Department of Management, Information Systems & Quantitative Methods at the Collat School of Business at the University of Alabama at Birmingham (UAB). Before joining UAB, he served as an Associate Professor in the School of Information Science (School) at the University of South Carolina (UofSC). He was also the Associate Dean for Research in the College of Information and Communications, a Faculty Associate in the South Carolina SmartState Center for Healthcare Quality (CHQ) at the UofSC Arnold School of Public Health, and Social Media Core Director at the UofSC Big Data Health Science Center (BDHSC). He will help this proposal develop materials regarding social media data collection and analysis.

**Moderator: Catherine Dumas**

Dr. Catherine Dumas is a Visiting Assistant Professor at University at Albany, State University of New York. She has been a member of ASIS&T since 2011 and has held several leadership positions. She is currently the Chair of SIG SM (Social Media). Her research is motivated by data generated by platforms potentially used for online collective action or digital activism, in particular, electronic petitioning. Most recently, she has been studying user behavior and interactions on next-gen social VR platforms and making sense of group interaction in VR in the context of next-generation e-Participation initiatives. She is also working on a project using VR to train library school students in crisis management in public libraries. Dr. Dumas is exploring the usability and effectiveness of using immersive technologies in teaching and learning. She will help with this proposal to develop materials for data collection, data analysis, and visualization.

**REFERENCES**


Search Systems and Artificial Intelligence: Enhancing Searching as Learning Approaches to Counter Misinformation

Ghosh, Souvick
San Jose State University, USA | souvick.ghosh@sjsu.edu

Gwizdka, Jacek
The University of Texas at Austin, USA | jacekg@utexas.edu

Lewandowski, Dirk
Hamburg University of Applied Sciences, Germany | dirk.lewandowski@haw-hamburg.de

Reynolds, Rebecca
Rutgers University School of Communication & Information, USA | rbreynol@comminfo.rutgers.edu

Rieh, Soo Young
The University of Texas at Austin, USA | rieh@ischool.utexas.edu

Heck, Tamara
DIPF, Leibniz Institute for Research and Information in Education, Germany | heck@dipf.de

Imeri, Aylin
Heinrich Heine University Düsseldorf; Germany | aylin.imeri@uni-duesseldorf.de

ABSTRACT
Searching as a learning process implies that learning occurs during a search process and might happen incidentally, influenced by the context the search takes place and the system that is used. Searching and learning are not isolated but co-occurring events. Research investigates how search systems can be improved to foster learning processes, integrate information literacy enhancing methods and support user’s sense-making of information. Regarding the advancement of AI algorithms and their implementation in search systems, the concept of searching as a learning process can help to better understand human-computer interactions and future information-seeking processes. The panel advances current research on search systems for learning in non-formal settings, with a focus on investigating the relation between searching and learning processes that influence people’s understanding, assessing and use of information. It will focus on the contributions of information science research and the expectations of future searching behavior with respect to emerging advances in AI.

KEYWORDS
searching as learning; information seeking; AI; misinformation; disinformation

INTRODUCTION
Searching as learning can be considered as an interdisciplinary topic between information science, educational research, psychology and machine learning (Rieh et al., 2016). According to Ghosh et al. (2018, p. 22), “[i]n recent years, ‘Searching as learning’ has emerged as an important area of research in library and information science (LIS) as it allows for a better understanding of search behavior using the broader context of human learning.” For information science, at least three communities are involved: information behavior, information literacy and information retrieval (Rieh et al., 2016). Vakkari (2016) investigated empirical studies on information searching and learning. He (2016, p. 7) explained that “[s]ome research in information science either conceptualizes searching as learning or otherwise explores links between searching and learning. Most of the studies belong to the latter category. These studies do not explicitly use the word ‘learning’, although implicitly they deal with this phenomenon.” Further, according to Reynolds et al. (2018), searching and learning are not isolated but co-occurring events, and the learning outcomes are often influenced by the cognitive complexity of the search tasks (Krathwohl, 2002), the choice of information sources (Rath et al., 2018), the affordances offered by search devices (chatbots, personal assistants), and the environment (Ghosh and Shah, 2019). The searchers’ topic knowledge, topic interest, and perceived task difficulty also affect the behavioral patterns and learning goals. There are also studies (Ghosh et al., 2018; Liu et al., 2019; Roy et al., 2020) that developed learning-related search tasks to better understand users' knowledge gain and change during searching. Roy et al. (2020) did not only concentrate on the overall learning outcome, but on learning during search sessions, and stressed that “[w]e lack insights into when learning occurs and whether this differs among different types of users (e.g. those without prior knowledge and those with prior knowledge)” (p. 432). O’Brien et al. (2022) investigated this issue within digital library systems and showed that search expertise plays an important role for learning during a search process, more so than one’s domain knowledge. The panel by Rieh et al. (2014) discussed novel methods and approaches to investigate the topic. Participants at the Schloß Dagstuhl workshop (Collins-Thompson et al., 2017) discussed different perspectives and challenges of search system design. The special issue of Eickhoff et al. (2017, p. 401) includes six contributions on “modeling learning intents and activities in the context of information search and retrieval”.

Searching happens in all daily life and professional work situations. Through purposive searching, people gather and seek information to solve an identified information need. However, sometimes information needs seem to be elusive. Research about searching as learning investigates how the process of searching is related to learning experiences and learning outcomes. The last years are shaped through the infodemic (García-Saisó et al., 2021), characterized by the spreading of mis- and disinformation. It is increasingly apparent that understanding how people...
search for information, how they learn through searching and how this influences their knowledge and epistemological beliefs is crucial. In this panel, we emphasize that searching as learning should encompass broader issues such as the potential risk of receiving and using misleading or low quality information resulting from the search process and human learning. Therefore, the panel focuses specifically on the topic concerning the challenges in fighting misinformation and the obstacles posed by the advancement of AI.

Rieh et al. (2016) essentially distinguish two main concepts: Searching as a process for learning and searching as a learning process itself. In this contribution we refer to the latter one as it implies that learning is not determined as a goal in the first instance, but it can happen incidentally during the search process and it might be influenced by the context the search takes place and the application that is used. Vakkari (2016, p. 8) stresses that “learning occurs in many ways, not only by studying or by being taught, but also by experiencing something, like by doing. This definition includes both intentional and unintended learning.” Unintended learning can occur in non-formal settings like everyday life information seeking. Therefore, the concept of searching as learning is suitable to investigate such settings and the “learning experience during the search process outside of formal educational settings” (Hauff et al., 2017, p. 136). Search as a learning process stresses the “necessity of studying and designing search systems to foster exploration and discovery, that the learning experience during the search process is just as important as the learning that occurs with retrieved documents” (Reynolds et al., 2019, p. 7).

Search engine results pages (SERPs) provide “meta-information users easily understand in forms such as list order, cue-laden item content summaries (title, url, snippet), entity cards, dictionary definitions, images, video links, news item headlines, items for sale, suggested queries, and extracted facts or answers” (Smith & Rieh, 2019, p. 55). Interestingly, Schultheiß et al. (2022) investigated to what extent search engine optimization impacts users’ perception considering quality. It is no surprising that Smith & Rieh (2019, p. 55) point out that “SERPs provide minimal structure or support for [information-literate action], so even information literate searchers must devise or learn an approach for enriching the limited information provided.” Smith & Rieh (2019) discuss the need for the development of a learning-centric search system. Reynolds et al. (2019) discussed during a panel to what extent the system plays a crucial role, considering user’s interaction with the information, system’s potential to integrate information literacy enhancing methods and supporting user’s sense-making of information.

With the rise of new AI systems, one might ask if these challenges investigated in information research will soon be resolved? New AI systems compete with traditional search systems like web search engines or professional information systems. They promise to support users in finding correct answers. Users are able to seek information not only via natural language or speech. Moreover, they receive not a list of potentially relevant information sources to click on, but immediately get the information for their answer and do not need to scan and assess the results. For everyday life questions, people can apply systems like ChatGPT. For research, systems like Elicit (Ought, n/A) promise to show explicit information in a result list referring to the research question a user entered. Other systems implement chatbots (Stokel-Walker, 2023) that focus on user guidance and assistance, while imitating a communication with a real person. These approaches are not new, but the development and performance of the new AI algorithms and their implementation in real-life systems speeded up in the last months and are critically discussed in numerous debates (Future of Life Institute, 2023; UNESCO, 2022; Bender et al., 2021). Therefore, the question that arises is not if AI systems can solve problems in information seeking, but how they influence and change searching and learning processes and how this impacts the spread of misinformation.

The proposed panel advances current research on search systems for learning in non-formal settings, with a focus on investigating the relation between searching and learning processes that influence people’s understanding, assessing and use of information. It will discuss research regarding new technical innovations that will influence people’s searching and learning processes. In the panel, the speakers discuss the two questions:

- How can information science contribute to the concept of search as learning to better understand people’s perception and processing of information to fight misinformation?
- What can we expect search and information gathering processes will look like in the future with respect to emerging advances in AI algorithms and platforms?

Panel Structure
The panel will start with a short introduction into the topic and a discussion session of 40 minutes, where the panelists debate on the two questions, referring to their recent work. Thereafter, the moderators will introduce the interactivity session (30 minutes), where the panelists and audience will come together in small groups to discuss how they relate their work to searching as learning, which methods they apply or think should be applied and which data, tools, and infrastructure the library and information science community needs to investigate searching as learning. Together with the audience the panel speakers will collect approaches and methods to investigate searching as learning from different perspectives. Here the panel builds on existing work Rieh et al. (2014) to share methods and measures to assess searching and learning processes in relation to mis- and disinformation and upcoming
technical innovations in AI. The audience will be motivated to write down relevant points of their discussions in online pads (e.g. mirror boards) that will be shared within the community. The wrap-up of the interactivity part will summarize further ideas for networking and collaboration on the topics.

**Bios**

**Souvick Ghosh.** Souvick ‘Vic’ Ghosh is a tenure-track Assistant Professor at the School of Information, SJSU. Ghosh is a mixed-methods researcher who specializes in applications of Machine Learning (ML), Artificial Intelligence (AI), and Natural Language Processing (NLP) to solve problems in Information Retrieval (IR). Ghosh has designed experimental user studies to investigate the relationship between searching and learning, by conceptualizing information-seeking as a learning process and learning as a subconscious and associated outcome of seeking information (Ghosh et al., 2018). Ghosh will discuss the influence of AI. While AI offers the potential to positively impact searching as learning, it is vital to be cognizant of potential drawbacks, such as over-dependence on AI-generated content, filter bubbles, misinformation, and privacy issues. It is crucial for the research community and educators to assess the changes in the searchers’ search experiences and learning outcomes, as AI potentially transforms the way we search and learn.

**Jacek Gwizdka** is an Associate Professor in the School of Information at the University of Texas at Austin. He investigates human information interaction, search and retrieval and applies methods from experimental cognitive psychology and neuro-physiology to understand information searchers and improve search experience. He is interested in inferring and quantifying cognitive and affective phenomena in human information interaction from neuro-physiological signals and subsequently in creating models that relate and predict these phenomena. He employs eye-tracking, pupillometry, neuro-physiological signals in assessment of search as learning, reading, mind-wandering and in inferring information relevance. He was one of the original contributors to formulating search-as-learning agenda at Dagstuhl seminar in 2012 (Freund et al., 2013) and co-organized two international workshops on search as learning (2014 at IIiX and 2016 at SIGIR; Gwizdka et al., 2016)). In 2015-2017, he guest co-edited two special issues on the topic for Journal of Information Science and Information Retrieval Journal.

**Dirk Lewandowski** is a Professor of information research and information retrieval at Hamburg University of Applied Sciences, Germany, and an Interim Professor in the Department of Computer Science and Applied Cognitive Science at the University of Duisburg-Essen, Germany. His research interests are Web information retrieval, search engine user behavior and search engines' role in society. He follows an approach combining data science and social science methods to research commercial search engines. Lewandowski will discuss how commercial influences in web search engines like Google (as described, e.g., in Lewandowski & Schultheiß, 2022) influence learning and learning outcomes. While search engines can tremendously help people in their learning tasks, commercial influences can hinder learning without the learner noticing. Therefore, a thorough understanding of commercial influences on search engine results and users' understanding of these influences is needed to better understand learning processes mediated through commercial search.

**Rebecca Reynolds.** Rebecca Reynolds, Associate Professor at Rutgers, will build upon ideas communicated in a recent article co-authored on mis- and dis-information (Paris et al., 2022). Reynolds will discuss Milner and Phillips' model of ecological literacy (2020), a recent framing contributing to mis- and dis-information research that sees the problems of mis- and disinformation as multifaceted and situated in socio-technical systems dynamics (such as those facilitated by AI). The approach recommends increasing publics’ understandings of socio-technical systems components, agents and dynamics, as existing within structures of power. This model posits that communities can enact change in these systems through social practices (Lopez, 2012; Mars & Bronstein, 2018; Van Dijck, 2021), considering how interconnected parts of socio-technical configurations have allowed misinformation to proliferate. This disentangling aims to empower knowledgeable publics to arbitrate how we wish technology to work for us -- per theoretical perspectives such as social shaping of technology (Barad, 2003; Wajcman, 2015) and critical informatics (Noble, 2016; Sweeney and Brock, 2014).

**Soo Young Rich.** Soo Young Rich is Professor and Senior Associate Dean for Academic Affairs in the School of Information at the University of Texas at Austin. Her research areas include credibility assessment of online information, search as learning, learning-centric search systems, and searching for supporting creativity. Her prior research (e.g. Rich et al., 2016) has focused on conceptualizing searching as a learning process and evaluating human learning during web searching. Currently, she investigates ways to foster critical thinking and creativity in the search process, with a focus on the intersection of information search strategies and idea generation. She has served as a Co-PI for the IDEA Institute on Artificial Intelligence Project and PI for the Training Future Faculty in Library, AI, and Data Driven Education and Research (LADDER) Project, both funded by IMLS.

**Moderators**

**Tamara Heck.** Dr. Tamara Heck is a researcher at the Information Center for Education at DIPF | Leibniz Institute for Research and Information in Education in Frankfurt, Germany. She has a PhD in Information Science and her
research focuses on the interface between users, information, and information systems. Her current work investigates open science and open educational practices, and how information infrastructures can be designed to serve those practices. A further focus lies on information seeking in research synthesis and systematic reviews, and new approaches to automate searching and selection processes when applying those methods. Searching as a learning process helps to better understand information seeking and relevance assessment to improve digital infrastructures for research, teaching and learning.

Aylin Imeri. Dr. Aylin Imeri is a research associate at the Department of Information (Institute Linguistics) at the Heinrich Heine University Düsseldorf in Germany. She has a PhD in Information Science and her research focuses on information behavior and health related topics. She investigated in her dissertation different aspects such as gamification, data privacy, health information behavior regarding activity tracking technologies (fitness tracker, mobile fitness applications), and users' interaction with those devices. She is currently working on the development of an e-learning course for students at the Heinrich Heine University. Together with her student assistants they develop a learning environment to raise awareness for challenges considering how to find good and proofed information in the digital world.

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Reflecting on Two Decades of Information Horizons Theory and Method: Applications and Innovations

Greenberg, Jane  
Drexel University, USA | jg3243@drexel.edu

Sonnenwald, Diane H.  
University College Dublin, Ireland | diane.sonnenwald@ucd.ie

Hartel, Jenna  
University of Toronto, Canada | jenna.hartel@utoronto.ca

Montague, Kaitlin  
Rutgers University, USA | kaitlin.montague@rutgers.edu

Fourie, Ina  
University of Pretoria, South Africa | ina.fourie@up.ac.za

ABSTRACT

Information horizons is a theory and method that embraces behavioral, cognitive and social aspects of information seeking, sharing, and use. As the first method originating in information science that uses a graphical data collection technique (Hartel, 2016), it has served as the underpinning methodology for numerous investigations for over 20 years. Information horizons is also valuable in teaching master’s and doctoral students about information behavior and importance of theoretical constructs. For example, over 700 master’s students at the University of Toronto have completed exploratory, empirical studies using the method. A strength of the method is its extensibility; researchers have extended and adapted the method for use with different populations and to investigate different types of information behavior. This panel will explore the varied applications of the information horizon method, engage the audience in open discussion about the information horizons method for research and teaching, and explore how theoretical and methodological approaches can be more effectively shared across the information science and related communities.

KEYWORDS

Information horizons, mixed methods, lower socio-economic communities, teaching, research.

INTRODUCTION

Information horizons is both a theory and method that embraces behavioral, cognitive and social aspects of information seeking, sharing, and use. The information horizons method is the first method originating in information science that uses a graphical data collection technique (Hartel, 2016). The theory was introduced in 1999 (Sonnenwald, 1999), and the method in 2001 (Sonnenwald, et al, 2001). The method was awarded the 2001 ALISE Research Methodology Best Paper Award and cited as one of the ten most impactful research results in last decade by ASIS&T SIG-USE (in 2011).

The method has been used in numerous investigations to learn from communities not traditionally included in scientific research studies. It has been used to study information behavior of immigrant children (Henefer, 2008), earthquake preparedness in Indonesian villages (Romo-Murphy, 2013), refugee and immigrant women (Zimmerman, 2018), and Korean immigrant mothers in the US (Lee, 2018). The method is taught in doctoral and master classes and used by master students (e.g., master students used the method to study information behaviour in a LGBTQ community (Hartel et al, 2018). Researchers have also extended and combined this method with other methods. For example, Huvilo (2009) used the information horizon maps to illustrate the information practices of a group; Savolainen & Kari (2004) extended the approach to create information source preference maps; and, Greyson and colleagues (2017) extended information horizon maps to include additional information behaviours, such as receiving, sharing, storing and managing information. Additionally, the significance of the information horizons method is underscored by over 900 views of an instructional video (INFIDEOS: The Information Horizon Interview), and over 870 citations to the initial key papers.

PANEL GOALS

This panel has three key goals:

1) Introducing the information horizons theory and method.
2) Sharing experiences using and extending the information horizon research method, and experiences teaching the method.
3) Engaging the audience in an open discussion to identify additional ways the method can be extended, and propose new ways innovative methodological approaches can be more effectively shared across the information science and related communities.

INFORMATION HORIZONS OVERVIEW

The information horizons method consists of an interview during which study participants are asked to provide a graphical and verbal articulation of their information horizon in a particular context, after discussing experiences when it was difficult and when it was easy to find information in that context. The graphical illustration, or map,
portrays the participant’s information horizon by capturing the full range of information resources, including people they typically access when seeking information within a specific context. Each study participant is also asked to describe the information resources and explain their value and role in the information seeking process. Techniques to analysis these data are drawn from social network and graph theory.

Key ideas in the theory include the role of social networks and contexts in information behavior, the importance of understanding information behavior as a process, and the concept of an “information horizon” that constrains and enables information behavior, and varies according to the information need. These concepts illustrate that certain types of data, which have not been traditionally included in studies of information behavior, are, in fact, important. These data include: when and why people access and do not access individuals and other information resources; relationships among information resources; the proactive nature of information resources; experimentation as information seeking behavior, and the impact of contexts and situations on the information seeking process.

Study participants often report enjoying the information horizon interview; it is an opportunity for participants to tell their story and to create a map that illustrates their information seeking patterns. Participants frequently request to keep a copy of their map. The method is straightforward to teach and applied by university students at all levels. The method is less intrusive and time-consuming compared to observational techniques, e.g., participants do not need to continually log their behavior. The information horizon maps created by study participants embed the first level of data analysis and synthesis, aiding the researcher in data analysis.

**PANEL FORMAT**

The panel has two parts. **Part 1:** Four experts will share their expertise and experience with the information horizon method (10 to 15 minutes each); **Part 2:** The audience and panel members will engage in an open discussion to identify new approaches in teaching, using and extending the information horizons method, and propose new ways to more effectively share innovative methodological approaches across the multi-faceted information science community and related communities (30-40 minutes). This discussion will be moderated by Greenberg.

**Panel member abstracts**

_Diane H. Sonnenwald, Emerita Professor, University College Dublin, Ireland._

**Information Horizons: Foundations, Extensions and Personal Reflections**

Sonnenwald, the primary author of the theory and method, will provide an overview of the theory and method, presenting central concepts and data collection and analysis techniques. In addition, she will highlight ways it has been used and extended. Further, going beyond the typical research presentation, Sonnenwald will share her personal journey formulating the theory and method, and discuss potential future pathways for extending the method, including ways the method can be extended to incorporate political and power relationships that impact information behavior. The aim is to inspire future methodological development.

![Figure 1. Information Horizon Maps produced by informants in studies by Hartel’s students.](image)

_Jenna Hartel, Associate Professor, University of Toronto_

**Teaching Information Behaviour with the Information Horizons Interview**

For the past decade, Hartel has been teaching information behaviour using Sonnenwald’s information horizon interview (Hartel, Oh, & Nguyen, 2018). More than 700 students in her introductory course on Library and Information Science have completed exploratory, empirical studies with the information horizon interview, on a topic or population of their choice. Hartel’s presentation will focus on the pedagogical potentials of an information horizons interview-centered assignment at the master’s level, including, the: ethical protocol, social organization, background materials (Hartel, 2021, 2016), and week-to-week staging. Hartel will report on topics and populations selected by students, her student’s surprising methodological insights—including a selection of striking information
horizon maps, and feedback on the assignment from course evaluations. A complete set of instructions for implementing small-scale information horizons interview studies in a course context will be provided.

Kaitlin E. Montague, PhD candidate, Rutgers University

**Using and Extending the Information Horizons Method to Study the Information Behavior of Vehicle Residents**

Montague will describe her experience using the information horizons method in a high exposure study focusing on the information practices of vehicle residents via Zoom. Participants engaged in two sets of interviews: the first was a semi-structured interview with the goal of understanding vehicle residency and their general information practices on a broader level, accompanied by a guided tour of their vehicles. Four months later, participants engaged in information horizon interviews to understand when and why they accessed different resources over others in the context of health, government, legal, and employment information. Participants then drew information horizon maps, depicting all information resources, including people, which they accessed in the aforementioned contexts while describing their preferences. After the interview, participants took photos of their information horizon maps and emailed their pictures. Additionally, Montague will also describe her adaptation of the information horizons method—longitudinal information horizon diaries, in which Montague integrates the information horizons interview using time-space diaries (Kenyon, 2006) where participants record what they are doing and where, their information horizons, and information resolution movements over an 8-week time period.

![Information Horizon Maps](image)

**Figure 2. Information Horizon Maps produced by Montague's study participants**

Ina Fourie, Head of the Department of Information Science and Chair of the School of Information Technology, University of Pretoria, South Africa

**Using the Information Horizons and Complementary Methods to Understand Commuting Challenges in Lower Socio-economic Communities**

Fourie will describe the use of information horizons method in a mobility information behavior study focusing on lower socio-economic commuters who depend on informal transportation methods, such as minibus-taxis and tuk-tuks, for everyday commuting in an urban area in South Africa (Fourie, et al. 2022). In this study, information horizon maps were enhanced with additional methods. Study participants, i.e., commuters, first completed a three day travel diary collecting quantitative details on the times and frequency of travel, means of transport, and costs; and they concurrently collected photos and voice recordings on the conditions and contexts of travel during the three day period (Julien, et al., 2013). Next, information horizon interviews were conducted, during which commuters were asked to draw pictures of the information sources they used for two (critical) incidents, e.g., typical daily commuting and a non-routine or first-time incident. Drawing maps opened opportunities for participants to focus on experiences and to share their emotions during the information encounters as well as their perceptions of human information sources as being helpful or rude. The diaries were essential in providing factual quantitative information. Thus, the information horizon interview was an enriching method, and the additional complementary methods provided supplementary persuasive evidence regarding the complexity of challenges faced by commuters and the need for advocacy for better circumstances.

**Panel participant biographical notes**

Diane H. Sonnenwald is Emerita Professor at the University College Dublin, Ireland. She currently conducts workshops on collaboration skills and strategies, and consults with CILIP and the European Commission. Sonnenwald has received 25 grants from international foundations, corporations, and funding agencies, and has authored over 130 publications. Her research has focused on interorganizational and interdisciplinary collaboration,
and on the design and evaluation of emerging and future technologies. She served as ASIS&T President in 2012, and in 2020 she was awarded the ASIS&T Award of Merit.

**Jenna Hartel** (www.jennahartel.info) is an Associate Professor at the University of Toronto. Her scholarly career has been motivated by the question, "What is the nature of information in the pleasures of life?" To that end, she explores information in pleasurable and profound contexts and employs visual and creative research methods. She is the source of (INFIDEOS) a YouTube channel of educational videos, where she shares her passion for information in outrageously playful ways. She is a recipient of Library Journal/ALISE’s Excellence in Teaching Award (2016) and the ASIS&T/SIG-USE Outstanding Contribution to Information Behavior Award (2022).

**Kaitlin E. Montague** is a PhD candidate from Rutgers University, The State University of New Jersey, at the School of Communication and Information in the Department of Library and Information Science (LIS). Her research focuses on place and mobility in information behavior in the context of vehicle residents. Kaitlin received a Master’s of Information (MI) from Rutgers in 2016. She worked as a public librarian for four years before returning to Rutgers to begin the PhD program in LIS.

**Ina Fourie** is a Full Professor, Head of the Department of Information Science and Chair of the School of Information Technology, University of Pretoria, South Africa. Ina holds positions in the leadership of the ASIS&T Executive Board and the Research and Supervision Section of the European iSchool Region. Her research focuses on information behavior, especially health information behavior in cancer, palliative care, grief and bereavement.

**Panel moderator: Jane Greenberg** is the Alice B. Kroeger Professor and Director of the Metadata Research Center, College of Computing and Informatics, Drexel University. Greenberg’s research and teaching covers automatic metadata generation, semantic web/linked data, knowledge organization at the intersection of data science and AI. She teaches a foundations information science doctoral course and introduces the information horizons theory and method, along with other theories and methods.

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Hara, Noriko  
Luddy School of Informatics Computing and Engineering, Indiana University, Bloomington, USA | nhara@indiana.edu

Fichman, Pnina  
Luddy School of Informatics Computing and Engineering, Indiana University, Bloomington, USA | fichman@indiana.edu

Chae, Seung Woo  
Luddy School of Informatics Computing and Engineering, Indiana University, Bloomington, USA | seuchae@iu.edu

Meyer, Eric  
School of Information, University of Texas at Austin, USA | eric.meyer@ischool.utexas.edu

Rosenbaum, Howard  
Luddy School of Informatics Computing and Engineering, Indiana University, Bloomington, USA | hrosenba@indiana.edu

Sawyer, Steve  
School of Information Studies, Syracuse University, USA | ssawyer@syr.edu

Yang, Shengnan  
University of Western Ontario, Canada | syang859@uwo.ca

Zhu, Xiaohua Awa  
School of Information Sciences, University of Tennessee, Knoxville, USA | xzhu12@utk.edu

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ABSTRACT

Early social informatics research focused primarily on ethnographic, site-specific observations within organizations and was based on smaller case studies. The rising of social media and big data availability has made large-scale data analysis accessible and easier. This has informed social informatics perspectives by examining the roles and impacts of social media in our work and social lives. The panel aims to utilize the principles of social informatics approach to understand emerging issues related to social media, which are pervasive in almost every aspect of our daily lives, and to Information and Communication Technologies (ICTs) more broadly. To push social informatics research forward, the panelists will address the questions regarding the future of social informatics.

KEYWORDS

future of social informatics, emerging technologies

INTRODUCTION

Early social informatics research focused primarily on ethnographic, site-specific observations within organizations and was based on smaller case studies. The rise of social media and the availability of big data has made large-scale data analysis more accessible and easier. This has informed social informatics perspectives for examining the roles and impacts of social media in our work and social lives.

The panel aims to utilize the principles of social informatics to understand emerging issues related to social media, which are pervasive in almost every aspect of our daily lives, and related to Information and Communication Technologies (ICTs) more broadly. The panel discussions intend to pave the way forward while reflecting backwards. Taking a social informatics perspective, this panel investigates the interaction between society and ICTs, including pervasive mobile and wearable devices, social media, big data, and artificial intelligence.

It has been over twenty years since Rob Kling, one of the prominent advocates of social informatics, passed away, and during this time we have also lost some of the other early social informatics scholars, such as Less Gasser, Roberta Lamb, and Susan Leigh Star. At the same time, other social informatics scholars have made efforts to expand the theoretical depth and richness of the discipline (Sanfilippo & Fichman, 2014; Allen, 2014; Sawyer & Hartswood, 2014), the methods implemented (Fichman & Rosenbaum, 2014), and the settings in which ICTs are used (i.e., internal vs. external to organizations) (Meyer, et al., 2019). As studies of emerging ICTs continue to gain popularity and move from descriptive to analytical approaches, researchers are critically reflecting on their findings, which may provide insights into the future of social informatics research.

To push social informatics forward, the panelists will address the following questions:

1. How can the insights from your scholarly work inform the future of social informatics research?
2. In what ways does previous social informatics research impact your work?

The panelists will engage with these questions by discussing their research to draw implications for the conceptual and theoretical boundaries of social informatics. They come from a variety of backgrounds and study a range of ICTs from diverse perspectives. Given that these scholars all take critical approaches to the questions that drive their work, we expect a lively and interactive session as the panelists raise provocative issues and questions about the ways in which their work impacts and has implications for social informatics research.
The following panelists will reflect their roots of theoretical frameworks within social informatics and present various perspectives on the future of social informatics research by using individual research about emerging technologies. Eric Meyer will offer an insight on blockchain using the Computerization Movement (Elliott & Kraemer, 2008; Hara & Rosenbaum, 2008; Kling & Iacono, 1994) and Socio-Technical Interaction Networks (Kling et al., 2003; Meyer, 2006, 2014). Steve Sawyer will describe how the principles of social informatics shape research in the context of his research on digital labor platforms. Yang and Zhu will use their research on artificial intelligence algorithms to illustrate misinformation governance practices in three leading economies. Chae and Hara will provide analysis regarding various social media platforms using the Mediation framework (Lievrouw & Livingstone, 2006). Howard Rosenbaum will reflect on the studies of social informatics that will pose questions for the panel and the audience. Pnina Fichman and Noriko Hara will moderate the panel discussions.

**Meyer** will discuss Blockchain as a Computerization Movement and Blockchain Technologies as Socio-Technical Interaction Networks. Blockchain, and particularly its incarnation as bitcoin, as a concept had its inception in 2008 when the pseudonymous ’Satoshi Nakamoto’ published the original bitcoin white paper (Nakamoto, 2008), although the underlying technologies had been under development for decades. However, outside of specialist circles, widespread public attention only increased a few years later, particularly since 2016. One of the strengths of the social informatics approach is that it can help understand emerging technologies while they are still emergent. Meyer will explore the emergence of selected blockchain technologies as socio-technical constructs and specifically as part of a broader blockchain computerization movement. Like other computerization movements, the rhetoric around blockchain has involved extensive public discourse to build a technological action frame supporting collective action and encouraging widespread uptake (Iacono & Kling, 2001). He will unpack the finer points of how this computerization movement has developed and evolved at a macro level, and will explain in more detail how select blockchain technologies can be understood within the broader computerization movement as specific socio-technical interaction networks (STINs).

Drawing from an ongoing multi-year study of a digital labor platform, **Sawyer** will highlight how the principles of social informatics frame the research questions, study design, and data collection. Acknowledging that his scholarly interests are in the computerization of work (harkening back to social informatics research of the 1990s), the emergence of digital labor platforms drew him to their study. Digital labor platforms are a window into one of the visible futures of work, emerging from the confluence of under-regulated labor markets, the change from relational to transactional employer/employee relations, and the rise of data-driven algorithmic guidance. Knowing that the different groups of participants have both diverse goals and some agency, we embarked on a panel study. This study design is premised on routine data collection from a carefully selected sample population. They rely on data collection efforts common to digital ethnographies: routine open-ended interviews, trace data collection, secondary data collection, and extensive fieldnotes. For the purposes of this panel, the trace data and secondary data collection that is possible when studying an online phenomenon opens social informatics research efforts in ways not possible in the 1990s. Sawyer will also comment on studying phenomena that may not actively seek attention.

**Yang** and **Zhu** will present a critical analysis of misinformation policies, with a focus on examining two concepts related to AI and algorithms—algorithm governance (particularly regulations of misinformation-related algorithms) and algorithmic governance (regulatory practices through/using algorithms). They analyze the dual role of algorithms in the context of misinformation governance: on the upside, algorithms can serve as tools of misinformation governance; meanwhile, their potential downsides, especially in generating misinformation, require algorithms themselves to be regulated. From a socio-technical perspective, they demonstrate that algorithms possess both materiality and agency, through a critical and comparative analysis of algorithm-related misinformation governance practices in three leading economies: China, the European Union, and the United States. The findings of this analysis will contribute to both theoretical and practical discussions on legislation related to AI and algorithms.

**Chae** and **Hara** will examine social media messages delivered in various forms via different platforms (e.g., video on YouTube and tweets on Twitter) using Lievrouw and Livingstone’s prominent conception of mediation in communication and technology research. The constant evolution and diversification of social media platforms are an important variation in artifacts, which can lead to a significant change in the way we communicate (Lievrouw, 2014). Despite these important variations and the sheer amount of prior literature in science communication, it is still understood how the distinct functions and affordances of different artifacts relate to the unique pattern of science communication on each platform. They will investigate this topic by addressing how the pattern of health communication varies by social media platform, with a specific focus on how scientists have communicated with ordinary people during the COVID-19 pandemic across three popular social media platforms (Twitter, Reddit, and YouTube), each of which provides significantly different affordances from the others. By incorporating a Social Informatics Perspective, context matters (Kling, 2007), we will discuss the unique community culture of each social media platform and how that culture is associated with their affordances.
**Rosenbaum** will explore a need for social informatics to critically examine its foundations through the following questions: what is it about SI that allows it to cast such a wide net and, in a sense, accommodate most comers? Are there common themes that run through the diverse research that makes up contemporary SI? On what foundations does SI rest? What is the research philosophy that animates SI? How is the world constituted when viewed through the lens of SI? This is the question of the ontological grounds of SI. Given this, how can we best come to know this world? This is the question of the epistemological grounds of SI (Skoldberg (2009; Moon and Blackman, 2017). What, then, are the ontological and epistemological foundations of SI? This question has not received sufficient attention throughout the history of North American social informatics research, and this panel provides an opportunity to highlight the discourse about the foundations of SI. His presentation will explore this question through a close reading of selected works in structuration theory, sociomateriality, and postphenomenology.

**Panelist Bios**

**Seung Woo Chae** is a postdoctoral fellow in the Luddy School of Informatics, Computing, and Engineering at Indiana University, Bloomington. Before entering academia, he worked as a TV producer for 7 years and as a PR/advertising manager for 4 years in South Korea. His last job in the industry was a TV producer in the Korean Broadcasting System (KBS), which is the largest broadcaster in South Korea producing a variety of K-content. Based on his expertise in video production, his research focuses on communication on video-based social media platforms such as Twitch, YouTube, and TikTok. Currently, he works on a project on science communication during the COVID-19 pandemic, which is supported by the U.S. National Science Foundation.

**Pnina Fichman** is a Professor of Information Science at the Luddy School of Informatics Computing and Engineering, and the Director of the Rob Kling Center for Social Informatics at Indiana University, Bloomington. She is the director of the Doctoral Program in Information Science. Her Ph.D. is from the University of North Carolina, Chapel Hill. She has published six books and over a hundred peer-reviewed journal articles, conference papers, and book chapters about social informatics, trolling, information intermediation, and online communities.

**Noriko Hara** is Chair and Professor in the Department of Information & Library Science in the Luddy School of Informatics, Computing, and Engineering at Indiana University. Her research in Social Informatics focuses on public engagement with science & technology, knowledge sharing, and communities of practice in mediated environments. She is currently investigating social media use for two-way communication between scientists and the public. Her research has been funded by several grants including the National Science Foundation. She is the author of various publications including “Communities of Practice: Fostering Peer-to-Peer Learning and Informal Knowledge Sharing in the Work Place” from Springer.

**Eric T. Meyer** is Dean, Mary R. Boyvey Chair, and Louis T. Yule Regents Professor at the School of Information, University of Texas at Austin. His research looks at the changing nature of knowledge creation in science, medicine, social science, arts, and humanities as technology is embedded in everyday practices, as described in his 2015 book with co-author Ralph Schroeder “Knowledge Machines: Digital Transformations of the Sciences and Humanities.” Prior to joining UT Austin, he was Professor of Social Informatics at Oxford University.

**Howard Rosenbaum** is a Professor of Information Science in the Department of Information and Library Science in the Luddy School of Informatics and Computing at Indiana University. He has been at Indiana University since 1993 and is currently interested in social informatics and critical data studies. He has published in a variety of information science journals and has presented at ASIS&T, iConferences, and elsewhere. He has been involved in social informatics since 1997 and works with collaborators to raise the profile of SI in information science. In 2015, he published Social Informatics Evolving with Dr. Pnina Fichman and Dr. Madelyn Sanfilippo; in 2014, Social Informatics: Past, Present, and Future, also with Fichman; and in 2005, Information Technologies in Human Contexts: Learning from Organizational and Social Informatics with Dr. Steve Sawyer and the late Rob Kling.

**Steve Sawyer** is on the faculty of Syracuse University’s School of Information Studies and is currently the Editor in-Chief of The Journal of the Association of Information Science and Technology. His research focuses on the changing forms of work and organizing enabled through uses of information and communication technologies. This is done through detailed field-based studies of scientific collaborators, software developers, real estate agents, police officers, organizational technologists, freelance workers, and other information-intensive work. He has also been active in advancing sociotechnical approaches to studying computing collectively known as social informatics and emphasizing the sociotechnical basis of digital technologies. Sawyer’s work is published in a range of venues and supported by funds from the National Science Foundation, IBM, Corning, and others. Before returning to Syracuse, Steve was a founding faculty member of the Pennsylvania State University’s College of Information Sciences and Technology. He earned his Doctorate from Boston University in 1995.

**Shengnan Yang** is an assistant professor in the Faculty of Information & Media Studies at University of Western Ontario, Canada. Her main research areas include digital inequality, information policy, and digital civil society. She
situates her work at the intersection of digital technology, organization studies, and state-society relations in various political regimes. She employs a mixed-methods approach to conduct research, including qualitative interviews, quantitative surveys, and big data analysis. Before pursuing an academic career, she worked as an IT consultant in Accenture Greater China. Shengnan’s publication outlets include Journal of the Association for Information Science and Technology, The Information Society, ACM on Human-Computer Interaction, and Hawaii International Conference on System Sciences.

Xiaohua Awa Zhu is an Associate Professor at the School of Information Sciences at the University of Tennessee, Knoxville. Her primary research areas include information policy, social informatics, and academic libraries. Her work focuses on several themes at the intersection of those areas: Rights related to digital intellectual properties, especially access rights and ownership rights; the governance and regulation of misinformation; government information use and access, especially open government data; digital transformation and its impact on libraries, especially academic libraries. Her work combines qualitative and quantitative methods, often drawing on social theories and historical perspectives.

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Theorising Information Literacy: Opportunities and Constraints

Hicks, Alison
University College, London, UK | a.hicks@ucl.ac.uk

Pilerot, Ola
Swedish School of Library and Information Science, Sweden | ola.pilerot@hb.se

Coelho Bezerra, Arthur
Brazilian Institute of Information in Science & Technology (IBICT) | arthurbezerra@ibict.br

Haider, Jutta
Swedish School of Library and Information Science, Sweden | jutta.haider@hb.se

Hirvonen, Noora
University of Oulu, Finland | noora.hirvonen@oulu.fi

Johansson, Veronica
Swedish School of Library and Information Science, Sweden | veronica.johansson@hb.se

Schneider, Marco
Brazilian Institute of Information in Science & Technology (IBICT) | art68schneider@gmail.com

ABSTRACT
Information literacy research is growing in importance but has been critiqued for remaining focused on practical topics of interest and attainment approaches to practice. Prior attempts to conceptualise information literacy have also often taken place without a comprehensive understanding of the ontological or epistemological foundations of theoretical work. The aim of this panel is to critically examine theory development and use within information literacy research through discussing the ways in which understandings of information literacy, including how it happens and how it shapes social life, are both enabled and constrained through critical, sociomaterial and discursive theoretical approaches. Providing a space to discuss and reflect on the impact of theory on information literacy scholarship, this panel creates a focal point for researchers, practitioners and students interested in the construction and advancement of conceptually rich information literacy research and practice.

KEYWORDS
Information literacy, Theory, Theoretical Frameworks, Theory Development

INTRODUCTION
Theory is a critical element of research. Providing the intellectual scaffolding that is necessary for the development, implementation, analysis, interpretation, and critical evaluation of scholarship, theory provides the concepts that are needed to describe how a phenomenon is enacted or experienced. The last twenty years marks impressive progress in the application of theory to information literacy research. Resulting in the conceptualisation of information literacy as a socially situated practice, the application of sociocultural, postmodern, and post-structuralist theoretical perspectives has enabled researchers to understand what information literacy is, how it happens and how it shapes social life. Yet, attempts are still made to conceptualise information literacy without a comprehensive understanding of the ontological or epistemological foundations of theoretical work, including its strengths or limitations. And, theoretical advances and contributions still tend to be drowned out by the dominant provision and attainment view of information literacy practice.

This panel addresses these issues by providing an opportunity for key researchers, theorists, and practitioners in the information literacy field to discuss and reflect on the impact of theory within information literacy research through reference to a range of theories and theoretical perspectives. Examining how five conceptual approaches impact the presentation and treatment of key information literacy concepts, including learning, information and the learner, the panel further explores how the use of theory both enables and constrains the landscape of information literacy research. While the panellists recognise that information literacy is a practical field, and that theory and practice cannot be separated, we argue that there must also be space for purely conceptual information literacy reflection and development if we are to continue critically interpreting how we understand and position practice. Impetus for this panel further stems from a recognition of how information literacy is often excluded from existing theoretical consideration within the field of information science, with relevant contributions on information literacy theory, development and use often limited to Kuhlthau (Sonnenwald, 2016) or loose understandings of Freirean thought (e.g., Leckie, Given and Buschman, 2010). The stated wish to integrate more theoretical work into information literacy models and frameworks (e.g., ACRL, 2016) means that the panel will be of interest to both practitioners and researchers who are trying to extend their understanding of theoretical approaches in the field.

In focusing on theory development and use within information literacy, driving questions for this panel include:

- How do theoretical stances used within information literacy research fit with or challenge each other, including how they position information literacy as an object of research?
- Why is theory needed within information literacy research; what understandings does theory open information literacy up to and what does it close it to?

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PANEL OUTLINE
The panel will start with a brief overview of theory in relation to information literacy, centred on an analysis of theoretical information literacy research to date. After the introduction, each panellist will present a lightning talk introduction to a theoretical stance that has or could be used for studying information literacy. After each lightning talk, the moderator and panellists will then lead a short discussion on the rich palette of theoretical approaches that has emerged within information literacy research, including related to tensions about how these theories fit with or challenge each other. After this discussion, each panellist will take the floor to present a short reflection on why theory is needed within information literacy research, including what theory opens the field up to and what it constrains, ontologically, epistemologically, and methodologically speaking. During the final part of the panel, the moderator and panellists will engage the audience with a wider discussion on the use of theory within information literacy research, including what grows or diminishes in importance when we consider theoretical rather than practical approaches to information literacy research, and ideas for future research. The audience will leave with an expanded perspective on the rich theoretical complexity that lies at the heart of information literacy research, and how this work can broaden key information science constructs.

Panelist Perspectives
Alison Hicks, UCL, UK
Alison Hicks will serve as the moderator for the panel as well as 1) introducing the topic through presenting findings from recent metanalytical work exploring information literacy theoretical development and 2) presenting concluding observations related to how theory contributes to and shapes information literacy research. Serving to contextualise panellists' contributions, the opening section will draw upon a recent literature review of theoretical information literacy to elaborate themes within the framing of empirical research and analysis to date, including tension between agency and enactment; the moral imperative of information literacy; discourse and power; marginalisation; privilege as critical reflection, and revisioning the premises on which information literacy is constructed. Providing a more nuanced understanding of the intricate layers that constitute the landscape of information literacy research, this section also sets the scene for how theory accounts for the lived experience, conditions and the arrangements that enable information literacy to be enacted. The concluding section will draw out observations about the ways in which theoretical information work can take place, including through employing broad theoretical frameworks, a central theoretical concept, and the use of theory to zoom in and out of action. This section will also look to the future by examining emerging themes within theoretical research and the silences (and their implications for teaching practices) that remain.

Professor Ola Pilerot, Swedish School of Library and Information Science, Sweden
Ola Pilerot will propose an approach grounded in institutional ethnography (e.g., Smith, 2005) for the study of information literacy. The aim of the proposal is to suggest a theoretically informed mode of inquiry that discovers how local information literacy practices are shaped through their relationships to not only the immediate context in which information literacy is enacted but also to constellations of discourses and knowledge regimes located elsewhere, in other places and times. A fundamental idea for this approach is that time and place constitute a web of what Smith (2005) describes as “the ruling relations”. These relations contribute to coordinate activities “across and beyond local sites of everyday experience” (Smith, 2002, p. 45). Information literacy practices are thus viewed as an empirical object that should be investigated through paying attention to situated practices but also to the myriad of documents – directives, guidelines, and other texts – as well as material objects that serve as connectors and mediators between the local and the extra-local. Employing theory for investigating information literacy can be done with different purposes. In this presentation, however, theory is conceived as a device that allows for a certain explanatory perspective that guides the researcher regarding what to look for and how to describe and understand the empirical object of information literacy.

Arthur Coelho Bezerra - Brazilian Institute of Information in Science and Technology (IBICT); International Center of Information Ethics (ICIE) and Marco Schneider - Brazilian Institute of Information in Science and Technology (IBICT); Universidade Federal Fluminense (UFF); International Center of Information Ethics (ICIE)
Starting from Paulo Freire's critical pedagogy, which is used by many authors to overcome the essentially technical character of the notion of information literacy, Arthur Coelho Bezerra and Marco Schneider will draw upon critical theory to propose a deepening of one of Paulo Freire’s main theoretical roots: the critique of political economy, which characterises historical materialism both as philosophical perspective and as a scientific dialectical method. The goal is to stimulate the formulation of critical diagnoses of the informational environment aiming at the autonomy of “literate” individuals. The dominant notion of information literacy, focused on the instrumental use of information to solve immediate problems, is the result of an ideology that submits individuals' competences to the demands of the capitalist world of work, instead of promoting a libertarian education towards people's autonomy. Understanding the ideological components of information regimes is essential in order to criticise the mechanisms of exploitation and oppression that are manifested in what Freire calls “banking education”, which are also reflected in...
the digital ecosystem dominated by big tech corporations that profit from disinformation and scientific denialism. This contribution ends by proposing a path to reach a “theoretically informed praxis” that is based on the critical evaluation and ethical use of information.

Professor Noora Hirvonen, University of Oulu, Finland
Noora Hirvonen will address information literacy from the viewpoint of mediated discourse theory (MDT) which can be characterised as a discursive theory of human action. MDT offers a way to view the actions of humans as occurring at the intersection of multimodal discourses in specific time-place; people with their unique histories; and mutually produced social arrangements. This view of social action highlights that although action would be taken by specific individuals at specific times and places, they are always dependent on multiple elements, including other persons, times, and places. MDT invites a way to view information literacy practices as constituted from chains of small-scale actions taken by individual people but shaped by various material and symbolic tools, people, and discourses circulating through them. The approach may help in conceptualising information literacy as both individual and collective and as both historical and situated. As such, it can be useful in addressing the tensions between the individual and community-focused understandings of information literacy. Hirvonen draws from MDT and its methodological extension, nexus analysis, to argue that theory in information literacy research is essential in interrogating our taken-for-granted understandings of reality and identifying ways to change it.

Professor Jutta Haider, Swedish School of Library and Information Science, Sweden
Jutta Haider will consider information literacy through the lens of sociomateriality. Increasingly, the evaluation of information and other information practices, as well as much of the public debate, are co-produced by a rapidly evolving, ubiquitous digital information infrastructure dominated by a few global, multi-sided platforms and other corporate actors. Sociomateriality considers the material aspects of information literacy and offers a multi-faceted understanding of how practices, technologies and information literacies mutually constitute each other. After briefly outlining the main features of sociomateriality, Haider proposes a punk approach to sociomateriality to consider how today’s information infrastructures are largely beyond the control of society and individual users. A punk approach to sociomateriality resists the fetishisation of technology and technological progress that shrud information technologies in such mystery that their exploration threatens to become the privilege of a minority. It creates an understanding based on playful, even angry, or defiant encounters with technology configurations, and is not intimidated by the limits set by corporate information infrastructures, nor constrained by the pursuit of frictionless conceptual consistency. A punk approach to a sociomaterial understanding of information literacy is a "good enough" tactic, where the researcher performs and resists sociomateriality through their own actions. As this presentation will argue, a punk approach to a sociomaterial understanding of information literacy takes materiality and co-constitution seriously while explicitly foregrounding power relations. In this way, a broader understanding of harms becomes possible, hopefully including a rethinking of information literacy that includes opportunities and resources for refusal.

Veronica Johansson, Swedish School of Library and Information Science, Sweden
Veronica Johansson will elaborate on critical dimensions of information literacy through the application of critical design theories. Critical design theories problematise uncritical replication of social norms and values – so-called affirmative (or problem-solving) design – as perpetuating status quo and power imbalances. But they also offer tools for oppositional critical (problem-finding) design, intended to support critical awareness and possibilities of action among individuals and society (Dunne and Raby, 2002; Malpass, 2012). The resulting critical literacy-critical design synthesis aligns with poststructuralist and sociotechnical views and offers novel expansions on several levels. Conceptually, critical literacy is extended to competencies to identify, contest, and transform limited, biased representations in information and information systems with associated power effects. Empirically, studies are guided towards the situated intersections of material embodiment (as design) and social enactment through which the mediation of values and power in information construction, use, and exchange can be surfaced and addressed. Finally, and practically, it points to not only responsibilities but concrete means for information actors to forge critically attuned design alternatives. For discussion, examples of such critical information design practices as e.g., context-transfer, hybridity, and cut-up is offered.

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Managing Information Gaps and Non-Information

Huvila, Isto  Uppsala University, Sweden | isto.huvila@abm.uu.se
Andersson, Lisa  Uppsala University, Sweden | lisa.andersson@abm.uu.se
Fulton, Crystal  University College Dublin, Ireland | crystal.fulton@ucd.ie
Haider, Jutta  University of Borås, Sweden | jutta.haider@hb.se
Harviainen, J. Tuomas  Tampere University, Finland | tuomas.harviainen@tuni.fi

ABSTRACT
While the focus of information science and technology research is in information, sometimes the lack of information, information gaps and non-information can make an equally great or even greater difference. The purpose of this panel is to nuance the understanding of the absence of information and addressing the gap in theorising, investigating and working with information gaps and ‘non-information’ across the information field. Panellists present research conceptualising, documenting, and describing information gaps and non-information and how they are dealt with in the information field specifically addressing: 1) how conceptualisations of information gaps and non-information influence how they emerge as describable entities; 2) what approaches to manage information gaps and non-information exist in information science and technology research; 3) what aspects of information gaps and non-information different approaches address, make visible and invisible; and 4) how novel insights from the current state-of-the-art research can be translated to practice, policies and actions.

KEYWORDS
information gaps, lack of information, missing information, secretive information behaviours, silences

INTRODUCTION
A key focus of information science and technology research is, as Bates termed it, to follow “the red thread of information in the social texture of people's lives” (Bates, 1999, p. 1048). A central aspect of this effort is to help people to find relevant information and as Dervin put it, “building bridges” (1998) across information gaps. In contrast to gap-bridging and the human-side of gaps in terms of information needs and, for example, anomalous states of knowledge, the gaps themselves—when information is not available, it has been silenced or it does not exist—have been addressed to a much less systematically in the earlier research. While the issues with non-existing and unavailable information are not absent from the earlier work, there has been little exchange across the information field in developing a structured understanding of them. In parallel, much of the earlier research pertinent to gaps and non-information has had a tendency to follow the information poverty (Haider & Bawden, 2007) or deficit discourses (Gray, 2022). The same tendency is also dominating the contemporary policy landscape. From this perspective, the lack of information unfolds as a problem of not finding the relevant information while often, the absence of information is an inescapable aspect of reality. Relevant information might not exist at all, it can be unavailable or unretrievable. Consequently, it is reasonable to ask if, how and whether all information gaps can or even should be eliminated, how gaps can be productive, when they are a source of distress, and what distinguishes unavoidable gaps from avoidable ones.

The purpose of this panel is to nuance the understanding of the absence of information and addressing the gap in theorising, investigating and working with information gaps and ‘non-information’, how they are managed and dealt with across the information field and how not only information but lack of it can make a difference. Panel members will present research conceptualising, documenting, and describing information gaps and non-information and how they are managed and dealt with in the information field specifically addressing: 1) how different conceptualisations of information gaps and non-information shape how they emerge as describable entities; 2) what different approaches to managing information gaps and non-information exist or have been proposed in information science and technology research; 3) what aspects of information gaps and non-information different approaches address, make visible and invisible; and 4) how novel insights from the current state-of-the-art research can be translated to practice, policies and actions. The panellists are information science researchers who have conducted empirical research and concept development relating to different aspects of information gaps and non-information relating to diverse settings and contexts, ranging from archaeology and health to information literacy, environmental communication, and information pertaining to illegal substances and gambling.

EARLIER RESEARCH
Much of the earlier information science and technology research has conceptualised both information gaps and non-information (i.e., information that does not exist) as a negative state of deprivation. Much of information behaviour literature has been focused on overcoming information gaps, remedying anomalous state of knowledge (Belkin et al., 1982), and satisfying information needs by providing more and more relevant information. Gap bridging, undoubtedly best known from the work of Dervin (1998), has become one of the most powerful metaphors in

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Pointing out that absence and need of information are not always the principal reason for interacting with information does not mean that the lack of information would not often be a real problem. An information gap is an integral part of information experience (Graminius, 2022) and far from being merely a minor hindrance to interacting with information. It is often a major impediment to do whatever one desires or needs to accomplish, cause of anxiety and additional work. For example, Fulton shows how the lack of information is a major barrier to helping those vulnerable to harm from gambling (Fulton, 2019b). Missing (meta-)information—metadata (Tenopir et al., 2015), and for instance, paradata (Huvila, 2022)—is a barrier to data reuse that sometimes can be remedied by effective management and curation (Luong et al., 2021), sometimes through meticulous analysis of the data itself by using methods such as cognitive mapping (Fu et al., 2022) and critical data modelling (Wickett, 2023). Golebiewski and Boyd (2018) underline further how even information systems, including search engines, should implement measures to mitigate adverse effects of data voids. Easy to access information and information systems that hide complexity and enact filter bubbles—including the major contemporary search engines—contribute to the creation of information gaps, ignorance and skewed informedness (Haider et al., 2022; Haider & Rödl, 2023).

While gaps and non-existence of information (or existence of non-information) can clearly be experienced as a deficit, it is not necessarily only detrimental. Increasingly common experience of information overload (Belabbes et al., 2022) has made it apparent that more is not always better. People restrict and control their urge to search, as Haider (2017) puts it, and abstain from information for multiple reasons. Information avoidance is routine everyday life information strategy (J. D. Johnson, 2009). It is a common strategy of dealing with information overflow but also when encountering potentially distressing information, for example, relating to medical conditions and personal non-trivial situations (Case et al., 2005). Avoidance can play out in terms of habituated long-term passive bypassing of information that is incongruent with personal, for instance, religious or political views, or as active short-term coping mechanism for dealing with bad news (Narayan et al., 2011).

Information seekers’ avoidance of information and intentional creation of information gaps can also function as strategies of directing attention to more relevant aspects of the remaining information. Börjesson et al. (2022) analysis of archaeological research data points to how even the lack of information can be informative of how research was conducted. Harviainen and colleagues (e.g., 2020) have shown how in anonymous environments, factors such as artificially created usernames can become important pieces of information for establishing potential trust. Omitting details—such as names of individuals and replacing them with a collective name—can be used to increase trust on information and redefine who or what acts as a cognitive authority with particular information in a given situation. Huvila (2017) shows how archaeologists use anonymity and authorship designated to field directors and ‘archaeology’ as a collective actor to (re)define and negotiate trust in their information work.

The both positive and detrimental experience of information gaps and non-information instigate and are linked to particular information behaviours and practices. Sometimes secrecy and retaining information can be a key premise of a particular activity. For example, selective withholding and sharing of information are fundamental in how urban exploring is experienced (Fulton, 2017). Also, selective or delayed release may be a premise for archiving sensitive data in research, industry and government alike, generating purposeful information gaps (Bowers et al., 2021). A study of secretive information behaviours of gamblers, their families and friends show how specific information practices can contribute to keeping—the apparently fundamentally negative—behaviour of gambling addiction secret (Fulton, 2019a) but how supportive information behaviours can help in their recovery (Fulton, 2022).

Besides gaps, both information research and neighbouring fields have referred to a broad array of alternative concepts to discuss non-existing information. Philosophers have pursued the understanding of the nature of absence and nothingness beyond only as a negation of presence or non-absence (Mumford, 2021). Absence is a central concept and issue also in such disciplines as archaeology (Wallach, 2019) and material heritage studies (Felder et al., 2014; Rubio, 2020) where absence of information and transience of physical contemporary and historical artefacts routine. In parallel, especially critical studies of knowledge organisation (e.g., Olson, 1998), data (Muller & Strohmayer, 2022) and records management (V. Johnson et al., 2017; Youngman et al., 2022) in the information field but also in, for example, history and archaeology (e.g., Davis, 2012; Huggett, 2020) have highlighted the presence and implications of conscious and unconscious silences in information and how it is described. Finally, forgetting and removal provide additional examples of associated concepts to the making of non-information that has attracted attention both in information research and beyond. Forgetting has been embraced in heritage and...
memory research in the information field (Jansson, 2023; Youngman et al., 2022) but also, for example, studies of scientific work (Hauser, 2021) and information futures (Rosenbaum et al., 2007) underline its generative nature in the contemporary culture where digital information systems, as Shilton notes, “increasingly banish forgetting” (Shilton, 2012 p. 1911). The related concept of removal has been used to describe practices that are in the essence enabling and facilitating forgetting, namely erasing and selective keeping of information (Homewood et al., 2020).

**LAYOUT OF THE PANEL**

The panel starts with an introduction to information gaps and non-information as topics of research and practice and brief overview of key concepts in this area. After the introduction, all panellists give short lightning talks on their work relating to the panel topic with a specific focus on theoretical and empirical insights and reflecting on implications for information practice, policy and action. After the lightning talks, the panellists provide brief commentaries on their colleagues’ presentations with a focus on identifying commonalities and differences in approaches and the relationship between their differing understandings of information gaps and non-information. During the final 30 minutes of the panel, the audience is invited to join the discussion. The discussion is guided by the moderator and facilitated by a series of questions based on the panellists’ presentations. Before the closing of the panel, the panellists are invited to give short reflections on how they would push the state-of-the-art of research on information gaps and non-information. The panel closes with an invitation from the moderator to the audience to contribute to the discussion started at the panel.

The presentations and commentaries combine two parallel approaches to engage with information gaps and non-information. All presentations explicate how gaps and the lack of information are conceptualised in different contexts across the information field and how these different understandings coincide and diverge. At the same time, all presentations also engage with the question of what—possibly positive, negative, or for instance, desirable stabilising or transformative—implications the gaps and non-information might have in particular contexts or situations. By bringing these two perspectives together, the panel explicates gaps and non-information as a perspective for information and technology research and their implications for key questions regarding information behaviour and practices, knowledge organisation, information management, literacies and systems development.

**PANELLISTS AND THEIR CONTRIBUTIONS**

**Isto Huvila, Uppsala University (moderator)**

Isto Huvila presents empirical findings of his research on information gaps and non-information in archaeological documentation of archaeological work. The presentation draws on an ongoing empirical research project on archaeological information work and documentation of information making processes and practices in archaeology. A major source of information gaps in archaeology stems from the fragmented nature of archaeological material but Huvila’s presentation shows how gaps are also inherent in the documentation of the incomplete sources. Some of the omissions and non-information are accidental but many are conscious and aimed at making information work and the documentation more informative and effective by leaving out unnecessary details, increasing the trustworthiness of the documentation and pointing attention to relevant details. The findings call into question information gaps and non-information as a deficiency and points attention to how the lack of information can be informative.

Professor Isto Huvila holds the chair in information studies at the Department of ALM (Archival Studies, Library and Information Science and Museums and Cultural Heritage Studies) at Uppsala University in Sweden. His primary areas of research include information and knowledge management, information work, knowledge organisation, documentation, and social and participatory information practices.

**Lisa Andersson, Uppsala University, Sweden**

Lisa Andersson presents empirical findings of her research (conducted in collaboration with Emma Laurin, Department of Education, Uppsala University) on information work in families with children with autism and ADHD, including a focus on managing non-information and information gaps in everyday life and the care of the child. The presentation draws on completed empirical research on parents’ interactions with welfare actors, such as education professionals like teachers and special education specialists (Andersson & Laurin, forthcoming). While parents engage in a wide range of information work tasks such as finding, interpreting, evaluating, opposing and sharing information with and between welfare actors, a substantial part of the information work consists of managing information gaps. Major sources of information gaps in the everyday life and care of children with autism and ADHD is uncertainty related to diagnostics, the needs of the individual child, and the responsibilities and capacities of the professionals in contact with the child. The implication is that parents need to find ways to communicate potential information about diagnoses and interpretations of the child’s need to professionals who may or may not have the responsibility and capacity to support the child. The findings show that non-information is unavoidable in the situation, it can for example take several months to establish a correct diagnosis, but that the parents’ information workload could be alleviated by innovative use of health and education information systems, leaving parents with more time and energy to focus on the well-being of the child and the family. Further research
will probe deeper into how parents’ experience the information workload, in what situations they are experiencing the information workload as burdensome, and what can be done in terms of health and education information systems and practices to alleviate the burden of parents’ information work and particularly the management of missing, potential or incomplete information.

Lisa Andersson is a researcher in information studies at the Department of ALM (Archival Studies, Library and Information Science and Museums and Cultural Heritage Studies) at Uppsala University in Sweden. Her primary areas of research include data, information and knowledge management, information work, and documentation. She specialises in research and professional practices, including the semi-professional work of caretakers.

**Crystal Fulton, University College Dublin**

Crystal Fulton will present findings from her research into the social impact of gambling in Ireland, addressing how secretive behaviours create information gaps for families affected by gamblers as they navigate this crisis context for information. Findings reveal that those affected by harmful gambling have multiple, diverse information needs, which result from secretive information behaviours. Research outcomes point to a public health issue in which information provision for those affected by harmful gambling requires urgent and significant attention, in particular the development of information and services aimed at helping the recovering gambler’s social connections who struggle to overcome missing information and barriers to information.

Crystal Fulton is an Associate Professor in the School of Information & Communication Studies at University College Dublin (UCD), Ireland. Her research focuses on social participation in a range of everyday social settings, from information worlds in serious leisure contexts to the social margins and darker communities. Her work has revealed new constructs around information creation, secrecy, and manipulation, extending the boundaries of our understanding of information behaviour. Funded by the Irish Research Council for Ireland, she conducted the country’s first national project to examine the social impact of gambling addiction, and further research for the Department of Justice and Equality, her research has been used to support new legislation in Ireland.

**Jutta Haider, University of Borás**

Jutta Haider discusses the notion of "networked silences," which refers to a particular logic of ignorance that emerges at the intersection of various information infrastructures - often algorithmic and commercial - with everyday life and capitalist society. Specifically, she elucidates how different expressions of ignorance associated with climate change, including productive, necessary, strategic, manipulative, as well as destructive ones, are co-constituted by algorithmic systems and various datafication imperatives. Haider argues that this gives rise to complex and layered, yet specific, sociotechnical and socio-political configurations that she proposes to conceptualise as "networked silences" (Haider et al., 2022; Haider & Rödl, 2023).

Jutta Haider is Professor at the Swedish School of Library and Information Science (SSLIS). Her research focuses on the shaping of knowledge and information, but also of ignorances and ways of not knowing, in contemporary digital cultures. This includes work exploring paradoxes of media and information literacies and the crisis of information, as well as the algorithmic shaping and datafication of environmental concerns and the climate crisis.

**J. Tuomas Harviainen, Tampere University**

J. Tuomas Harviainen will present findings from Dark Web boards where people buy and sell illegal narcotics and related materials, as well as discuss the effects of the substances, and related topics. Of particular interest to information studies is the way in which the disnormative, often criminal nature of the information makes people use non-optimal communication strategies in order to avoid legal consequences, and how they have to navigate the establishment of sufficient trust through communication while trying to stay anonymous. Data for this research comes from the projects Extremist Networks, Narcotics and Criminality in Dark Web Environments (ENCODE, 2020-2022, Finland) and Sieci klauza, obieg znaczeń i treści oraz konteksty offline internetowego handlu narkotykami (2022-2025, Poland).

Harviainen is Professor of Information Studies and Interactive Media at Tampere University, Finland. His main research interests are the information practices of marginalised communities and the information sharing that sometimes takes place between competing businesses within creative industries.

**ACKNOWLEDGMENTS**

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ABSTRACT
While the potential and benefits of research-practice partnership are well documented, there is limited discussion around approaches and challenges of establishing and sustaining public library-university partnerships in LIS research to bridge the gap between research and practice. This panel brings together five groups of panelists to highlight a diversity of public library-university partnerships within LIS and their approaches, models, practices, and implications toward consequential pedagogies and programming at public libraries. Through a collaborative panel discussion, this 90-minute panel will convene scholars and members of the ASIS&T community to improve concrete approaches and practices involved in public library-university partnerships to develop pedagogies and programming that are informed by the voices, needs, and interests across various communities.

KEYWORDS
Research-practice partnership; Public libraries; LIS research; Research into practice

INTRODUCTION AND BACKGROUND
Research-practice divide is a known concern in various disciplines, including the field of Library and Information Science (LIS). Obstacles include difficulty in establishing and maintaining relationships with practitioners (Ponti, 2013), different research goals and expectations (Booth, 2003), and lack of successful application of research into practice (Powell et al., 2002). One effective approach to bridge this gap between research and practice is through research-practice partnership (RPP). RPP provides the opportunity to identify research and design needs that are grounded in practice, develop innovations that integrate diverse expertise, support recruitment of participants from more diverse contexts and inclusion of practitioners in research projects, and scale up solutions through expansive professional networks (Coburn & Penuel, 2016).

While the potential and benefits of RPP are well documented to bridge the research-practice divide, there is limited discussion around approaches and challenges of establishing and sustaining public library-university partnerships in LIS research (Adkins, 2019; Latham & Lenstra, 2021; Wynia Baluk et al., 2023). Adkins (2019) highlighted that there is little documentation of public library-university partnership based on an analysis of journal articles relating to public librarianship. Furthermore, although several panel discussions have been formed in LIS to discuss ways to support applied research in the field, the nature of discussion was related to LIS research-practice divide broadly (Abbas et al., 2016) or specific to a single country (Partridge et al., 2019).

This 90-minute panel brings together five groups of panelists who are engaged in successful implementation of RPP with public libraries at different sizes and settings (i.e., rural, urban, suburban) on multiple topics (i.e., STEM, engineering, data literacy, AI, health) to highlight a diversity of public library-university partnerships within LIS. In alignment with the 2023 ASIST theme of translating research to practice, this panel seeks to improve approaches and practices involved in public library-university partnerships to bridge the LIS research-practice divide.

PANEL STRUCTURE
Introduction (5 minutes)
The moderator, Soo Hyeon, will introduce the panel topic and the goals of this panel. This panel aims to:

1. introduce a diversity of public library-university partnerships toward consequential pedagogies and programming at public libraries;

2. identify strategies that supported mutually beneficial RPP relationship with public libraries;
3. discuss different theoretical perspectives and methodological approaches that are used to translate their research into practice;

4. expand our understanding on the role of public libraries in applied LIS research

Panel discussion (30 minutes)
Each panelist will have 5-6 minutes to share a brief overview of their projects and discuss their RPP experiences with public libraries, with particular focus on approaches for building and sustaining RPP, challenges and opportunities working with public libraries. The moderator will introduce each panelist.

Raise up radio: Family and youth engagement in library supported learning via radio – Sarah Evans and Lance Simpson
This two-year project is inspired by radio broadcasting as a stable source of information in rural America and by the university-based researchers’ experience working in public libraries. Using a design-based research methodology, rural library staff partner with local youth and families to investigate a STEM topic relevant to community needs and interests. As a team, library staff and families gather information from community experts and identify local resources to create four episodes of an audio program that can be broadcast on a local radio station and shared in podcast format for maximum community access. Each episode features STEM content, including an at-home science activity, with materials provided in library take-home kits.

During the program implementation stage, researchers quickly realized how different rural-serving libraries can be from each other. Staffing structure, open hours, and individual staff members’ prior knowledge dictated the level of the researcher’s direct involvement with families. Each library did meet the goals of the project, including increased connections to local STEM resources yet in diverse ways. An important finding for researchers is the need to assess the support needed to create a fully realized partnership that puts research into practice successfully.

Community health and wellness: Small and rural library practices, perspectives, and programs – Christine D’Arpa
This study, which ends June 2024, aimed to understand current programming, services, and partnerships at small and rural libraries. The research team, Ellen Rubenstein and Susan Burke (University of Oklahoma), Noah Lenstra (University of North Carolina Greensboro), and Christine examined publicly available information and gathered data in the form of interviews from library workers, patrons, and outside partners with whom libraries develop and implement these programs. The research documented and analyzed current practices in small and rural libraries to help them become more robust catalysts of community health. The project focused on 16 small and rural libraries representing different regions of four U.S. states (Michigan, North Carolina, Oklahoma, and Vermont). The research team is completing its analysis of a rich dataset that will result in locally adaptable, evidence-based educational projects that can be freely shared and used in libraries across the nation. In addition, the research data will be used to develop and disseminate a model that will inform both library practices and library science pedagogies. The model will be grounded in the voices of the practitioners, patrons, and partners we interviewed and address successful strategies and common obstacles associated with developing health and wellness programs in small and rural public libraries, as well as how to assess, sustain, and extend existing programs.

Family makers at rural libraries – Soo Hyeon Kim (Organizer & Moderator) and Gi Woong Choi
This project responds to educational inequities of underserved rural children by developing a new outreach approach at rural libraries through online space and supporting rural library staff to become learning facilitators. By adopting culturally-relevant pedagogy and constructionism, the research team aims to engage elementary-aged children and caregivers in rural communities in engineering learning using familiar making practices. The research team is currently conducting research-practice partnership (RPP) and co-design with eight small rural libraries from eight states to develop usable solutions informed by professional practices, and aligned with the resources, practices, and constraints of rural libraries. As a result of our implementation research through two iterations across eight rural library settings, the primary outcome will be a culturally-relevant online engineering program and webinars to support rural libraries across the nation to implement online engineering programs.

As the team completes Year 1 of a three-year study, several areas of RPP challenges and opportunities have emerged. One immediate challenge was forming the partnership with eight rural libraries as the project did not have any prior networks or relationships with public libraries and managing staff turnover. The project team also experienced challenges related to building shared understanding among eight different partners and relying on rural libraries to recruit family participants. However, regular meetings and open communication provide a way to
generate creative ideas that the project team implements to address these challenges, which will be shared during the panel discussion.

**AI and co-design in public libraries** – **Hee Rin Lee and Kahyun Choi**

In this project, the research team examines the role of the library as a community catalyst to enable economically underserved youth to 1) have access to core knowledge about AI, and 2) play an active role in designing AI technologies for their communities. This project follows a pedagogy built upon a critical race theory that views students from socially underserved communities not as people with deficits but as people with “community cultural wealth” (Yosso, 2005). By using participatory design methodology, 10- to 14-year-old students will utilize their assets to co-design AI technologies for their community. The project will generate publicly available open-source AI education modules and webinars to support public libraries to run their own AI literacy programs. In collaboration with YALSA, project materials will be disseminated to many youth librarians across the country.

The research team established partnerships with three large public libraries in MI, CA, and MD that contribute significantly by assisting in participant recruitment, providing resources, offering feedback on materials and sessions, and sharing their expertise to help us incorporate best practices. In this project, the research team encountered challenges such as staff turnover and pandemic-induced work overloads, however, also found ways to adapt and address these issues effectively. In contrast, numerous opportunities arise from local connections and the valuable facilities and resources our partner libraries provide, significantly enhancing educational programs.

**Building public libraries’ capacity for open data services** – **Andrea Copeland and Ayoung Yoon**

This project is a validation and an implementation of a theoretical model for developing public library services relevant to open data. A model for Community Open Data Engagement (mCODE) was developed from our previous project employing multi-step evidence-based research studies. mCODE addresses four areas in libraries’ support of open data: 1) promoting open data access, 2) providing instructions to promote data literacy among the public, 3) developing library programming from open data, and 4) developing internal data capacities for future service creation. The project team partnered with four different types of public libraries from various geographic locations (mix of urban, suburban, and rural areas in MI, IN, and WA) to implement one area of the model each. Library partners were selected based on the alignment of the library’s strategic plan with the aspect of the model to be evaluated. Each partner library was matched with an advisory board member from a public library who was considered at the leading edge of providing data services.

As the research team approaches the midpoint of a 2.5-year project, they have encountered two significant challenges, especially concerning the scalability of our model. The first challenge relates to the scarcity of staff members with expertise in data services and the high rate of staff turnover. The second challenge involves the complexity of integrating a community engagement dimension into our model due to variations in the operations of public libraries, the characteristics of local communities, and the nature of the relationship between libraries and their communities. These challenges demand our attention as we strive to develop effective strategies to enhance the role of public libraries in promoting community data and engagement within their communities.

**Group activity (40 minutes)**

After the presentations from five groups of panelists, the moderator will share one slide on the virtual brainstorming tool (i.e., Miro) with key themes that were presented in the panel discussion. The moderator will engage the whole group to add more themes and/or questions to the slide to identify 3-5 topics that will be discussed in the group activity. One of the panelists will be the notetaker.

The moderator will invite the attendees to share their partnership experiences to brainstorm concrete approaches and practices involved in public library-university partnerships around 3-5 topics that were previously decided. If the audience size permits, small groups will be formed to share ideas and solutions for addressing the challenges and opportunities in public library-university partnership. Each group will create a mind map that illustrates key themes discussed during the discussion. Panelists will be the facilitators to lead small group discussions and take notes.

**Each group share out (10 minutes)**

One member from each small group will volunteer to share key findings with the larger group. Mind maps created during the group activity will be made available in a google drive.

**Wrap-up (5 minutes)**

The moderator will summarize key themes and outcomes of the panel discussion.

**PANEL MEMBERS**

Kahyun Choi is an Assistant Professor in the Luddy School of Informatics, Computing, and Engineering at Indiana University Bloomington. Her research explores public library-based AI education programs, ethical AI for Libraries,
Archives, and Museums (LAMs), music information retrieval, and computational analysis of lyrics and poetry. Her research applies computational methods and machine learning algorithms to audio and text data. She has received the 2023 IU Trustees Teaching Award, the 2022 IMLS Early Career Research Development Project Grant, the 2021 IMLS National Leadership Grant, and the 2021 Luddy Faculty Fellowship.

Gi Woong Choi is an Assistant Professor of Instructional Design and Technology at the University of Cincinnati. He has received the 2022 IMLS grant as a Co-PI, received Best Awards from AERA SIG Instructional Technology, Korean Conference on Human-Computer Interaction, and Korean Conference on Management Information Systems and received Ralph T. Heimer Award at Penn State University. He is an educational researcher with a prior background in HCI and UX. His current research interests include AI in education, mobile learning, informal learning, problem-solving, makerspaces, educational affordances of technologies, and HCI in education.

Christine D’Arpa is an assistant professor in the School of Information Sciences at Wayne State University. Her research focuses on the history of libraries; the role of the federal government in information provision; and public libraries and community engagement and has been published PLQ, The Library Quarterly, The International Journal of Information, Diversity, & Inclusion (IJIDI), Library Trends, Journal of Agricultural & Food Information, and IFLA Journal. D’Arpa is co-investigator on a National Leadership Grant from the Institute of Museum and Library Services (IMLS), LG-18-19-0015-19.

Andrea Copeland is an Associate Professor and chair of the Department of Library and Information Science in Luddy School of Informatics, Computing, and Engineering at IUPUI. Her past research focused on the role of public libraries in personal and community digital collection preservation, which led to a multi-year collaboration with the Bethel AME Church of Indianapolis. Her current research examines community data and public library services that encourage equitable access and use of data to promote more socially just communities.

Sarah A. Evans is the Presidential Early Career Professor in the College of Information at the University of North Texas. She serves as the Director for the Children’s and Young Adult Librarianship program and as Co-Director of the Multiple Literacies Lab. Her research examines the literacies and identities taken up in informal learning experiences and environments.

Soo Hyeon Kim is an Assistant Professor at Luddy School of Informatics, Computing, and Engineering (IUPUI). Her scholarly goal is to transform public libraries to facilitate STEM learning for children and families through making. She has received the 2022 National Leadership Grant from IMLS as a PI, New Frontiers in the Arts and Humanities Research Grant from Indiana University, 2022-2023 IU Trustees’ Teaching Award, and Ralph T. Heimer Award at Penn State University. She has extensive experience facilitating idea generation sessions as part of her previous experience in industrial design engineering and IT industry.

Hee Rin Lee is an Assistant Professor in the Department of Media and Information at Michigan State University. Her research focuses on Human-Robot Interaction (HRI) and Human-Computer Interaction (HCI) to design and evaluate robots for social good. Her work has been recognized with a Best Paper Award and four Best Paper Nominations at respected HCI conferences, including CSCW, HRI, UbiComp, and CHI. Additionally, she has received funding from prestigious institutions such as the IMLS, NIH, and NSF to further her important work.

Lance Simpson is an Assistant Professor and serves as the Assessment Librarian in the University Libraries at The University of Alabama. Lance earned his Master of Library and Information Studies from The University of Alabama, and worked in public libraries where he developed STEM- and arts-focused learning labs for teens, and facilitated training for national cohorts of youth-serving librarians. His research interests include community learning ecosystems, connected learning in rural communities, and assessing learning in informal learning settings.

Ayoung Yoon is an Associate Professor at Luddy School of Informatics, Computing, and Engineering (IUPUI). She is interested in building community capacity for constructing an equitable data ecosystem and infrastructure to promote data sharing and reuse. She is currently the Co-PI of two IMLS grants, and was the PI of Data Reuse for Local Community (LG-96-17-0184-17) and Library Capacity Assessment and Development for Big Data Curation (LG-72-17-0139-17). She was previously an RDA/US data share fellow at Research Data Alliance (RDA) supported by Alfred P. Sloan Foundation (#G-2014-13746).

CONCLUSION
RPP can develop applied research that can create direct impact to the everyday life of citizens. Understanding approaches, challenges, and implications for translating research into practice through public library-university partnerships will stimulate mutual beneficial partnerships between public libraries and higher education.
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Evaluating the Value of Exploratory Tools in Digital Humanities Collections and Scholarly Projects: Discussions from Researchers, Developers, and Users’ Perspectives

Ma, Rongqian
Indiana University Bloomington, USA | rm56@iu.edu
Chen, Annie T.
University of Washington, USA | atchen@uw.edu
Poole, Alex
Drexel University, USA | ahp56@drexel.edu
Chassanoff, Alexandra
North Carolina Central University, USA | achass@nccu.edu
Wingate, Alexandra
Indiana University Bloomington, USA | alewingga@iu.edu

ABSTRACT
Digital content management systems have enabled cultural heritage institutions and humanities researchers to create interactive, public-facing, and open-access scholarly work, including digital libraries, databases, archives, manuscripts, and collections. Exploratory tools have become a widely deployed feature of such digital projects that support in-depth, creative interaction with digital materials. However, producing and managing a digital project with such tools can be complex, time-consuming, and expensive, requiring significant financial investment, institutional support, and human capital. This has led to a critical need to evaluate the effectiveness of such embedded exploratory infrastructures across different stages of digital projects. This 90-minute panel discussion aims to explore the questions of how to evaluate the use and effect of such exploratory infrastructures, from diverse perspectives of researchers, developers, and downstream users. The panelists will draw from case studies to address questions such as: (1) the perceived value and impact of embedded exploratory tools, (2) the involvement of communities and stakeholders in the evaluation process, and when to conduct such evaluations, (3) the methods and approaches to evaluation, and (4) the interpretation of evaluation outcomes. The discussion will also delve into the challenges and opportunities associated with evaluating embedded exploratory tools in digital projects and scholarship.

KEYWORDS
Digital humanities, digital curation, digital collections, exploratory tools, evaluation

INTRODUCTION
With the advances of digital content management systems tools, cultural heritage institutions and researchers in the humanities have leveraged novel technologies to create interactive, public-facing, and open-access scholarly work, ranging from digital libraries, databases, digital archives, manuscripts, and collections. Digital scholarly projects vary in form and purpose, but they have brought to humanities domains new ways and methods to engage with resources, archives, collections, and artifacts (Schreibman and Hanlon, 2010; Schöch, 2013; Poole, 2017; Fenlon, 2017; Chassanoff, 2018). More specifically, exploratory tools that facilitate interactive discovery, analysis, or visualization, have been widely deployed in digital collections and projects as an essential feature to support in-depth, creative interaction with the digital materials. Such exploratory tools in the context of digital humanities collections and projects can include, for example, visual analytic applications that allow users to explore the collection data broadly in the interface by means of visualization, or analytic applications embedded in interfaces that empower users to critically engage with the resources, performing interpretative activities of data, and sharing analysis and results via different scholarly communication channels (Gibbs and Owens, 2012; McCurdy et al., 2016; Jänicke et al., 2017; Chen et al., 2019; Chen & Cole, 2021; Ma, 2021).

However, producing and managing a digital project with such exploratory tools can require substantial financial investment (e.g., funding), infrastructural support (e.g., institutional support and policies), and human capital (e.g., team collaboration across various stakeholders). Such time-consuming, complex, and oftentimes costly knowledge production processes have prompted the need to critically evaluate the use and impact of such exploratory infrastructures across different stages of digital projects. Traditionally, libraries and archives have employed methods such as circulation and citation analysis, user surveys, and online analytics to assess the value and impact of scholarly projects and collections. However, as information is increasingly mediated, evaluating digital collections use in the 21st century necessarily requires expanding beyond the previous evaluative framings to include factors like digitization quality and interface navigation. In the case of digital collections, even defining what counts as “use” in these contexts warrants further discussion. Does clicking on an archival object in an online collection signify information use? Should it?
Recently, a Digital Library Federation (DLF) working group on measuring scholarly use of digital collections summarized the problem area thusly:

Beyond the need to make usability studies more accessible to librarians (as established at the 2014 Digital Library Federation Forum), critical gaps identified in the methodology and data analysis include a lack of behavioral observation and examination of users' task context (e.g., known item search vs. exploratory search, familiarities with the search topic, individual research vs. group work, etc.); an overreliance on standard testing tasks and user feedback rather than behavioral evidence; and a lack of studies on user interactions with digital libraries and institutional repositories (DLF, 2018).

Supplementing the framework, existing research literature has offered a number of case studies exploring strategies and approaches to evaluating such exploratory infrastructures. This approach has involved investigating the evaluation of tools using participatory, user-centered methods, such as contextual interviews and prototyping, as demonstrated by Heuwing et al. (2016) in their study of the digital history project *Children and their World*. Another example of this approach is the recent work of Gao et al. (2022), who constructed an evaluation system to examine the usage of digital humanities databases, with the *China Biographical Database Project* serving as a case study. Nonetheless, despite these contributions, many questions remain underexplored. For example, does the investment and effort lead to effective support for identified user communities and improve the use of the resources? How do different user groups, such as domain experts, students of varying levels of domain knowledge, information professionals, or laypeople, respond to such exploratory tools? Do such infrastructures add enough value to digital collections and scholarship and result in sufficient “information use”? And how do we define “value” and “information use” in such contexts?

**SESSION PLAN AND DISCUSSION QUESTIONS**

The proposed 90-minute panel aims to explore the questions pertaining to the evaluation of digital infrastructures and enhance the associated practices, with the objective of effectively engaging with exploratory tools in digital collections and scholarly development. The overarching goal of the panel is to build on these critical discussions to better assist digital collections researchers, developers, and users in evaluating, selecting, and implementing exploratory tools in their digital projects. We employ a case study approach to bring together researchers, practitioners, and developers who engage in digital collections, archives, and digital scholarly projects for the humanities from various perspectives and stages. From cases of specific projects, we will gather insight from individual practices and collectively discuss the process, practices, communities, and approaches involved in evaluating the effectiveness of exploratory tools embedded in these digital infrastructures.

More specifically, we will discuss the following questions related to the perceived value and use of exploratory tools in digital scholarship, as well as the practices and issues surrounding the evaluation of such infrastructures:

1. What are the commonly used exploratory tools in digital collections and scholarly projects? For what purposes are these tools used?
2. What is the *perceived value* of such exploratory tools in digital collections and projects? How can we evaluate the impact and value of digital scholarly projects?
3. Which communities and groups of stakeholders should be involved in the evaluation process, and when to evaluate?
4. How to evaluate? From which perspectives, and with what approaches and methods should evaluations be implemented for digital collections and scholarship?
5. How to interpret the evaluation outcomes and make sense of varying metrics to understand the value of the exploratory tools?
6. What are the other challenges, barriers, or opportunities for the evaluation of digital collections’ exploratory tools, if any?

This panel features five presenters, each delivering a 12-minute presentation to share their research experiences and projects while addressing the questions outlined above. Following the presentations, a 30-minute discussion session will take place, consisting of a 15-minute breakout session and a 15-minute collective debrief session. During the breakout session, the panelists and audience will have the opportunity to delve deeper into the topics, bring in new case studies, brainstorm new ideas, and propose questions for further discussion. Throughout the panel, we will use a shared Google Doc to collect these questions, comments, and ideas among the audience in real time. The collective debrief session will allow everyone to share their insights and perspectives, discuss the collected ideas, synthesize the key takeaways, and advance the conversation with future agendas. Below is a list of the panel participants and their contributions.
PARTICIPANTS AND THEIR CONTRIBUTIONS

Dr. Rongqian Ma is an assistant professor of information and library science at the Luddy School of Informatics, Computing, and Engineering, Indiana University Bloomington. Her research focuses on digital humanities, digital archives and curation, and information visualization. Dr. Ma holds a PhD in Library and Information Science from the University of Pittsburgh, where her dissertation examined digital humanists' use of visualizations and visual technologies in their research. Previously, Dr. Ma received her MLIS and MA in East Asian Studies, both from the University of Pittsburgh, and a BA in Chinese Classics from Renmin University of China. In this presentation, Dr. Ma will discuss two digital humanities project interfaces, namely the Chinese Cultural Revolution 10 (CR/10) project and the Contemporary Chinese Village Gazettes Data (CCGVD) project, as case studies to explore the evaluation of several embedded visual exploratory applications from the perspectives of project developers and downstream users. Meanwhile, the two case studies will be used to inspire the discussion of international practices of similar projects. Dr. Ma will serve as the moderator for this panel.

Dr. Annie T. Chen received her MSIS and PhD from the University of North Carolina, Chapel Hill. She is currently an assistant professor at Drexel University’s College of Computing and Informatics. Dr. Alex H. Poole studies digital curation, digital humanities, archives and records management, diversity, equity, and inclusion (DEI), and pedagogy. His work has received awards from the Association for Information Science and Technology (ASIS&T), the American Library Association (ALA), and the Society of American Archivists (SAA). Poole earned his BA from Williams College, his MA from Brown University, and his MSLS and PhD from the University of North Carolina. His contribution will highlight ongoing work on an Institute of Museum and Library Services (IMLS)-funded digital humanities curation project, Saving Ads: Assessing and Improving Web Archives’ Holdings of Online Advertisements, which explores the historical social and cultural value of advertisements on the current and past World Wide Web, a profoundly dynamic, ephemeral medium. Critical but neglected scholarly assets, web advertisements require preservation to ensure accurate composite representations. This project underlines the indispensable role authentic, trustworthy web archives will necessarily play in any digital humanities scholarship focusing on the mid-1990s and thereafter.

Dr. Alexandra Chassanoff received her MSIS and PhD from the University of North Carolina, Chapel Hill. She is currently an Assistant Professor at the School of Library and Information Sciences at North Carolina Central University and a faculty affiliate at UNC’s Center for Information, Technology, and Public Life (CITAP). She conducts research and teaches on digital cultural heritage, and co-directs the Hacking into History Project, a community-driven digital history project that examines the use and impact of racial covenant clauses in historic property deeds in Durham, North Carolina. Dr. Chassanoff will discuss ongoing research exploring the sociotechnical complexities of curating, preserving, and providing access to digital primary sources for scholarly research.

Alexandra Wingate is a PhD student in Information Science at Indiana University Bloomington. Her research lies at the intersection between book history and information science, and she is interested in the application of non-traditional methods like GIS or quantitative methods to book history. In this presentation, Alexandra will introduce her project Libros de Navarra | Books in Navarre (LN|BN), a database hosted on the open-source platform Heurist dedicated to the study of book culture in 16th and 17th-century Navarre, Spain. She will discuss her use of the platform, configuration of the database, and the exploratory tools embedded in Heurist from the perspective of her research needs and the needs of the public or other researchers. She will also discuss Heurist user groups—in particular the book history user group—and their role as stakeholders for the Heurist platform and its embedded tools.

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Toward Evidence-Based Cataloging Ethics: Research, Practice and Training in Knowledge Organization

McAdie, Diane Rasmussen
Edinburgh Napier University, UK | d.pennington@napier.ac.uk
Lee, Deborah
University College London, UK | deborah.lee@ucl.ac.uk
Snow, Karen
Dominican University, USA | ksnow@dom.edu
Fox, Violet
Northwestern University, USA | violetfox@gmail.com
Shoemaker, Elizabeth
Victoria University in the University of Toronto, Canada | beth.shoemaker@vicu.utoronto.ca

ABSTRACT
This panel considers the bridge between research and practice in cataloging ethics. Cataloging ethics – including indexing and classification – is an important part of practice, yet cataloging ethics research and practice are not always clearly connected. The purpose of this panel is to build towards more evidence-based cataloging ethics practice. Two main areas will be considered. The Cataloging Code of Ethics (2021) is a vital part of these discussions: this major codification of cataloging ethics was the result of both practitioner input and much research. This panel will discuss ways in which the Code can lead to more research-informed practices. Teaching and training is a crucial – and under-discussed – aspect of cataloging ethics, both within library and information science education and workplace training. Therefore, the panel will contemplate how training and teaching can germinate research-based practices. The panel will be in three parts: a panel presentation about cataloging ethics, including each member’s perspectives and experiences on teaching and training in cataloging ethics; small group discussions about real world cataloging ethics scenarios, utilizing the Code to generate discussion; and feedback to the whole group with a closing discussion about strengthening the relationship between practice and research in cataloging ethics.

KEYWORDS
Ethics and social justice; Cataloging ethics; Cataloging and classification; Teaching and training; Practice-based research

INTRODUCTION AND BACKGROUND
Cataloging ethics is a vital and pertinent part of knowledge organization research and practice, which extends far beyond the library catalog. “Cataloging ethics” has been defined as “principles and values that provide an intentional decision-making framework for those who work in cataloging or metadata positions” (Cataloging Ethics Steering Committee, 2021). In this proposal, the term “cataloging ethics” is used to represent the ethical issues in the cataloging, indexing and classification of library materials and information more generally. Fundamentally, the description and organization of resources is a societal issue; therefore, the ethical issue and frameworks which underpin these activities resonate with the users, the collections, the organization to which that metadata belongs, and to society itself. This panel contemplates the bridges between cataloging ethics research and practice, both by considering how initiatives generated by research can be applied to cataloging ethics practices, and by examining how we teach and train in cataloging ethics. Ultimately, the purpose of this panel is to advocate for and to help build research-informed, evidence-based cataloging ethics practices.

There is a question about how evidence-based library and information practice can be used for cataloging ethics. According to Koufogiannakis and Brettle’s (2016) seminal textbook about evidence-based library and information practice, being evidence-based includes “questioning our practice”, “gathering or creating the evidence (through research or evaluation) if we don’t have it already” and “using evidence or information wisely” (p. 3). While not written primarily with an ethics framework in mind, nor even focused on metadata work, it becomes clear that these ideas could be very useful for cataloging ethics. It can be argued that contemporary cataloging practice is already very concerned with questioning practices from an ethical viewpoint (see below), such as identifying Western biases in classification schemes, or contemplating the balance of power in establishing name identities. However, evidence-based practice has the potential to help develop what happens next, once the ethical issue has been identified, by demanding that evidence such as research is gathered and created, and then is used effectively. So, for example, in a common scenario when a classification scheme is found to focus too heavily on European countries at the expense of, say, South American and African countries, an evidence-based approach would lead the practitioner to take that classification scheme and to compare its coverage, to critically analyze those particular sections of the scheme, and/or to evaluate it, as well as potentially to gather evidence about the experience of library users, before using that research and evidence to decide whether and how to make changes to classification practices. An evidence-based approach encourages this type of thinking, which creates cataloging ethics practices which are informed by research.

There is also an interesting potential connection here between the idea of evidence-based cataloging practices and the knowledge organization idea of warrant. Warrant is the “... authority a classificationist invokes first to justify and

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subsequently to verify decisions …” in classification schemes (Beghtol, 1986, p. 11)). There are many different types of warrant. While Beghtol (1986) elicits four types of warrant – literary warrant (espoused by Hulme (1895) in 1911), scientific/philosophical warrant; educational warrant, and cultural warrant, Barité (2019) discusses how his 2018 review of knowledge organization literature found 21 different types of warrant. At the broadest level, there is an overlap between evidence-based cataloging ethics and thinking about cataloging ethics in terms of warrant: what is evidence about, if it isn’t justification and verification? However, there are significant dissimilarities too. Some discourse about warrant, especially earlier work by Beghtol (1986) and the initial introduction of literary warrant (Hulme, 1985), is concerned only with classification rather than cataloging, and is focused on the design and contents of systems rather than cataloging practices – even if later literature about warrant has a much wider reach (for example, Barité (2019), Dobreski (2020), and Martínez Ávila and Budd (2020)). Furthermore, evidence-based library practices are focused on evidence as a method and process, including questioning, gathering and using that evidence; whereas, warrant is generally concerned only with the sources of evidence – such as the book published about that topic, or that social system which exists in a particular way. Again, some recent thinking in warrants is getting closer to the method and process of evidence: for example, Watson’s (2020) delineation of catalogic warrant in contrast to bibliographic warrant sees catalogers examine subject headings and classification schemes from a position of potential harm and benefits. So, it is beneficial to use the wider and richer perspective of evidence-based library and information practices to contemplate ethical cataloging practices, yet useful to also keep warrant and its long history within knowledge organization in mind through the discussions.

The library profession has for many years grappled with the ethical dimensions of library work and codified values and principles important to the field (ALA, 2021; CILIP, 2018). Though cataloging has certainly not been excluded from the resulting ethical discussions and codes, there are nonetheless aspects of library cataloging work that require a closer inspection and a separate treatment from librarianship generally. For example, emphasis on the use or questioning of cataloging standards, such as Resource Description & Access (RDA) or Library of Congress Subject Headings (LCSH), are a substantial part of cataloging ethics discussions, but do not appear in ALA’s Code of Ethics (Snow & Shoemaker, 2020). While cataloging researchers and practitioners have been contemplating cataloging ethics for decades (e.g., Berman, 1971; Olson, 2002), social justice movements and diversity, equity, and inclusion (DEI) efforts in the last 10 years have yielded greater awareness of ethical issues in cataloging and an increase in the number of research studies and initiatives exploring ethics in cataloging work. Recent research literature on cataloging ethics has focused on topics such as the need for a cataloging code of ethics, as well as ethical issues related to subject vocabularies and classification systems, descriptive cataloging and authority work, and cataloging for specific topics, audiences, and materials (e.g., Shoemaker, 2015; Watson, 2020; Billey, Drabinski, Roberto, 2014; Lee, Nam, & Nam, 2013; Dobreski, Snow, & Moulaision-Sandy, 2022).

One of the most important initiatives related to cataloging ethics in the last few years has been the cooperative creation of the Cataloguing Code of Ethics, completed in January 2021 (Cataloging Ethics Steering Committee, 2021). This multi-country initiative began in 2017 with the bulk of the work on the document occurring from 2018 to 2020 (Chan, et al., 2022). During this time, several drafts of the Code were disseminated for comment to the global cataloging community. One particularly interesting aspect in the development of the Code was the intersection among research, teaching, and practice, as seen, for example, in those leading Cataloging Ethics Steering Committee and the 100 volunteers who took part in Working Groups created to inform the Code. The Code has been endorsed by the main professional bodies in the United States and United Kingdom, and it is under review in Canada. Furthermore, the Code has been the subject of translation into Greek, Arabic, Welsh, and a forthcoming French version. The Cataloging Ethics Steering Committee website (2023) contains links to translations of and presentations about the Code, the Working Group reports, and the drafts and final version of the Code. The Code is also the basis or inspiration for additional scholarship, such as Yon and Willey’s (2022) exploration of a retrospective project through the lens of the Code, and documentation and policy such as Frick and Proffitt’s (2022) report about inclusive cataloging workflows for OCLC. The focus of the Cataloging Ethics Steering Committee has moved towards working with the cataloging community of practice to determine ways to utilize the Code in practice, which information professionals have identified as a pressing need.

The Code itself is, in part, a research output: in addition to the input from practitioners, the Code was also created out of the significant research of the Steering Committee and the Working Groups, including analysis of cataloging ethics literature, existing documentation and policies, and much more (Cataloging Ethics Steering Committee, 2023). Therefore, this panel seeks to consider how the Code – itself a bridge between research and practice, both in its creation and expertise of its creators – can be used in practice, and by doing this, the panel will help build research-informed practices in cataloging ethics.

There is another element to the research/practice bridge in cataloging ethics: teaching and training. With cataloging ethics increasingly important to cataloging and classification practices, coupled with the importance of cataloging ethics to knowledge organization research, there is a significant and underexplored impact on LIS teaching. For
example, how is cataloging ethics enfolded into a contemporary library and information science (LIS) curriculum, and how does cataloging ethics research – including the Code – percolate that teaching? Furthermore, there are questions about the impact of cataloging ethics research on work-based, practitioner training, considering here both formal training courses and events, as well as more informal types of peer-based knowledge exchange within libraries and across libraries. For instance, how has the Code – a product of cataloging ethics research – affected practitioner training and learning? Has the recentness of the majority of cataloging ethics developments meant that cataloging ethics is perhaps more likely to be learnt in the workplace rather than through LIS programs, and what does this mean for building more cataloging ethics research into training? Cataloging teaching and training have long been a ubiquitous topic in knowledge organization (Harden, 2012), and major upheavals such as the advent of RDA in the early 2010s have (understandably) been catalysts for discussion and research into cataloging training (Lee, 2014). Yet, the increasing foregrounding of cataloging ethics has not – so far – resulted in similar discussions or generated new research about teaching and training, with Lee (2023)’s recent article about cataloging ethics in knowledge organization education being one exception. This panel will help fill this critical gap. Consequently, this panel explores two angles to research-informed and evidence-based cataloging ethics: the applications into practice of the research-based Code; and, the role of cataloging ethics research in LIS education and workplace training.

THE PANEL
The aim of the proposed panel session is to germinate additional dialog among researchers, educators, and practitioners about cataloging ethics. The panel will be useful to anyone interested in ethics. In particular, one of the ideas generated by the Code and in teaching, is how cataloging ethics both impacts upon and is governed by the wider ecosystem, including other aspects of library practice, the organization more generally, and national/international developments.

The panel focuses on the following main objectives:

- To share the work of recent years to codify ethical values and principles in cataloging work, including work on the Code;
- To discuss education and training in cataloging ethics, including its role in advancing research-informed and evidence-based cataloging ethics;
- To generate ideas about how cataloging educators, researchers, and practitioners can encourage more research-informed and evidence-based ethical cataloging practice.

The structure of this presentation will be centered on providing audience members the opportunity to learn about cataloging ethics and formulate ideas around promoting research-informed cataloging practice. The first part of the panel (30 minutes) will consist of a short overview of the scholarly discussion around cataloging ethics over the last fifty years, delivered by the panel. As part of this overview, each presenter will provide a brief description of their work in teaching cataloging ethics, both within and outside of formal LIS instruction.

In order to illustrate the ethical aspects of metadata work, the next parts of the panel will be a facilitated discussion, which will provide the opportunity for reflection and deliberation. The audience members will be divided into small groups and asked to consider real world examples of cataloging dilemmas that demonstrate concepts demonstrated within the Code (30 minutes). No knowledge of cataloging is required to take part in these discussions, and the contents will be of interest to researchers, educators, and practitioners in any field of LIS. Prepared questions will guide audience members to reflect on cataloging decisions and the Code, and to consider potential research topics that might inform those choices.

After discussion about both cataloging practice and research, audience members will be prepared for the conclusion of the panel, which will focus on approaches to strengthening the relationship between practice and research. This whole-group discussion facilitated by the panel (30 minutes) will highlight insights from the small group conversations and provide a creative space to consider new approaches to cataloging ethics. Participants will be guided by the panelists to brainstorm potential strategies for advancing research-informed ethical practice, ensuring the continued productive growth of this area of scholarship.

THE PANELISTS
The panel consists of cataloging researchers, educators and practitioners based in the UK, USA and Canada. The panel members lead a number of different cataloging ethics initiatives. For example, members of the panel are on the Cataloging Ethics Steering Committee that produced the Cataloguing Code of Ethics, and established the Cataloging Lab. The panel brings their collective cataloging, classification and knowledge organization teaching expertise to lead this panel, which includes teaching on a variety of different LIS courses and training practitioners in a range of environments. The panelists have also published on many different topics within cataloging ethics.
Diane Rasmussen McAdie
Diane Rasmussen McAdie is Professor of Social Informatics, Research Lead for Applied Informatics, and Director of the Social Informatics Research Group in the iSchool at Edinburgh Napier University in Edinburgh, Scotland. Previously, Diane was a Senior Lecturer in Information Science at the University of Strathclyde in Glasgow, Scotland. Her research broadly examines the relationships among individuals, society, information, and technology. Her current areas of focus are ethical metadata, non-textual metadata, new research methods for social media analysis, and online health information provision. A past chair of SIG VIS and SIG CR, she is a member of the Cataloging Ethics Steering Committee, and she was the liaison to the CESC’s Working Group on Resource Discovery and Accessibility.

Deborah Lee
Deborah Lee is a Lecturer in Library and Information Studies at University College London (UCL), where she researches and teaches knowledge organization, cataloging, and classification. Her research interests include music classification, knowledge organization systems, arts knowledge organization, and cataloging education. Her previous roles include Joint Acting Head of the Book Library and Senior Cataloguer at the Courtauld Institute of Art, and she has also worked as a consultant cataloging trainer. Within cataloging ethics, she is particularly interested in how cataloging ethics is taught and learnt, and how artistic works fit into – and challenge – thinking and practices around cataloging ethics.

Karen Snow
Karen Snow is a Professor and the Ph.D. Program Director in the School of Information Studies at Dominican University in River Forest, Illinois, USA. She teaches face-to-face and online in the areas of cataloging, classification, and metadata. Her main areas of research interest are cataloging quality, ethics, and education. In addition to numerous journal articles and book chapters, she has published two books with Rowman & Littlefield, *A Practical Guide to Library of Congress Classification* (2017) and *A Practical Guide to Library of Congress Subject Headings* (2021), and co-authored the *Core Competencies for Cataloging and Metadata Professional Librarians* (2017) and the *Cataloguing Code of Ethics* (2021). She is the co-chair of the Cataloging Ethics Steering Committee that produced the *Cataloguing Code of Ethics*.

Violet Fox
Violet Fox is a Cataloging & Metadata Librarian at the Galter Health Sciences at Northwestern University in Chicago. Her previous positions have included roles editing the *Sears List of Subject Headings* and the *Dewey Decimal Classification*, where her efforts focused on making the classification systems used in libraries more equitable. She is the creator of the Cataloging Lab, a wiki intended to facilitate collaboration in addressing bias within cataloging and classification structures.

Elizabeth Shoemaker
Beth Shoemaker is the Head of Bibliographic Services at Victoria University in the University of Toronto. Her work includes collection development, management, cataloging and collections stewardship. Her research interests encompass ethics in the workplace, cataloging education, artists’ books, and book history. Authoring the 2015 article *No One Can Whistle a Symphony: Seeking a Catalogers’ Code of Ethics* led to her to co-chair the Cataloging Ethics Steering Committee, the body ultimately responsible for the *Cataloguing Code of Ethics*.

CONCLUSION
This panel offers an original perspective on work about cataloging ethics, helping to move the practices and discourses about cataloging ethics to a new phase: evidence-based cataloging ethics practice. Through presentation and practical group work, the panel will demonstrate the challenges and complexities of cataloging ethics, and advocate for the importance of research-informed cataloging ethics. The intended output of the generation of ideas and creation of novel ways forward for future cataloging ethics, is significant for libraries, research and education – both within the library catalog and beyond.

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Life and Times of Personal Information Management: Memento, Memory, or Memento Mori?

Narayan, Bhuva  
University of Technology Sydney, Australia | bhuva.narayan@uts.edu.au
Zijlema, Annemarie  
University of Greenwich, United Kingdom | annemarie.zijlema@greenwich.ac.uk
Reyes, Vanessa  
East Carolina University, USA | vreyesherridge@gmail.com

ABSTRACT
This panel/round-table discussion will explore contemporary challenges within our everyday personal information management practices when it comes to how we select, store, and prepare our life histories for ourselves and others. With all the affordances and access provided by digital technologies, we collect information across a variety of platforms, modes, and mediums, be they documents, text files, images, or audio. Not all of this information is meaningful to us in the long-term, but nevertheless, some of our most valuable information does get entangled in this chaos. Issues discussed include maintaining, organizing, and accessing our information, not to mention how others access what we want to pass on to them. Challenges include technological obsolescence, privacy concerns, cultural and generational changes, family dynamics, and even memory loss as we age. We will also explore solutions and propose an ‘idea box’ for how we can prepare for the future of our personal information, such as creating and implementing information legacy plans, digitization, storage, and access permissions.

KEYWORDS
Personal Information Management; Life Histories; Technology Across the Lifespan; Digital Afterlife; Materiality of Memories; Personal Archives Management

INTRODUCTION
Memento: Lists are the only way out of this mess. — Jonathan Nolan, Memento Mori
Memory: Who is it that can tell me who I am? — Shakespeare, King Lear

Memento mori: All photographs are memento mori. To take a photograph is to participate in another person's mortality, vulnerability, and mutability. Precisely by slicing out this moment and freezing it, all photographs testify to time's relentless melt. — Susan Sontag, On Photography

The organization of personal information in everyday life is problematic due to issues such as temporal and spatial factors, including the passage of time, along with the differences in the affective, cognitive, and psychosocial environment between when the information was organized and when the information is retrieved. These are compounded by technological factors. We will outline the implications of these for personal information management (PIM) and point toward the need for a contextually sensitive model of personal information organization that reflects the relation between information objects, information representation, information users, and their anticipated information retrieval needs. McKenzie and Davies (2015) analyzed temporal aspects of personal information management work and found that multiple temporalities are negotiated locally according to socially situated priorities. Hence, classifying, documenting, and coordinating multiple temporalities and contexts is an important aspect of personal information management. Beyond these, human aspects such as memory also play a big role in all of this; our information could always be at hand, but if our memory is not, none of that information serves its intended purpose for us.

According to Taylor (2004), we organize because we need to retrieve, and there seems to be a basic drive in humans to organize, and psychologists tell us that even babies' brains organize images into categories such as faces or foods and that children do a lot of information organizing during play. These may also be a part of our evolutionary impulse (Spink & Currier, 2006). Jones describes our human organizing behaviors in terms of a desire to keep found things found for future use (Jones, 2007). In the literature, many of the studies in regard to organizing information fall into either the area of cataloging and classification studies (as in Library Studies) or under Personal Information Management (Jones and Maier, 2003) with a specific focus on an individual’s personal information, and focus on tools and technologies. As the dichotomy between our work and non-work contexts is steadily disappearing (McKenzie & Davies, 2015), along with the delineation between organizers and users, everyday users are now using professional systems to organize their personal information, but without the same training. There is little research about how the broad range of information and documents, including personal records, are managed in the home. (Balogh, Billigsley, Paul & Kennan, 2022).

Narayan (2013) wrote that "One of the major issues found in information organization is the inter-subjectivity in communicating a concept or aboutness – the subject or topic association of a document that may or may not be a term within the document itself – of an information artifact between the person who may have organized the
information and the person looking for that same information. Increasingly though, we are not just looking for information within collections that have been designed by someone else, but within our own personal collections of information, which frequently include books, electronic files, photos, records, documents, desktops, Web bookmarks, and portable devices. The passage of time between when we categorized or classified the information, and the time when we look for the same information, poses several problems of intra-subjectivity, or the difference between our own past and present perceptions of the same information. Information searching, and hence the retrieval of information from one’s own collection of information in everyday life involves spatial and temporal coordination with one’s own past selves in a sort of cognitive and affective time travel, just as organizing information is a form of anticipatory coordination with one’s future information needs. This involves a lot of cognitive coordination, and consequently, a lot of confusion.” (p. 25)

This panel will explore some of the philosophical aspects of projecting ourselves into the future in order to organize information now. Narayani & Olsson (2014) wrote that “Documents are semiotic signifiers (Saussure, 1983), waiting for a person to interpret them. Like people, they can talk to us, but cannot tell us what they mean. This meaning is created and communicated from within us. Information searching, and hence the retrieval of information from one's own collection of information in everyday life involves coordination with one's own past selves in a sort of time travel, just as organizing information is a form of anticipatory coordination with one's future information needs. The problems arise due to the differences between the intended use of the information and its actual use at a future date. Creating and using organization schemas for information is a coordination of meaning between oneself and others (inter-subjectivity, as described by Berlin et al., 1993), and also involves cognitive coordination between one's own past and present selves (which we call intra-subjectivity) since the person organizing the information and the person retrieving it later in time is one and the same person, and yet not the same. This self-coordination is fraught with problems, for the longer the time between the two, the more changes are likely to have happened within oneself, changing the meaning of information.” (p.6)

Cognition plays a prominent role in the sense-making of personal information, and research by Zijlema, Van den Hoven, and Eggen (2019) described how different types of mental representations exist, and personal information thus differs in what they cue to the owner. Longitudinal research (Zijlema, 2018) also demonstrated the dynamic nature of people’s memories with their personal possessions. While some memories are strongly linked to their possessions and are brought nearly always to mind when seeing the object, the cued representations can change over time, such as cuing new (recent) events or changes in the emotions towards the object.

Reyes (2017) believes personal information management, memory, and cognition are all connected, as memory is the basis necessary to carry out the primary PIM functions of receiving, generating, keeping, using, organizing, re-finding (especially), and sharing. Studies have shown that computer use improves older adults' cognitive functions. Before PIM was researched as a technical topic, there were studies conducted in the field of psychology and philosophy by Bartlett (1932), for example, that demonstrated how difficult it is to understand memory by which he meant that “it is impossible to understand any high-level mental process if it is simply studied by and for itself.” (p. 186). He described the principle as one that was involved with the psychology of an individual’s memory and how and why people remember. In examining the importance that memory and cognition contribute to the process of PIM, Reyes (2022) has found that when it comes to aging adults, memory is the key component of managing personal information that may hinder the process of PIM. As we age, we struggle to remember where we put things, and how to access our own materials.

Finally, the panel will also reflect deeply on the use/uselessness of all our PIM in cases of dementia, which is increasingly foregrounded in contemporary times, and has been compounded by the global pandemic and its associated lockdowns, social isolation, and lack of complex social interactions (Numbers & Brodaty, 2021). Many of those affected have lived long lives, and have accumulated valuable information, objects, and memories. As a consequence of this disease, their ability to retrieve and give meaning to personal information may fade or become unstable. However, the value of the memories and knowledge we collect throughout our lives does not diminish. These experiences and insights help to shape who we are as individuals and can provide a sense of comfort and connection, even if they are not immediately accessible due to dementia. The knowledge and insights that individuals have gained throughout their lives can also be valuable to others, even if the individual with dementia is no longer able to directly benefit from them.

**PANEL PROPOSAL**

The panel session will be highly participatory and will provide flexibility to explore topics that reflect the interests and expertise of those in attendance. Some of these topics may include:

- **Technological Obsolescence**: As technology advances rapidly, old forms of personal information may become obsolete and difficult to access.
Privacy Concerns: Many people are concerned about the privacy and security of their personal information. This can make people hesitant to pass on personal information to future generations.

Generational Cultural Changes: Cultural norms and expectations can change rapidly over time. What may have been acceptable to one generation may be considered inappropriate or offensive to another.

Family Dynamics: Family relationships can be complex, and not all family members may be interested in preserving or passing on personal information. This can also create tensions within families.

Memory Loss: As people age, they may experience memory loss or other cognitive impairments that can make it difficult to recall important information.

Some of the solutions proposed over time have been:

Creating a legacy plan: A legacy plan is a document that outlines how we want our personal and digital assets to be managed and distributed after our death, including instructions for how to access important documents, passwords to online accounts, and other relevant information.

Using cloud storage: Cloud storage services allow us to store and access our personal information from anywhere with an internet connection, to ensure that our personal information is backed up and accessible to us and our loved ones even if our physical devices are lost, stolen, or damaged.

Digitizing personal information: By digitizing our personal information, we can ensure that it is easily accessible and shareable with future generations. This can include scanning old photographs and documents, creating digital copies of important records and certificates, and digitizing home movies and other media.

Using PIM-specific software tools, such as a password manager: Password managers can help us manage our online accounts and passwords, and ensure that our trusted family members can access our accounts if needed.

Writing a memoir: Writing a memoir can be a valuable way to share our personal experiences and insights with future generations, and provide a window into our unique perspectives and experiences.

Regardless of daily best practices, there are still significant gaps between the current and ideal usage of PIM practices. These gaps were mostly positive, revealing that participants wished to use more practices than they actually did, and were not satisfied with their PIM behavior. What can information literacy advocates do about this?

PANELISTS

The panel brings together three researchers from three different continents who are all passionate about personal information management, both as a discipline and as an everyday practice, and wish to foreground their importance and relevance in our environment of information overload and find solutions to issues that often go unnoticed until it is too late.

Bhuva Narayan
Dr. Bhuva Narayan is an Associate Professor, Digital Social Media in the School of Communication, and Director of Graduate Research at the Faculty of Arts and Social Sciences. Bhuva is the Associate Editor of the Journal of the Australian Library and Information Association and on the Editorial Board of ARIST, Education for Information, and DOCAM. Bhuva is a transdisciplinary and interdisciplinary researcher across Information Science, Internet Studies, Digital Media Studies, and Privacy Literacy, with additional expertise in IT, HCI, and UX, and applies this expertise in the context of social justice issues. As an Australian LIS educator with an MLIS from the iSchool at the University of Pittsburgh and a Ph.D. in Human Information Behaviors from the Queensland University of Technology, Bhuva brings a unique comparative perspective to the issues discussed. Lately, Bhuva's interests are in supporting the information needs of people and families as they age, through various technological and non-technological solutions. Bhuva has participated in two ASIS&T workshops on PIM and has recently published a paper at ALT-CHI with Prof. William Jones titled ‘It’s about Time: Let’s Do More to Support the Process of Aging (vs. the State of Being “Old”).

Annemarie Zijlema
Dr. Annemarie Zijlema is a Lecturer at the School of Computing and Mathematical Sciences at the University of Greenwich. She obtained her Ph.D. degree with the Materialising Memories program at the University of Technology Sydney. She has a strong interest in cognitive processes in relation to external cues, such as objects in the home, in the public space, or information on the web. She holds an International Master's degree in Library and Information Science from the Royal School of Library and Information Science in Copenhagen and obtained her bachelor's degree in Information Services and Management from the Hanze University of Applied Sciences Groningen. Her Ph.D. research focused on personal possessions as cues for autobiographical remembering.
Vanessa Reyes
Dr. Vanessa Reyes is an Assistant Professor of Instruction for the School of Information at the University of South Florida and Editor-in-Chief of the Florida Libraries Journal. She holds a Ph.D. in Library and Information Science from Simmons College, an M.S. in Library and Information Studies from Florida State University, and a B.A. in English from Florida International University. Having worked in archives, legislative, university, and public libraries, she became interested in exploring the PIM field when she noticed that researchers' interest was sparked when they used appropriately organized and preserved personal collections for scholarly work. Her current research contributes to the emerging field of personal information management (PIM), quantifying how individual users are organizing, managing, and preserving digital information. Dr. Reyes is finding ways to make a sustainable difference in how our digital heritage is preserved by examining trends in how individual users are managing and preserving their information.

STRUCTURE OF THE PANEL
Each panelist will present a 15-minute summary of their own research and experience and reflect on their implications. A 10-minute period following each panel member's presentation will be open for discussion. During this time, the audience will be engaged in the discussion of the panel's contribution, and be encouraged to contribute information from their own local perspective that is relevant to the global issues identified by the panel. We will also use an interactive audience platform such as Mentimeter to interact with the participants. Toward the end of the session, for the last 15 minutes, we will do an activity called the Lightning Decision Jam that will provide the participants with some concrete decisions and takeaways they can implement in their own practice or in their teaching. All three panelists will act as moderators for the session in turn, as well as present their own contributions as members of the panel. During the 90-minute period, approximately half will be dedicated to open discussion.

REFERENCES
(Talking About) Failing Better in Research: The First Rule of Failure Club Is...You Don’t Talk about Failure Club

Nicol, Emma
University of Strathclyde, Scotland | emma.nicol@strath.ac.uk
Willson, Rebekah
McGill University, Canada | rebekah.willson@mcgill.ca
Julien, Heidi
University at Buffalo, United States | heidijul@buffalo.edu
Greyson, Devon
University of British Columbia, Canada | devon.greyson@ubc.ca
Given, Lisa M.
RMIT University, Australia | lisa.given2@rmit.edu.au

ABSTRACT
Failure in research is an underexplored topic in the information science literature. Many instances of research failure go unreported due to the success-oriented nature of academic culture, and academic publishing in particular. In not discussing, or failing to enable the discussion and reporting of research failures, important learning opportunities are being missed by the information science community. The aim of this panel is to explore these missed opportunities and to consider the need for approaches to research design, research collaboration and relationships, community engagement, publishing, mentorship, and teaching that will make room for such discussions to take place. The panel will bring together prominent information researchers to discuss failure in research in a series of short themed provocations and moderated group discussion activities.

KEYWORDS
Failure; Research Design; Mentorship; Publication; Collaborative Research

INTRODUCTION
Failure in research, as in much of life, remains a taboo topic for many researchers. In the highly competitive environment of academic culture, the pressure to be the perfect researcher can induce a terror of being wrong and in many cultures, feelings of shame, that makes the sharing of failure with peers and others difficult. The resulting culture of silence often extends beyond complete failures, such that we may avoid discussing aspects of what did not go well or what could have gone better in any meaningful way. Academic publishing, not unreasonably, tends to favour the publication of “successful” research. However, in the natural and biomedical sciences, where publication bias against null results has been shown to lead to medical or environmental misinformation (e.g., interpreting SSRI antidepressants as more effective than they are (Driessen et al., 2015; Turner et al., 2022)), prospective registration of study protocols and journals dedicated to negative results have emerged as partial solutions to this bias against “insignificant” studies or findings. Earlier, the importance of learning from mistakes was discussed in the organisational learning literature (e.g., Davies & Nutley, 2000). New perspectives on failure have also begun to acknowledge its productive role in research. For example, the Journal of Trial and Error is currently looking for anecdotes about “failures in scientific practice” that led to new discoveries (Gaillard & Moonen, 2023, para. 1). This perspective is also explored in the newly published book Failurists – When Things Go Awry (Lammes et al., 2023), which considers failure to be “a productive part of engaging with and in the field. It is about acknowledging the ‘mess’ of the social and how we need methods, modes of attunement, and knowledge translation that address this complexity in nuanced ways” (p. 17).

However, in information science, how we deal with failure in research—such as interpersonal conflicts in collaborative teams, methodological issues, inaccurate assessments by peer reviewers, or scientifically-accurate but disappointingly unremarkable findings—remains an underexplored topic in the literature. Where failure has been written about in information science, this has often been in relation to how we react to it when it is discovered. Authors such as Budd et al. (2016) have written about retraction of published work when errors in research or instances of fraud have been revealed post-publication. There remains however a dearth of exploration where authors have felt able or been enabled to be open about their experiences of failure in research across all stages of the work.

The impacts of not talking about failure in research are myriad. The absence of published examples of failed research in the literature mean the myth of perfect research is further perpetuated. Individual researchers, research communities and the upcoming generations of students miss out on rich learning opportunities when such conversations do not take place. Biases – perceived and actual – in publishing mean such research is rarely submitted for review, so opportunities to receive feedback are missed. In other cases, a lack of openness and support for different research paradigms may lead to marginalization of some methods and topics during peer review. Fear of failure and the culture of secrecy around it mean fewer risks are taken in terms of domains explored and methodologies adopted, leading to compromised creativity in research design. In a culture where there are few
routes for failure to be discussed openly there may be implications for researcher confidence, mental wellbeing and academic identity, with the effects likely to be experienced differently depending on career stage.

In this panel we, as academics, publishers, and practitioners working in information science will discuss the missed opportunities arising from not discussing failure in research and the need for approaches to research, publishing, mentorship, and teaching to make room for such discussions.

In this panel, we propose exploring some of the following issues:

- What counts as failure in research?
- What do we do with failures?
- How do we use experiences of research failure for teaching, learning, and/or development?
- How should we frame discussions of failure with students, mentees, and others?
- How should failed research be addressed in the published literature?

**PANEL STRUCTURE**

- **Introduction**: The Moderator will introduce the panel and provide an overview of the topic and introduce how the panel will run (5 minutes);
- **Panelists**: Each of the panelists will provide a five-minute reflection on failure, related to research design, research collaborations and relationships, community engagement, research students, mentorship, research-related teaching, grant writing, and/or publishing, describing how they think failure should be addressed and ending by proposing a pivotal question (or questions) that remains to be answered (25 minutes total, including 5 minutes for handover);
- **Activity**: Panel attendees will be able to choose one of 4 different groups to join – research design, publishing, mentorship, or collaborative research. Each group will be led by a panelist. Discussions will begin by asking panel attendees to reflect on a time of failure or when something did not go well and discuss in the small group what they did to address it and what they would recommend in the future. They will also be asked to think about learning that occurred, what the impact of that failure was, what supports were/should be in place to help future learning, and how to deal with similar failures in the future (35 minutes);
- **Discussion**: The Moderator will lead a discussion amongst the panel attendees about what was discussed in each of the small groups (20 minutes); and
- **Closing**: The Moderator will close the session by reviewing the topics that emerged during the panelists’ presentations and the dialogue from the small group discussions, as well as discuss ideas for how to deal with addressing failure (5 minutes).
- **Sensitivity considerations**: In recognition of the sensitivity of the topic area, the group activity and discussion will be subject to clear participation rules around disclosure and respectful interaction that will be upheld by the panelists moderating each group.

**PANELISTS**

**Emma Nicol**

Emma Nicol, PhD, is Lecturer in Information Behaviour at the University of Strathclyde’s Department of Computer and Information Sciences. Her experience of empirical investigations of information behaviour (IB) and human computer interaction (HCI) encompasses studies in many domains including education, healthcare and cultural heritage. Emma’s current research is focused on developing theories of information resilience with information intermediaries in their work with vulnerable populations. Emma has published in many of the key IB and HCI venues and been a programme committee member, workshop organiser and panel member at many SIGCHI events. She has co-edited special issues of the *International Journal of Child Computer Interaction* and the *International Journal of Mobile HCI*.

In her role as moderator, Emma will provide an overview of the topic of failure in research with a focus on information behaviour, will introduce each of the panel members and coordinate the group activities, panel discussions, and conclusions.

**Rebekah Willson**

Rebekah Willson, PhD, is an assistant professor at McGill University’s School of Information Studies. She is in the field of information behavior/information practices, undertaking research in the contexts of higher education and workplaces. Her research focuses on individuals undergoing transitions, particularly early career academics and adjunct faculty members. Currently, Rebekah’s research is examining the influence precarity and marginalization have on information behavior and information access. She is actively involved in the information behavior and ASIS&T communities, as a Review Editor for *JASIS&T*, the former Chair of SIG-USE (Use, Seeking, and Needs),
and the immediate past Chair of the Research Engagement Committee. She is currently the President of the Canadian Association for Information Science.

In this panel, Rebekah will discuss how to address research failure with graduate students and early career academics, particularly focusing on how to help them prepare for conducting research that will (inevitably) not go to plan, as well as what to do to recover from failure. Rebekah will discuss the importance of incorporating conversations about failure into the planning process, particularly around research methodologies and methods that account for failure in diverse ways. Because of the lack of conversation about research failure, new researchers may view it as unacceptable or personal weakness, rather than a regular part of the research process. With this in mind, Rebekah will also discuss the importance of openly discussing expectations to help normalise the experience of failure, as well as the negative emotions and challenges to researcher identity that often accompany it.

**Heidi Julien**

Heidi Julien, PhD, is a professor of information science at the University at Buffalo. Her work focuses on digital literacy, information behavior, and the use of theory and methods in information science research. Among other editorial experience, she has edited the *Canadian Journal of Information and Library Science*, and currently serves as a Review Editor for *JASIS&T*, and on the editorial board of *ARIST*, as well as other journals. She has chaired SIG-USE and served as President of the Canadian Association for Information Science, as well as of President of the Association for Library and Information Science Education.

In this panel, Heidi will discuss how to guide graduate students and mentees through moments of failure in research. Her comments will be contextualized in an understanding of graduate mentorship as an act of pedagogy based on mutual respect and clear communication, with a goal to create safe spaces for discussions about failures and the opportunities they open for learning.

**Devon Greyson**

Devon Greyson, PhD, is an assistant professor in the School of Population and Public Health at the University of British Columbia in Vancouver, Canada. They study the health-related information practices of youth, parents, and families, as well as the ways health care providers and health systems use information in efforts to improve the health of populations. Current work focuses largely on perinatal care and decision-making as well as vaccine confidence and technical systems for vaccine records. Devon also mentors qualitative and mixed methods trainees and teaches research methodology in the PhD program. They are currently Chair of ASIS&T SIG-HLTH, and on the editorial board for *ARIST*.

In this panel, Devon will discuss maintaining and repairing relationships in community-engaged and participant-centred research. Recognizing that even the best-laid plans can go awry, these comments will highlight the importance of understanding, articulating, and returning to one’s values and ethics as a researcher, and acting in accordance with these when things do not go as expected.

**Lisa M. Given**

Lisa M. Given, PhD, FASSA, is Professor of Information Sciences and Director, Social Change Enabling Impact Platform, at RMIT University (Melbourne, Australia). Her interdisciplinary, collaborative research in human information behaviour brings a critical, social research lens to studies of technology use and user-focused design. A former President of the Association for Information Science and Technology (ASIS&T) and the Canadian Association for Information Science, Lisa is a Fellow of the Academy of the Social Sciences in Australia and has served on the Australian Research Council’s (ARC’s) College of Experts. A former Chair of ASIS&T’s SIG-USE, Lisa is also a Distinguished Member of ASIS&T and Editor-in-Chief of the *Annual Review of Information Science and Technology*.

In this panel, Lisa will discuss strategies for fostering effective collaborative relationships on research teams, in co-authoring publications, and in working with community partners. Drawing on her personal experience working in interdisciplinary teams in science, technology, medicine, digital humanities, sociology, and fine arts, and on her current and previous research leadership roles, Lisa will discuss some of the common points of research failure and strategies for maintaining effective research relationships.

**REFERENCES**


Neutrality in Library and Information Ethics: A Debate in Alternative Foundations

Oltmann, Shannon  
University of Kentucky, USA | shannon.oltmann@uky.edu

Knox, Emily  
University of Illinois Urbana-Champaign | knox@illinois.edu

McMenemy, David  
University of Glasgow, Scotland | david.mcmenemy@glasgow.ac.uk

Hamilton, Stuart  
Local Government Management Association, Ireland | shamilton@lgma.ie

ABSTRACT
Neutrality is a concept that has been under significant critique both within wider society and library and information science. Supporters cite it as a worldview that respects the choices of individuals and that no one view of the common good should prevail in a pluralistic society. Critics argue that it reflects an out-of-date concept that enshrines power structures created by those already powerful and limits the choices and opportunities for those without power. This panel reflects on the arguments and considers what a library and information science ethic that does not build itself around neutrality might look like.

KEYWORDS
Neutrality, libraries, ethics, rights, liberalism

INTRODUCTION
Neutrality has been a keystone value for liberal democracies for many decades, tracing its origins as an ethos back to the ideas of the Enlightenment (Bivens-Tatum, 2012). Since librarians and libraries are significant contributors to LIS ethics (Macdonald & Birdi, 2020).

The place of neutrality within LIS ethics is one of the key professional concerns of our time, and the debates on the topic raise a lot of heat. This panel will attempt to generate some light from that heat by exploring what liberal neutrality is, how it has historically been addressed in libraries, and the limitations this places on professional practice. If we drop neutrality as a core value, do we lose something valuable, or is neutrality simply an out-of-date concept that has no place in a modern democracy?

WHAT IS THE JUSTIFICATION FOR NEUTRALITY?
What purpose(s) does a civic value of neutrality attempt to serve? In his significant critique of neutrality, Sher (1997) begins by highlighting the three main philosophical justifications that have been posited for neutrality within a liberal democracy. These three justifications are inter-linked, but can be summarised as:

(1) Respect for individual autonomy: at the heart of liberalism as a political philosophy is the notion of the autonomous individual who is unencumbered by anything but their own approach to life, as long as in doing so they did not harm another. This notion posits that societies should respect the choices and values of each individual, rather than imposing any worldview or choices on them. This rather atomised view of society has obviously seen much criticism from other philosophical approaches, especially communitarians and other more progressive ideologies.

(2) Prophylactic neutrality: in this case, neutrality is a protection for citizens against policies that may harm them: “bureaucracies can be insensitive, arrogant, and self-perpetuating... and efforts to suppress the bad can lead to the suppression of the merely unpopular” (Sher, 1997, p.107). This concept further narrows down to three concerns that neutrality should help alleviate from the point of view of the power of the state: oppression, instability, and error.

(3) Respect for different perceptions of the common good: The notion of the common good can be a nebulous concept, but it is generally summarised as “facilities—whether material, cultural or institutional—that the members of a community provide to all members in order to fulfil a relational obligation they all have to care for certain interests that they have in common” and also “best understood as part of an encompassing model for practical reasoning among the members of a political community” (Hussain, 2018).

As we can see, the three key justifications for a neutral state, and therefore neutral professions, are intertwined in calls for respect for individual choices, protecting against coercion and imposition of any one groups’ view over any others, with the subsequent respect this entails for plurality in society. On their face these are noble goals, and they fit within a reasoned approach to the practice of librarianship.
NEUTRALITY AND LIBRARIES

In librarianship, a key contributor to reflections on the place of neutrality was the work *The Creed of a Librarian*, originally a speech delivered by D.J. Foskett to librarians in Lancashire, England, in 1962. For Foskett, “Librarianship is a social process inextricably bound up with the life of a community; a librarian is not some uninterested functionary standing guard over a collection of objects that might as well be bricks, or red and blue rags” (Foskett, 1962, p. 7). Foskett argued for a neutrality based on empathy for the worldviews of others, but tempered with the importance of the librarian helping guide the patron to alternative viewpoint: “if [the librarian] has no politics, no religion, and no morals, he can have all politics, all religions and all morals” (Foskett, 1962, p. 11). This arguably mirrors what Alfino and Pierce discuss in their treatment of library and information ethics when they argue that while neutrality may require “excluding one’s personal convictions” it does not mean “excluding one’s knowledge, even though one hopes that there is a substantial overlap between the two” (Alfino & Pierce, 1997, p. 131).

Indeed, in a 2021 study, Scott and Saunders identified a similar picture in the practice of public librarians in the USA. They found that, “[public librarians’] conceptualizations of neutrality are more nuanced and can include non-partisanship or abstaining from giving opinions on political figures and striving for a balanced collection representing a diversity of viewpoints… While most librarians seem to believe that they should not take sides or express opinions with regard to political figures, they seem more comfortable with taking positions on scientific issues such as climate change, or social issues such as police brutality and hate groups in their meeting spaces” (Scott & Saunders, 2021, p. 164).

This type of approach very much is in the spirit of the kind of public discourse advocated by Philosopher Michael Sandel, who argues that liberal neutrality “makes it difficult to cultivate the solidarity and sense of community on which democratic citizenship depends” (Sandel, 2009, p. 267). Is the answer, then, neutrality in some areas of enquiry and an approach that could be better described more accurately as impartiality in others? And can we even distinguish between the two?

Nevertheless, it has been suggested that in the past 10 years neutrality “has become a dirty word for many librarians committed to social justice” (Wenzler, 2018, p. 55). Is there room for a nuanced, informed application of neutrality in service provision, or is the concept itself fundamentally flawed?

SO, WHAT COMES NEXT?

Since at least the 1980s there has been a growing debate reflecting wider societal concerns related to social justice that consider neutrality as a value that, rather than guaranteeing detached subjectivity and equity, reflects the worldview of one particular group in society over others. The argument can be summarised in the sense that rather than being a doctrine that emphasises and respects universalism, neutrality instead “is defined surreptitiously by identifying the experiences of a specific group of subjects as the paradigmatic case of the human as such. These subjects are invariably white, male adults who are propertied or at least professional” (Benhabib, 1987, p. 81).

It can be argued that the American Library Association’s addition of a ninth principle in 2021 related to racial and social justice is a move away from neutrality as a core value of librarianship, but many would argue an overdue one. The ninth principle reads:

“We affirm the inherent dignity and rights of every person. We work to recognize and dismantle systemic and individual biases; to confront inequity and oppression; to enhance diversity and inclusion; and to advance racial and social justice in our libraries, communities, profession, and associations through awareness, advocacy, education, collaboration, services, and allocation of resources and spaces.”

Does such a new initiative pose any challenges for the profession? At the root of the principle is the rights of every person, a fundamental liberal concept that is built on neutrality. However, the dismantling of systemic and individual biases takes the principle out of a neutral place to one based on an activism that emphasises the importance of some concepts of the common good over others.

Navigating these waters may take nuance and much debate for what a revised LIS ethics looks like. If we consider again the three key justifications utilised for a neutral state defined by Sher, all three are, on their face, significant issues for a liberal society to consider of importance. However, we need to ask the following questions: (1) Are these still valid concerns? (2) If they are, and if we lose neutrality, how can we guarantee these concerns are addressed within another ethical framework? (3) What might such a framework look like that can achieve wider societal as well as professional support and acceptance?

In this panel, we discuss neutrality as it applies within library and information science ethics, the challenges it presents in an increasingly progressive world, and what other types of ethical approach can potentially replace it. Given the importance of the topic within current discourse, we anticipate a robust and challenging discussion with
attendees. Each panelist will speak for 5 minutes, leaving most of the time for a conversation with the audience. Furthermore, each panelist will develop 3-4 questions to prompt discussion with the audience.

**PANEL MEMBERS**

**Emily J. M. Knox:** Emily is an Associate Professor in the School of Information Sciences at the University of Illinois at Urbana-Champaign. Her book, *Book Banning in 21st Century America* (Rowman & Littlefield) is the first monograph in the Beta Phi Mu Scholars’ Series. She also recently edited *Trigger Warnings: History, Theory Context* (Rowman & Littlefield) and co-edited *Foundations of Information Ethics* (ALA). Her next book, *Foundations of Intellectual Freedom* (ALA), will be released in Fall 2022. Emily’s articles have been published in the *Library Quarterly, Library and Information Science Research,* and the *Journal of Intellectual Freedom and Privacy.* Emily serves on the boards of the Beta Phi Mu and the National Coalition Against Censorship. Her research interests include information access, intellectual freedom and censorship, information ethics, information policy, and the intersection of print culture and reading practices. She is also a member of the Mapping Information Access research team. She has been interviewed by media outlets such as NPR, Time, and Slate. Emily received her Ph.D. from the doctoral program at the Rutgers University School of Communication & Information. Her master’s in library and information science is from the iSchool at Illinois. She also holds a B.A. in Religious Studies from Smith College and an A.M. in the same field from The University of Chicago Divinity School.

**Shannon M. Oltmann:** Shannon is an Associate Professor in the School of Information Science at the University of Kentucky. She obtained her Ph.D. from Indiana University. Her research interests include information ethics, censorship, intellectual freedom, information policy, public libraries, privacy, and qualitative research methods. Oltmann is the past Editor of the *Journal of Intellectual Freedom and Privacy* and Associate Editor of *Library Quarterly.* She recently published a book, *Practicing Intellectual Freedom in Libraries,* and her next book, *The Fight Against Book Bans: Perspectives from the Field,* comes out in 2023. Oltmann’s work has been funded by the American Library Association and the Institute of Museum & Library Services. Oltmann is a member of the multi-institution Mapping Information Access research team. She has presented her research at numerous academic conferences and for practicing information professionals.

**David McMenemy:** David is a Senior Lecturer (Associate Professor) in Information Studies at the University of Glasgow. His research interests encompass information law and ethics, including intellectual freedom, and freedom of expression, freedom of access to information, digital citizenship, privacy, and the philosophy of information. He has also extensively researched public library policy and development in the UK. His work has been published in *Journal of Documentation, Government Information Quarterly, Journal of Librarianship and Information Science, Library Quarterly,* and *Public Library Quarterly.* David holds a BA in English Studies, MSc in Information and Library Studies, LLM in Internet Law and Policy, and PhD in Information Science, all from the University of Strathclyde, and an MA in Philosophy from the Open University. Previously David authored the book *The Public Library* (Facet, 2009) and was Editor of *Library Review* between 2006-2011 as well as co-author of *Librarianship: an introduction* (2008), and *A Handbook of Ethical Practice* (2007).

**Stuart Hamilton:** Stuart is the Head of Libraries Development for the Local Government Management Agency (LGMA) in Ireland. He is the national advisor on public libraries and leads the development and implementation of the national public library strategy across 31 local authorities. Stuart was previously Deputy Executive Director of International Relations and Communications at the Qatar National Library where he developed the library’s international relations, partnerships and outreach activities, and led the coordination of the library’s opening in 2017/2018. Before moving to Qatar he was Deputy Secretary General at International Federation of Library Associations and Institutions (IFLA) in the Netherlands where he directed the Federation’s policy and advocacy work around copyright, human rights, Internet governance, and all issues relating to access to information, libraries and the digital environment. He is the current Chair of the National Authorities on Public Libraries in Europe (NAPLE) Forum, the Chair of the IFLA Europe Regional Division, and a member of IFLA’s Regional Council. Stuart holds a PhD in Library and Information Science from the Royal School of Library and Information Science in Copenhagen, Denmark.

**REFERENCES**


Advancing LIS in iSchools:
Building a Coalition To Ensure a Vibrant Future

Palmer, Carole L.
University of Washington, USA | clpalmer@uw.edu
Bonn, Maria
University of Illinois, USA | mbonn@illinois.edu
Coward, Chris
University of Washington, USA | ccoward@uw.edu
Knox, Emily
University of Illinois, USA | knox@illinois.edu
Marzullo, Keith
University of Maryland, USA | marzullo@umd.edu
Ndumu, Ana
University of Maryland, USA | andumu@umd.edu
Subramaniam, Mega
University of Maryland, USA | mmsubram@umd.edu
Thomer, Andrea
University of Arizona, USA | athomer@arizona.edu

ABSTRACT
The LIS Forward initiative is addressing the urgent question: As LIS evolves within the context of iSchools, how do we best position our research and education programs to lead the field and the future of libraries? The initiative stems from the recognition that the evolution of iSchools presents opportunities and challenges for LIS and that there is great value in iSchools working together on charting directions forward. The growing coalition of iSchools is working to support LIS in taking full advantage of the multidisciplinary knowledge and expertise within iSchools, foster future leaders who will champion LIS within iSchools, and confront the dynamic tensions in research intensive iSchools. This session aims to engage international, professional, and academic stakeholders to guide activities and coalition building that can continue to strengthen LIS in iSchools. A panel will present highlights from a recent position paper to catalyze interactive, facilitated dialogue within the ASIS&T community on critical issues in LIS research and education. Breakout sessions will generate responses and recommendations to advance collaborative planning and strategy of value to LIS academic programs and the profession.

KEYWORDS
Library and Information Science; information schools; research; education; practice

INTRODUCTION
Schools of Library and Information Science (LIS) launched the iSchool movement nearly twenty years ago (Larsen, 2010). As concepts, problems, and opportunities related to information, people, and technology became prevalent across disciplines, the movement, and many individual schools, have grown in size and stature while expanding multidisciplinary scope. Much of that growth has happened since Dillon’s (2012) analysis of the co-evolution of iSchools and LIS programs, but his core observations continue to hold. iSchools are not distinct from LIS programs in their subject coverage or methods, and, as a recent study indicates, the current vision and mission statements of iSchools remain very similar to those of LIS programs (Bowman, Harrison, Tapia-Lynch, 2021). The orientation of iSchools, however, extends well beyond the organizational context of libraries to fundamental information problems that impact society, with a strong commitment to interdisciplinary inquiry and the norms of research productivity inherent in research intensive universities (Dillon, 2012).

For LIS as a field, the academic environment in iSchools presents challenges as well as opportunities. After twenty years of evolution, LIS is now one of many fields represented in the composition of the faculty and student interests, and libraries are among the many institutions that build on iSchool research and employ their graduates. This interdisciplinary mix of expertise has been an energizing force since the early days of the iSchool movement (Olson & Grudin, 2009), opening up research and education in librarianship to a much broader base of knowledge and methods. At the same time, the number and balance of academic programs and enrollments is also changing. A decade ago, ALA Master’s enrollments were still dominant in iSchools (Wedgeworth, 2013), but that dynamic is shifting with steady advances in Information Management and other specialized graduate programs, and robust undergraduate programs that respond to the growth in data science and other employment markets in need of data competencies in the workforce (Ortiz-Repiso, Greenberg, & Calzada-Prado, 2018; Shah, 2021). As iSchools balance their commitments to a growing range of information-focused disciplines and academic programs, investment in library-centric research and education could be diminished or diluted, or it could be enriched and reinforced. The LIS Forward initiative responds to this inherent and dynamic tension.

LIS Forward is a growing coalition of information schools invested in the growth and vibrancy of Library & Information Science (LIS) in Information Schools. The initiative was born out of the recognition that the evolution of iSchools presents opportunities and challenges for LIS and the value of schools working together to chart future

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directions in research and education. Initially motivated by internal strategic planning activities, five schools started working together informally in autumn of 2021 (University of Illinois at Urbana-Champaign, University of Maryland, University of North Carolina at Chapel Hill, University of Texas at Austin, and University of Washington as convenor), with the University of Arizona and Syracuse University joining in spring of 2022. The 15-member working group (see acknowledgments) of junior and senior faculty has been actively examining the state of LIS in iSchools with a focus on three priority areas:

- Strategies for LIS to take full advantage of the multidisciplinary knowledge and expertise within iSchools
- Support for future leaders who will champion LIS within iSchools
- Confronting the dynamic tensions in research intensive iSchools

To concentrate attention on the designated priorities, two topics have been identified as out of scope: accreditation and core curriculum. While critical to the full base of LIS Forward concerns, these areas will be held for future phases of the initiative to allow their consideration to be fully informed by progress on initial priorities and a broader coalition.

Guided by regular meetings for planning and discussion, the working group’s first phase of activities included informal surveys of faculty and students, semi-structured interviews with iSchool deans and directors, and additional background research on trends in iSchools. The group hosted a preliminary engagement session centered on “imagining 10 years of unprecedented progress in LIS research and education” (Palmer, Coward, Bonn, & Subramaniam, 2022) that provided early input from 2022 iConference participants. A working summit in November 2022 was devoted to planning a position paper to synthesize the first phase of work and catalyze dialogue within and across LIS academic and professional communities. Slated to be released in late 2023, the Position Paper is organized into the following sections:

1. Declaration
2. iSchool LIS profiles
3. Leadership Perspectives
4. Library Futures
5. Next Generation Perspectives
6. iSchool Futures

This 90-minute ASIS&T session is designed to initiate the second phase of LIS Forward, supported by the Institute of Museum and Library Services (IMLS) and focused on targeted outreach and engagement. It will expand the scope of input and involvement of iSchool faculty, students, leaders, and LIS professionals. The session outputs will contribute to a second volume of the LIS Forward Position Paper representing the broader interests and concerns emerging from the LIS community as we share the results of LIS Forward activities. In particular, this session responds to explicit expressions of interest from schools and faculty outside the initial scope of LIS in research intensive universities in North America.

AUDIENCE
The ASIS&T community is essential to expanding the representation and range of contributors and expertise within the LIS Forward coalition. We have designed the session to be generative to produce concrete contributions from researchers, educators, students, and practicing professionals representing the unique range of LIS stakeholders within ASIS&T. We are particularly eager to engage and learn from the international audience and practicing professionals to better understand the challenges and opportunities facing LIS worldwide in academia and in practice.

In this second phase of work, we are also working to establish connections with individuals committed to the aims of LIS Forward who can serve as delegates to schools and organizations. We plan to integrate student perspectives as we expand representation of LIS faculty and practitioners across professional and academic ranks, with a continued emphasis on early career faculty and PhD students who will shape and drive the future of LIS within the iSchool movement. Engaging leaders is also critical, since, as iSchools have become more multidisciplinary, there are many fewer deans and directors with LIS backgrounds.

STRUCTURE AND CONTENT
This interactive session will engage the ASIS&T community in a dialogue on how to advance LIS in iSchools and evolve the initiative to represent broader interests and goals. It will serve as a forum for sharing highlights from the new LIS Forward Position Paper as a catalyst for conversation and deliberation on critical issues in LIS research and education, as well as recommendations for future collaborative activities among iSchools and the LIS profession. The 90-minute program will include a panel representing early and mid-career LIS faculty and iSchool leadership to lay the foundation for breakout groups and a closing plenary segment.
The first segment will provide an overview of the LIS Forward initiative. The panel that follows will highlight two sections of the Position Paper—Leadership Perspectives and Next Generation Perspectives, followed by a more general summary of Risks and Opportunities for iSchools. The closing panel presentation will offer views from leadership in the international iSchools organization.

- **Overview.** Palmer will present background and framing for the session, highlighting the current inflection point for LIS in iSchools, where growth and multidisciplinarity are both the greatest strength and the greatest risk to the field and the profession. 10 minutes.

- **Panel.** Presentations will provide grounding derived from the Position Paper to catalyze discussion of the salient issues facing LIS in iSchools.

  - **Leadership Perspectives.** Coward will present results from a set of interviews conducted with iSchool deans and directors who shared many significant LIS achievements and challenges. He will highlight the successes celebrated by iSchool leaders and primary areas of concern, including MLIS diversity and the LIS PhD-to-faculty pipeline.

  - **Next Generation Perspectives.** Ndumu and Thomer will cover highlights from an essay developed by five early career LIS faculty from five different iSchools on their experiences establishing careers in research intensive iSchools. Their analysis calls out the need for a cultural shift toward more inclusive doctoral admissions and more LIS-congruous paths to promotion.

  - **Risks and Opportunities.** Subramaniam and Bonn will discuss potential investments in LIS that respond to the risks and opportunities identified by the LIS Forward working group to date. They will consider potential strategies to improve the faculty pipeline, the need to support LIS approaches to community and practice-engaged research, the dearth of centers of research excellence, and the balance of tenure and teaching track faculty.

  - **North American iSchools Perspective.** Marzullo will close the panel with perspectives based on his role as North American Regional Chair of the iSchools Organization. He will share his observations on growth and change in iSchools and the potential for coalition based strategies.

The majority of the session will be devoted to breakout groups and a final plenary discussion.

- **Breakout groups.** Knox will set the foundation for the breakout groups, providing an overview of key themes from the panel. She will present the primary aims of the breakouts—to learn from the unique and diverse ASIS&T audience, enrich the dialogue, and broaden representation of stakeholders. 30 minutes.

  The breakout groups will focus on the theme of Risks and Opportunities for LIS within iSchools, with the aims of gaining broader perspectives from various countries, the profession, and early career academics and practitioners. There will be four breakout groups:

  - **International perspectives.** Commonalities and contrasts in LIS priorities across regions. Potential for global partnerships.

  - **Professional perspectives.** Priorities for LIS practice. Strategies for partnering with the profession.

  - **Early career vision.** Ideal iSchool environment for students and early career faculty, and support for future leaders.

  - **Coalition building.** Strategies and inclusive approaches for integrating views ranging from those entering the field to visionaries and advocates from outside the field.

- **Plenary discussion.** Knox and breakout facilitators will lead a report back and exchange among the full group of participants. Breakout group representatives will share highlights from their groups, with facilitators prepared with prompts to enrich and further clarify important contributions and critiques. We will wrap up the session by asking attendees to share final thoughts that emerge for them after hearing the plenary discussion. We will collect big ideas, directions, and challenges on physical post-it notes or an online Jamboard. Additionally, we will collect nominations for thought leaders and names of attendees interested in serving as representatives of individual schools or professional organizations. 20 minutes.

**CONCLUSION**

Conversations on the future of LIS in iSchools need to represent the deep and diverse base of interests and expertise within the ASIS&T community. This session will generate rich dialogue and new ideas and perspectives from a broad set of LIS stakeholders. The exchange will be documented in a synopsis for inclusion in the second volume of the LIS Forward Position Papers and translated into recommendations for priorities and plans for further
engagement with LIS academic programs and the library profession in the coming year of outreach and engagement activities.

ACKNOWLEDGMENTS
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Pathways to Positive Change: Exploring Research Engagement in Practice Contexts

Polkinghorne, Sarah  RMIT University, Australia | sarah.polkinghorne@rmit.edu.au
Bowker, Lynne  University of Ottawa, Canada | lynne.bowker@uottawa.ca
Detlor, Brian  McMaster University, Canada | detlorb@mcmaster.ca
Greenshields, Mary  European University Institute, Italy | mary.greenshields@eui.eu
Mckay, Dana  RMIT University, Australia | dana.mckay@rmit.edu.au

ABSTRACT
Bringing library and information science (LIS) research into practice often means identifying ways for our work to effect positive change within information institutions. Such change is more likely if it is well-grounded in understanding of how practitioners engage with research, and how research influences change within institutions. This panel addresses these issues through the diverse perspectives of its international panelists, who all bring diverse and substantial experience working in both research and practice contexts. Panelists will speak to lessons from experiences such as research co-design, researcher-in-residence programs, mentorship, and community-based research. Attendees will have opportunities to discuss strategies for enhancing the impact of their own research on practice.

KEYWORDS
Research into practice, societal impact, libraries, researcher-in-residence programs

INTRODUCTION
Library and information science (LIS) researchers, like researchers everywhere, are increasingly called upon to document how their research will be put into practice, part of the process of achieving societal impact. Much of the discussion at the conference will focus on questions asked in the call for proposals, which invites us to consider how we can “release the transformational power” of our research, and “translate our findings into positive difference” in people’s lives (ASIS&T, 2023). In support of these broad aspirations, this panel digs into the challenges and considerations around reaching practice contexts, and practitioners, with LIS research.

Imagining our research in practice often means identifying how our work leads to positive change within information institutions, such as through better-informed services, programming, infrastructures, policies, and decision-making processes. A key to positive impact, then, is understanding how change occurs within institutions, and how practitioners connect with research. The purpose of this panel is to explore these questions and create an opportunity for everyone, including attendees, to discuss and exchange recommendations. The panelists and moderator all bring experience inhabiting both research and practice contexts. Attendees will come away with strategies to support their own research partnership, co-design, and translation efforts.

BACKGROUND
There is a narrative that LIS research will cause positive change if it is effectively “translated” for practitioners, communities, and policymakers (ASIS&T, 2023). This narrative rests on core hopes and assumptions, primarily that people outside the research sphere will change their views and actions if they sufficiently understand the knowledge generated by research. The predominance of such a narrative is understandable. Studies have documented the growing pressure on researchers to demonstrate societal impact, as well as the emotional dissonance that results from labouring to meet impact agenda requirements (Chubb, Watermeyer, & Wakeling, 2017). Researchers often find themselves needing to articulate how their research can be put into practice, without necessarily having the resources or support to do so.

Developing understanding of practice contexts, the focus of this panel, is key to putting research into practice. For many LIS researchers, libraries, archives, and related institutions are the places where their research has the greatest potential for uptake. However, translation alone, no matter how expertly done, will not necessarily spark positive change. It is also necessary to recognize how research circulates and is factored into decisions within institutions.

For example, practitioners such as librarians often have their own critical appraisal practices through which they assess the quality and relevance of research. Those who adhere to evidence-based library and information practice (EBLIP) are well-known for adapting approaches imported directly from evidence-based medicine, where randomized controlled trials are privileged, and qualitative research can be entirely disenfranchised as evidence (Koufogiannakis & Brettle, 2016, p. 50). Even having found, assessed, and synthesized the best available research to inform a decision, practitioners must still navigate bias, organizational culture and politics, and power dynamics (Koufogiannakis & Brettle, 2016). They must also address larger contextual concerns, such as the institutional or
community setting in which the library is embedded, the time required for evidence-gathering, and the availability of relevant research. These factors can present challenges to the uptake of research.

The professions under the LIS umbrella are also predominantly conceived of as “practical,” as Hudson (2017) has analyzed. This conception exists among many practitioners and LIS educators. It has been documented as a factor for librarians who do not wish to engage in evidence-based practice (Partridge, Thorpe, & Edwards, 2007). Other researchers have documented that a perceived “gap” between research and practice is not substantiated by analysis of topical coverage in published literatures, although such perceptions persist (Hider, White, & Jamali, 2019). As Hudson (2017) explains, practitioners’ “expectations and assumptions about the practical character and value of our field subtly police the work we end up doing and supporting, the kind of questions we ask and conversations we have, our sense of what useful and appropriate conferences, publications, and research look like” (p. 205). This discourse of practicality influences how research is sought out, valued, and potentially incorporated into practice. It also affects practitioners’ direct involvement in research, whether in terms of their individual inclination or in terms of institutional support, recognition, and autonomy.

There are approaches to designing research, and to translating it, that increase its potential to create positive change. Research that includes practitioners as true co-designers and collaborators is one example. The benefits for librarians—one important contingent of practitioners—of being involved in research extend beyond the insights generated by the research itself; they also report improved job satisfaction and skill development, as well as reputational benefits for the library (Borrego, Ardanuy, & Urbano, 2018; Borrego & Pinfield, 2020). As the EBLIP movement continues to evolve, its proponents have highlighted the need to communicate findings and outcomes generated by the research itself; they also report improved job satisfaction and skill development, as well as reputational benefits for the library (Borrego, Ardanuy, & Urbano, 2018; Borrego & Pinfield, 2020). As the EBLIP movement continues to evolve, its proponents have highlighted the need to communicate findings and outcomes outwardly (Thorpe, 2021). This concern parallels researchers’ growing focus on societal impact, indicating another potential common ground for collaboration. Overall, research that intends to influence practice benefits from mutually respectful relationships with practitioners. Our panelists will draw on their experiences in order to illuminate challenges, considerations, and strategies around research engagement in practice contexts.

**FORMAT**

This interactive 90-minute panel features four panelists and a moderator, all of whom have done substantial work within both research and practice contexts. Moderator Sarah Polkinghorne will begin the panel with introductions and an explanation of the purpose and format of the session. Each panelist will offer an 10-minute presentation on their work. They will share insights into practice contexts and offer observations about how LIS research can be impactfully integrated into practice. A moderated discussion will follow the presentations.

**MODERATOR AND PANELISTS**

This international panel draws on the expertise of a distinct group of people: those who have inhabited both research and practice contexts. Some panelists are researchers who have held library-based residencies, some are practitioners involved in research, and some are former practitioners who now work as researchers. Panelists range from early-career to well-established. They represent a range of experiences, interests, and specializations, and they bring diverse perspectives on the challenge of integrating research into practice.

**Sarah Polkinghorne, Moderator**

Sarah Polkinghorne is Research Fellow in Social Change at RMIT University in Melbourne, Australia. Her research explores human information practices, including embodied practices, with the goal of better understanding how people become informed. Sarah’s current work examines how people are coping with the rising cost of food, and how community organizations can more holistically support food security. She also has an interest in changes to the scholarly publishing system, particularly the ongoing transition to open access.

Sarah’s research is in part inspired by her 15-year career as an academic librarian. As a librarian, she held multiple specialized roles within a large university library system. Interacting with people in the structured confines of the library motivated Sarah to study people’s information experiences more broadly, in everyday life. Having advocated for research engagement as a librarian, she remains deeply committed to the issue as a researcher. Through her advocacy, Sarah has generated a track record of research mentorship, including within the Canadian academic librarian community, as a Peer Mentor in the Canadian Association of Research Libraries’ intensive research training program, the Librarians’ Research Institute.

**Lynne Bowker, Panelist**

Lynne Bowker is Full Professor at the University of Ottawa, Canada, with a cross-appointment between the School of Information Studies and the School of Translation and Interpretation. Her research lies at the intersection of language and technologies, including machine translation and multilingual information management. In 2019, she was Researcher-in-Residence at Concordia University Library in Montreal, where she launched the ongoing Machine Translation Literacy project using a community-based participatory research (CBPR) approach where end users (e.g., international students) and colleagues from various campus services (e.g. international office, student
success centre, library) participate as members of the research team to help ensure that the project addresses a genuine need within the community, and that it is designed and implemented in a way that leads to responsible uptake of machine translation tools (e.g., Google Translate).

Lynne’s experience as Researcher-in-Residence offered an opportunity to engage various types of practitioners and end users in her own project, as well as to provide research mentorship to practitioners launching their own applied research projects. By embedding researchers in a practice-based unit (i.e., the library), the Researcher-in-Residence program removes some of the potential barriers by providing visibility/valorization for research, direct access to research experience/expertise, and seed funding for research projects.

Brian Detlor, Panelist
Brian Detlor is Professor of Information Systems at McMaster University, Canada and Visiting Professor at the Centre for Social Informatics at Edinburgh Napier University, Scotland. His current research investigates the factors affecting the delivery of digital literacy training led by public libraries and other community organizations. To study this topic, Brian embeds himself in practice contexts where digital literacy training is given and works directly with practitioners in this space to co-design and carry out his research. Brian has served as “Researcher in Residence” at McMaster University Library where he embedded himself in the university library for 12 months and assisted librarians with their own research projects. Working with Hamilton Public Library, he co-hosted two digital literacy summits to facilitate the exchange of knowledge between digital literacy training community providers and researchers. In May 2023, Brian with colleagues from Edinburgh Napier will host a workshop bringing LIS practitioners and researchers together to exchange ideas on the research conducted by themselves and their experiences sharing findings from this research with others. For the ASIS&T panel, Brian will discuss these examples, as well as the importance of co-design and researcher embeddedness to conduct research of high value and impact to practice.

Mary Greenshields, Panelist
Mary Greenshields is the Teaching and Learning Librarian at the European University Institute in Florence, Italy. She is also a doctoral student at RMIT University in Melbourne, Australia. Her research considers the lived experiences of women working in data science to approach the problem of reasons for women’s low participation in the field. She is particularly interested in how these experiences inform women’s career paths and decision-making, and how these ultimately intersect with issues of justice and equity (D’Ignazio & Klein, 2020).

Mary’s research interests have been influenced by her work as an academic librarian in Canada and Italy, as well as over a decade as a contract undergraduate instructor. She has been active as an LIS researcher and practitioner since she began her MLIS studies. As a practitioner, she has advocated for the importance of community-based research in LIS, as well as critical approaches to how we understand and enact our roles within institutions. Her experience has taught her that research with real world consequences, where we understand one another and our experiences better, has the biggest influence. She encourages practitioners to think about the implications of our practices, as well as the ways in which we take and understand decisions.

Dana Mckay, Panelist
Dana Mckay is a Senior Lecturer in Innovative Interactive Technologies at RMIT University in Melbourne, Australia. Dana’s disciplinary home sits somewhere between human computer interaction, and information science. Her research focuses on how advances in information technology can be used to promote social good, using information for a fairer, more equitable society. Recent projects have included how to provide effective health information to migrant groups, how information access within the home is increasing the use of technology in family violence, the role of (mis)information in view change, and how to better facilitate online information browsing, so we can finally find something good to watch on Netflix.

Dana’s research career started in computer science and human computer interaction. In 2007 she started a 10-year stint working as a user experience professional, working in a university library, studying users and their needs to help build better systems and processes. Upon discovering that she was venturing further and further into unknown spaces to support users, Dana began a part-time PhD in 2014, returning to academia full time in 2017 and graduating her PhD in 2019. Throughout her career Dana has presented her work to the GLAM sector, industry, and academics to ensure that it benefits people as widely as possible.

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Strategies for Conducting Critical Research in Information Science by Designing Social Justice Research Informed by Intersectionality

Senteio, Charles  Rutgers University, USA | charles.senteio@rutgers.edu
Chancellor, Renate  Syracuse University, USA | rlchance@syr.edu
Brewer, Robin  University of Michigan, USA | rnbrew@umich.edu
Gray, LaVerne  Syracuse University, USA | lgray01@syr.edu
Threats, Megan  University Michigan, USA | threats@umich.edu

ABSTRACT
This panel will present examples of how to conduct critical social justice research in Information Science (IS) that acknowledges intersectionality. Each of the panelists has extensive experience in designing and conducting IS investigations with communities underrepresented in research who may belong to various, interdependent social identities. The panelists will present their specific empirical research and/or make a theoretical contribution that applies the intersectionality framework. Each of the panelists will give a presentation followed by a Q&A session.

KEYWORDS
Social Justice, Translational Research, Intersectionality

INTRODUCTION
While the amount of social justice research in Information Science (IS) has increased in recent years, few studies have explored actionable strategies for conducting this critical research such as investigations that address inequities and systemic barriers and access to information. Intersectionality refers to the idea that intersecting systems of oppression (e.g. racism and colonialism) based on mutually constructed and interdependent social identities, such as race, ethnicity, sex, gender, class, disability status, sexual orientation, and immigration status, shape human experiences. With its origins in Black feminist legal theory (Crenshaw, 2013), the intersectionality framework advocates moving beyond unitary/single-axis analytical approaches to holistically accounting for multiple axes of power and inequality that operate simultaneously to disadvantage (or advantage) various populations. Each of the panelists will present their specific empirical research and/or theoretical contributions which have incorporated intersectionality in their approaches to conducting this research.

SPEAKERS
Renate Chancellor, Ph.D.
Dr. Chancellor is an Associate Professor and Associate Dean of Equity, Diversity, Inclusion and Accessibility at the Syracuse University School of Information Studies. She has published widely in the areas of critical cultural information studies, Equity, Diversity and Inclusion (EDI), and social justice in Library and Information Science. Dr. Chancellor is on the editorial boards of Library Quarterly and Education for Information. She also serves on the American Library Association’s Publishing Committee.

Methods of oral history and Critical Race Theory (CRT) are compatible research tools that share several propositions that are apt for helping researchers subvert the silencing, marginalization, and objectification of systemically underserved communities (Chancellor & Lee, 2016). This presentation illustrates how this methodological-theoretical approach can be used for designing studies in Library and Information Studies.

Robin Brewer, Ph.D.
Dr. Brewer an Assistant Professor at the University of Michigan School of Information. She researches Human-Computer Interaction (HCI) at the intersection of social computing and accessibility. She investigates how experiences with technology can be made more accessible to digitally constrained communities. Specifically, she designs, builds, and studies systems to better engage older adults and people with vision impairments who face barriers to accessing and engaging with technology. She also studies how people in these communities are actively engaging digitally and how researchers and designers can learn from their strengths. Dr. Brewer leads the Accessibility, HCI, and Aging (AHA) lab and is an affiliate faculty member with the Digital Studies Institute and the Center for Ethics, Society, and Computing (ESC). She received a Ph.D. in Technology and Social Behavior from Northwestern University.
“An Intersectional Lens on Accessible Computing”
Disability often intersects with other identity characteristics. This presentation discusses why discussing intersectional disability identity is important for designing technologies to better support social interaction for blind and low vision older adults (Brewer and Piper, 2017) and non-Western privacy preserving mechanisms for blind and low vision people (Alharbi, Brewer, et al., 2021).

LaVerne Gray, Ph.D.
Dr. Gray is an Assistant Professor at the Syracuse University School of Information Studies. She uses Critical Race and Black Feminist perspectives, in exploring information location and value in marginal community spaces. She is keenly interested in African-American historical information collectives and archival-evidence analysis. She received a Ph.D. in the College of Communication and Information at the University of Tennessee, Knoxville.

“History and Memory: Intersectional Approaches to Uncovering the Black information experience”
Black informational contexts express power within the margins. It is defined by the ties that bind, linkages, and fellowship born out of exclusion. This presentation describes using creative critical-historical approaches to uncover meaning in Black informational contexts. It blends archival analysis, narratology, and grounded theory as iterative elements toward theory building(Gray, 2021; Gray, 2022). The presentation provides examples of examining Black women, libraries, and community collectives.

Charles Senteio, Ph.D.
Dr. Senteio is an Associate Professor at the Rutgers School of Communication and Information in the Department of Library and Information Science. He is a health equity researcher who investigates barriers and facilitators to quality care, concentrating on chronic disease outcomes. He is a licensed clinical social worker who applies community-based participatory research in his investigations. He received a Ph.D. from the University of Michigan School of Information.

“The IS discipline should apply intersectionality in health equity research via community engagement. Engagement can help IS researchers take novel, creative steps to influence how health/wellness research can be translated to some of society's most pressing issues. Senteio et al. (2021) offer specific guidelines for IS researchers who lead community-based participatory research (CBPR) investigations and projects. While CBPR is not a new concept, it is still underutilized partly because the IS literature is sparse concerning how to initiate and sustain community partnerships across specific projects.

Megan Threats, Ph.D.
Dr. Threats is an Assistant Professor at the University of Michigan School of Information and the Department of Health Management and Policy at the University of Michigan School of Public Health. In her work, she uses anti-racist praxis and methods to investigate the existence and elucidate the magnitude of determinants of health and information equities. The goal of her research program is to leverage informatics to achieve health justice with and for racial/ethnic minoritized and lesbian, gay, bisexual, transgender, and queer (LGBTQ) communities through the design and implementation of informatics interventions and consumer health technologies; as well as, to translate her findings into the development of policies, programs, and practices that reduce health disparities and improve health outcomes. She received a Ph.D. in Information Science from the University of North Carolina at Chapel Hill.

“Advancing health justice through Informatics”
Informatics research to support health and health justice requires a deep and nuanced understanding of the interrelated factors driving inequity. Dr. Threats will share insights into how to incorporate intersectionality into the design of a health informatics study that also uses a community-based participatory research approach. She will discuss how she used intersectionality as a theoretical framework for the analysis of qualitative interview data, and present findings from a study aimed at understanding how racism and sexual orientation discrimination together impacted engagement in sexual healthcare among Black queer communities and user-centered design recommendations for an informatics intervention to address intersecting marginalizations among Black queer communities. (Threats et al., 2021)

CONCLUSION
This panel describes examples of how to conduct critical social justice research in IS that acknowledges intersectionality. While the social justice research in IS continues to expand, these panelists offer actionable strategies for conducting this critical research.

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Global AI Initiatives: from Theory to Practice

Singh, Vandana  
The University of Tennessee, USA | vandana@utk.edu

Bilal, Dania  
The University of Tennessee, USA | bilal@utk.edu

Cox, Andrew  
The University of Sheffield, UK | a.m.cox@sheffield.ac.uk

Chidziwisano, George Hope  
Carnegie Melon University, USA | hchidziw@andrew.cmu.edu

Dinneen, Jesse David  
Humboldt-Universität Berlin, Germany | jesse.dinneen@hu-berlin.de

ABSTRACT
Information Sciences is deeply invested in improving the future of AI globally. Information science researchers provide a critical voice in the growth of AI by bringing in perspectives related to AI Ethics, diversity, equity, inclusion, and AI education for all. AI is seeping into everyday life and is often a source of concern for people whose lives are impacted. The concerns of losing employment, inequitable access, and biases create a fear of AI among people. Library and information science educators and researchers have a rich history of working with local communities and representing local contexts. This experience places us in an important position to understand and evaluate AI applications and their varied impact in different contexts; for example, the same library-related AI application would have different results in Europe versus Africa. However, AI and its applications in the global context are yet to be discussed and understood in the information science community.

KEYWORDS
Artificial Intelligence, Global AI, AI Ethics, AI in libraries, AI Education

INTRODUCTION
AI has become a rapidly growing disruptive force in society (Rubel 2021). Every aspect of life that is impacted by technology is being impacted by AI. Discussions around AI range from new, exciting, and full of potential to dangerous, exclusionary, and unethical (Schwab, 2017) and cross all sectors, such as education, manufacturing, agriculture, design, human resources, supply chain management, medical imaging, banking, etc. This rapid expansion and adoption of AI technologies globally is simultaneously facing skepticism and warnings about the risks of AI adoption. Recently, AI leaders from around the world called for a pause on the growth of AI until its impacts can be better understood. DAIR (Distributed AI Researchers) posted a response to this letter adding that the AI impact on worker exploitation, data theft to create products that profit a few entities, the reproduction of oppression through synthetic media, and the concentration of power in the hands of a few people is exacerbating social inequities. These developments bring to light the need for improved AI education, a better contextual understanding embedded into AI systems, and a consistent global focus on ethics for AI.

In this panel, researchers and experts from different countries will share their perspectives on AI applications in libraries in Europe, including barriers to broader adoption of AI, AI ethics, and banning ChatGPT to protect citizens’ data; AI impact on social and economic inequalities across marginalized communities in Africa; AI education for All and gaps in AI education in iSchools programs in North America, as well as challenges in AI implementations in the technology industry. Attendees will share insights with the panelists about AI use and implementation in their own contexts.

BACKGROUND
One can imagine that pervasive issues of AI, like bias and abuse, could indeed manifest in library-related applications (Cox, 2022), but it is unclear how or to what extent. And although there are hundreds of guidelines (Munn, 2022), statements, and even specific approaches (Floridi & Strait, 2020) to audit AI projects to promote ethical outcomes, these have not been evaluated inside our institutions or out, so their efficacy and practicality is at best conjectural (Bubinger & Dinneen, 2021). The goal of this panel is to elevate the discussion about these aspects, identify relevant initiatives across the globe, and discuss the challenges that AI bears in various contexts, ultimately developing networking opportunities for future collaborations. Panelists will address the growth, impact, and future of AI in the context of library and information science globally. The discussions will include presentations on the following topics – 1) AI in libraries focusing on how European libraries are utilizing and shaping AI technologies and tools for serving their patrons 2) iSchools Leaders’ Vision of Information Science Curricula in the Age of AI; 3) European perspectives on AI Ethics and libraries; 4) Leveraging current infrastructure for AI growth in Africa; and 5) AI Ethics in the Information Technology Industry. After the presentations, the attendees will work in small groups to discuss questions about AI, including ethical considerations in various contexts, AI education gaps, and challenges in implementing AI applications globally.

PANEL FORMAT (90 MINUTES)
Session Introduction (10 minutes)
The moderators will outline the panel format and agenda and will introduce the panelists and their topics.
Panel Discussion (40 minutes)

Dr. Andrew Cox – AI in Libraries (8 minutes)

AI has multiple potential applications in libraries; indeed, some, such as recommendation systems, are already familiar. In the European context, individual practitioners are primarily engaging with AI through the use of commercial and open-source tools that use AI, such as for translation, summarization, captioning, and writing, within everyday professional practice. But most institutional activity is concentrated in research libraries (e.g., university and national libraries) with proof-of-concept projects to improve knowledge discovery in special collections, leveraging the ability of AI to categorize images, sound collections as well as texts at scale. There is a strong link here to supporting digital humanities. But communities of data scientists from all disciplines are emerging in many research institutions, and they may turn to libraries for support around data discovery, use, and preservation. Health libraries may struggle to find a role, but AI is a priority for the national health service. In the legal sector, developments are in the hands of technologists. Public libraries are struggling in general but have an important role in promoting algorithmic literacy among all citizens as an aspect of information literacy. We lack sector-wide studies of progress, but the impression is that it is very early days in many areas of AI application, eg chatbot development. Cox will discuss barriers to broader adoption of AI, including but not limited to lack of off-the-shelf solutions, cost and resource demands, lack of clarity about sector trends, staff skills and lack of development capacity, IT infrastructure, and the pull of many alternative priorities.

Dr. Dania Bilal – iSchools Leaders’ Vision of Information Science Curricula in the Age of AI. (8 minutes)

AI technology is transforming education at all levels. AI growth is creating demands for professionals with AI knowledge and skills in theoretical and technical aspects of AI. AI affords many challenges, including but not limited to bias, privacy, ethics, and impact on society. As demands for AI skills increase across disciplines, educational institutions, and industries, iSchools should prepare the next-generation workforce in information science that is capable of planning, designing, evaluating, and implementing AI solutions effectively and responsibly, as well as training user communities in understanding and using AI. Currently, not all iSchools programs have integrated AI into their curricula. Bilal et al.’s (2022) content analysis of fifty-four iSchools programs in North America revealed that 43% did not have any courses related to AI, and a handful of the programs focused on the ethical and societal implications of AI. Paul (2021) found that AI courses offered at four iSchools programs (Carnegie Mellon University, Drexel University, Indiana University Bloomington, and Pennsylvania State University) were technical and computer-science-centered, lacking focus on AI’s impact on society, echoing Bilal et al.’s findings (2022). In this presentation, Bilal calls upon iSchools leaders to discuss this AI education gap. Discussion questions include 1. For what reasons is AI yet to be integrated into many iSchools programs? 2. What vision do iSchools leaders have for their information science programs in the age of AI? How well are iSchools programs preparing the next generation workforce in information science? 3. What are the most feasible approaches to broaden adoption of AI, including but not limited to lack of off-the-shelf solutions, cost and resource demands, lack of clarity about sector trends, staff skills and lack of development capacity, IT infrastructure, and the pull of many alternative priorities.

Dr. Jesse David Dinneen – European Perspective on AI ethics and Libraries (8 minutes)

In Europe, some states have responded by banning specific applications: Italy has temporarily banned integrating AI into their programs? Dr. Jesse David Dinneen argues that such approaches are not especially effective at identifying unknown risks. Other public institutions will be facing similar risks and uncertainties; thus, there is a great opportunity for our institutions to model the use of AI in a highly planned, constrained, and responsible way, or if it cannot be used responsibly, to bravely emulate Italy and forego its use.

AI in European LIS Research – Nearly all LIS research topics active in Europe today are highly relevant to AI and AI ethics. Prepending “AI” to the name of almost any LIS topic results in something interesting and timely: AI information services & policy, AI information behavior & literacy, AI information retrieval, AI information ethics. Some of these are already established topics in LIS, but considerable research remains to better understand the human-information nexus created by AI today. Notably, AI-powered chat bots are increasingly influencing how people find, interpret, and use information, but the nature of this influence and its outcomes for individuals is relatively understudied in Europe (and elsewhere). For example, it is unclear what the rise of these systems means for people’s information-seeking and practices, or the expectations they will bring to other digital search systems (e.g. library discovery tools), or what impact the systems (and their many well-established biases) will have on
European society. A paper presented at ASIS&T 2021 suggested that because GPT-3 already generated plausible but false content, future iterations might "drastically change the nature of everyday information retrieval... with serious social and ethical" consequences (Dinneen & Bubinger, 2021, p. 10). With ChatGPT and its contemporaries, that future is now, and society is in an uncharted information frontier. How LIS navigates that frontier will depend in part on how we think information should serve human activity (e.g. our professional values). European LIS scholars and practitioners thus have an opportunity to complement global perspectives on AI and AI ethics, for example, by promoting pro-social European values like peace, dignity, equity, and sustainability.

**Dr. Hope Chidziwisano - AI Initiatives in Africa: Leveraging Existing Infrastructure to Address Complex Global Challenges (8 minutes)**

Over the last five years, the adoption of artificial intelligence (AI) applications has accelerated across the globe, with over 90% of companies putting AI at the center of their digital transformation (InDataLabs, 2023). While AI applications address some of the complex human challenges, they come with potential risks to people living in marginalized communities, such as Africa. This is because AI applications and algorithms are primarily developed in Western societies, then exported to African countries (Gwagwa, Kraemer-Mbula, Rizk, Rutenberg, De Beer, 2020). The transfer of technology from one region to another results in applications that are grounded in non-representative data, thereby exacerbating existing social and economic inequalities. For example, ChatGPT—an AI chatbot that has gained exponential adoption—is heavily trained on data from western societies. Between 2015 and 2020, data from only one African country—Egypt—was used to evaluate ChatGPT’s performance (Komminoth, 2023). Africa’s underrepresentation in training data makes it difficult for AI models to produce results that match with cultural and economic realities of the continent. Relatedly, decision-making AI algorithms in the financial sector exclude women from accessing loans because of their low education status in African countries, such as Uganda (Gwagwa, et al, 2020). One of the contributing factors to Africa’s underrepresentation is the poor technological infrastructure that can be used to collect data and train AI models. To collect data and train well-balanced models, technologists require a robust infrastructure, like access to the internet, electricity, and computing systems with high processing power and memory. Africa consists of resource-constrained infrastructure that is not compatible with the rapidly changing infrastructure in Western societies (The World Bank, 2016). For example, Wi-Fi Internet, which is a requirement for most data collection tools and AI applications, is widely available in Western societies but not in African countries (ITU, 2020). On a positive note, Africa has alternative infrastructure that can be leveraged to support the collection of data and training models. The penetration of mobile internet services over cellular networks has increased in African countries. As of 2020, the Global System for Mobile Communications reported that 79% of the population in Africa lives within reach of mobile networks (Delaporte, 2021). Previously, data-driven solutions in the region have failed due to the disconnected applications not being aggregated for policymakers to make data-driven decisions (Moyo, Doan, Yun, and Tshuma, 2018). In this case, the widespread availability of mobile internet presents an opportunity to improve data collection and aggregation, training AI models, and service delivery in the region. Unlike importing tools embedded with different connectivity requirements, such as Wi-Fi, existing mobile internet infrastructure presents an opportunity to collect data that can improve Africa’s representation. Dr. Chidziwisano will share his perspectives on developing equitable AI applications for global use, including taking advantage of already existing infrastructure to collect data that reflects Africa’s realities. In doing so, we would be encouraging inclusive approaches from the initial stages to the implementation of AI-based solutions. These approaches are inscribed in new emerging sub-fields, including human-centered AI, responsible AI, and human-AI collaboration. By extending these sub-fields to African societies, we would include underrepresented users as well as local technicians who are well conversant with existing socio-cultural and infrastructural challenges. More importantly, inclusive approaches—in the presence of technological infrastructure—would also result in the collection of vast amounts of representative data that can be used to train well-balanced AI models.

**Dr. Vandana Singh – AI Ethics in the Technology Industry (8 minutes)**

In the technology industry, AI is being integrated into enterprise software suites, and tech workers are increasingly interacting with AI applications in their day-to-day life. According to a recent survey, most higher-income workers report working with AI in their daily jobs (Kulp, 2023). Some of the dominant industry leaders in the AI ethics debate are Google AI, IBM, Microsoft, and Open AI. Google was recently in the news, when its new AI chatbot made a mistake, and the company dropped $100 billion in one day (Olson, 2023)—demonstrating very clearly that the leaders in the industry are experiencing a steep learning curve in implementation of AI applications. IBM developed its own AI ethics to ensure trust and transparency in developing and deploying AI applications. OpenAI focuses on creating “safe” AI applications, and aligning AI systems with human intentions and values. Microsoft maintains its Office of Responsible AI, which outlines its commitment to responsible AI principles, including fairness, reliability and safety, privacy and security, inclusiveness, transparency, and accountability. In this presentation, Dr. Singh will present an overview of evolving responsible AI dimensions across the industry and the impact of these regulations on AI applications. The audience will be invited to share their expertise, knowledge, and
opinion on the questions of defining responsible AI, the expected versus the real impact of such initiatives, and the takeaways for future workforce development in the field of responsible AI.

**Group Activity (30 minutes)**
The panelists and the audience will be divided into smaller groups to discuss questions from each of the panelists for 20 minutes. Following the group discussion, a spokesperson from each group will report back to the larger group.

**Panel Wrap-Up (10 minutes)**
The moderators will conclude the session by highlighting a summary of the panelist presentations and the group activity. The moderators will discuss a plan for future action with the attendees by discussing opportunities for continued future discussions and research collaborations.

**CONCLUSION**
Upon completion, this panel will have achieved its goal of increasing the audience understanding of global AI initiatives including AI Ethics, AI in libraries, AI infrastructure in Africa, and AI ethics in the technology industry. The audience and the panelists will have discussed issues relevant to different aspects of AI in library and information sciences and learned from each other to forge future collaborations.

**Panelists**

**Dr. Vandana Singh** – Dr. Vandana Singh is the Program Director for Data Science and a Professor at the School of Information Sciences, at the University of Tennessee- Knoxville. Her research focuses on empowerment thought technology use in various settings and includes Gender and Information Technology; Open-Source Software; Diversity, Equity, and Inclusion; Online Learning; Rural Libraries and Technology; STEM education; and AI ethics. She is currently the Principal Investigator on a grant funded by Google Award for Inclusion to “Educate better Citizens for the Technology Industry”.

**Dr. Dania Bilal** – Dr. Dania Bilal is a Professor at the School of Information Sciences, The University of Tennessee in Knoxville, Tennessee. Her research in human information behavior sits at the intersection of human information behavior, human-computer interaction, human-AI Interaction, and information retrieval. Her most recent research includes using humanoid robots to facilitate the delivery of reminiscence therapy to older adults with dementia and the use of theory in children and youth information behavior research. She is the guest editor of a special issue in Information and Learning Sciences, titled Artificial Intelligence (AI) in Education: Transforming Teaching and Learning. AI in Education She is currently the Principal Investigator (PI) on the IDEA (Innovation, Disruption, Enquiry, Access) Institute on Artificial Intelligence (AI), funded by the Institute of Museum and Library Services (IMLS) in the United States.

**Dr. Andrew Cox** – Dr. Andrew M. Cox is a Senior Lecturer at the Information School at the University of Sheffield. His main research area has been around the response of the information professions to contemporary societal challenges such as new technologies, increasing managerialism, datafication, changing conceptualizations of learning, and a perceived crisis of well-being. Building on work over a decade on the role of information professionals in data stewardship, in the last two years, Dr. Cox has developed a particular focus on artificial intelligence.

**Dr. Hope Chidziwisano** - George Hope Chidziwisano is a Presidential Postdoctoral Fellow in the Human Computer Interaction Institute at Carnegie Mellon University. His research focuses on designing sensing technologies for resource-constrained areas. More specifically, he conducts design-oriented studies in the Global South, where he collaborates with local technicians and families to design, develop, and deploy novel sensing technologies that have the potential to solve some of the challenges facing homes in Sub-Saharan Africa. Hope’s research has received recognition from Google Research and ACM COMPASS. Hope was a fellow in the Data Science for Social Good program. He used his expertise in machine learning, natural language processing and deep learning to contribute to a project on identifying disinformation in online news articles. Hope has also participated in the Global Innovation Exchange program.

**Dr. Jesse D. Dinneen** – Dr. Dinneen is a Junior professor at the Berlin School of Library and Information Science at Humboldt-Universitat zu Berlin. His primary research interest is in information ethics and personal information management. His research improves people’s everyday lives in the information society (e.g., through systems, services, and perspectives), which necessarily requires integrating technical, social, and philosophical research methods. One of Dr. Dinneen’s current projects is on ethical information services, specifically focusing on libraries and AI, data ethics, and the information society.

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### Multispecies Information Science

**Solhjoo, Niloofar**  
School of Information Management, Victoria University of Wellington, New Zealand  
niloofar.solhjoo@vuw.ac.nz

**Fuller, Steve**  
Department of Sociology, University of Warwick, UK | S.W.Fuller@warwick.ac.uk

**Hartel, Jenna**  
Faculty of Information, University of Toronto, Canada | jenna.hartel@utoronto.ca

**Lueg, Christopher**  
School of Information Sciences, University of Illinois Urbana-Champaign, USA | cplueg@illinois.edu

**van der Linden, Dirk**  
Department of Computer and Information Sciences, Northumbria University, UK | dirk.vanderlinden@northumbria.ac.uk

### ABSTRACT

Information is not just for humans. And humans do not only live with, care for or interact with other humans. Information Science, lagging behind most other social sciences, has not yet broached a public conversation about the multispecies turn. This panel aims to attract attention to the timely and important question of “What is Multispecies Information Science?” An introduction to the topic and key concepts will be established, followed by the provocative reflections on theoretical, methodological, ethical, and practical aspects of the topic. Panelists will bring their own examples of multispecies research, teaching, and design in Information Science and related fields. The discussion about the potential and implications of including Multispecies in Information Science would encourage empathy to non-human animals we live with, and start a new turn in the field.

### KEYWORDS


### INTRODUCTION

Information is not just for humans. And humans do not only live with, care for, or interact with other humans. Other (non-human) animals, capable of thoughts, feelings and consciousness of their surroundings (i.e., sentience), are acting as free-living, working, production, companion, and social entities in our communities. To live and flourish with or without humans, they sense, store, use, and shape information. In fact, all living beings have various capabilities and experiences for information detection and communication (Bates, 2006, see also Bates, 2022).

Information behavior, as a main field of research, is interested in the totality of information making and taking of different types of agents, whether human or non-human (Huvila, 2022, p. 529). In information design, a new class of socio-technical systems, interspecies information systems, is emerging in which both human and animal can take actions based on the information (van der Linden, 2021). Thus, animals do matter, for both the field and the people. Yet, Information Science, lagging behind most other social sciences, has not yet broached a public conversation about this topic; we consider non-human beings outside our scope, or even irrelevant. **The panel at hand aims to attract attention to the timely and important question: What is Multispecies Information Science?**

From the information that a cat actively shapes by staring at you, to information that you take from the collar a cat wears, and the communicative touch between you, there are many emotional, embodied, and intersubjective facets to the interactions between humans, animals, and information. In my PhD research about information experience, I (Niloofar) have attended to this idea to understand how information appears for all the habitats living in a multispecies home: cat, dog, and their human (Solhjoo, et al., 2022a). My theoretical perspective played an important role. I have a holistic and empathic way in exploring information behavior and framed my study within a blend of posthuman and information experience to bring animals, humans, and information all together. Post-humanism is an ontological position that facilitates the contexts for holistic knowledge production. Spanning (2017) post-humanism in educational philosophy draws attention to the myriad ways in which animals are already part of ourselves, our learning and our culture (p. 65). Exploring information within larger ensembles, that include the human, is creating new perspectives and a methodological shift in information science, which we call “Multispecies turn”. For instance, due to the lack of true speech between me and other species, in the research I had to think creatively about possible visual and sensory techniques to include dogs and cats in the research (see Solhjoo et al, 2022b). From my frame of reference, excluding non-human actors would mean that I would miss vital information forms and activities within the texture of a multispecies home.

It is not surprising that information, the red thread that goes through all animal lives, could be studied from many directions and perspectives (Bates, 2022). So, we can learn from multiple species, whose lives are intertwined with us, when it comes to information. Such learning may take different forms, still to be considered by Information Science with empathy and dignity.
THE PANEL

We believe this significant question and topic of a “Multispecies Information Science” is best introduced to the ASIS&T community in a multimodal strategy, centered on a panel and public discussion.

Niloofar Solhjoo is an emerging Information Scientist from Iran, now waiting for the examination of her Doctoral Research on Information Experience of Multispecies Families at the Victoria University of Wellington (VUW), New Zealand. Her passion for animals is recognizable in all her works and studies within the field. Niloofar has worked with different international groups at the intersection of information and animals, the Association for Veterinary Informatics (AVI), the International Conference of Animal Health Information Specialists (ICAHIS), and the European Veterinary Libraries Group. The loss of her dog after seventeen years, became the inspiration of thinking about including non-human animals in Information Behavior Research. She already published theoretical, methodological and practical papers on Information within human-animal daily life in Library and Information Science Research and Journal of Documentation. In her recent photo exhibition she shared a holistic and subjective meaning of information shaping the shared daily activities and experiences of humans and their companion animals. (Solhjoo, 2023).

Niloofar will introduce the Multispecies Information Science and establish the key concepts and definitions. She will visually present her empirical research on this front. Some visual stories of the dogs, cats, and humans will become the origin of knowledge in discussion between audiences and panelists, give them a voice to talk about a Multispecies Information Science.

Then, the invited panelists will share their viewpoints related to the Multispecies Information Science:

Professor Christopher Lueg is a Professor in the School of Information Sciences at the University of Illinois at Urbana-Champaign. Internationally recognized for his research in human computer interaction and information behavior, Dr. Lueg has a special interest in embodiment—the view that perception, action, and cognition are intrinsically linked—and what it means when designing for others. He is an associate editor of the Journal of the Association for Information Science and Technology. Prior to joining the faculty at Illinois, Lueg served as Professor of Medical Informatics at Bern University of Applied Sciences in Biel/Bienne, Switzerland and as a Professor of Computing at the University of Tasmania, Australia, where he co-directed two of the university's research themes, Data, Knowledge and Decisions (DKD) and Creativity, Culture, Society (CCS). Dr. Lueg's doctoral degree in Informatics was awarded by the University of Zurich, Switzerland where he spent his time in the Artificial Intelligence lab, a multi-disciplinary group of scientists exploring the link between embodiment, cognition, and intelligent behavior.

As the first commentator to speak, Dr. Lueg will offer his view about how multispecies focus could influence on our perception, changing perspectives, and other ways of seeing, and what that means for information design and, more broadly, interaction design. In a 2014 Journal of Documentation article he linked the physical reality of our specific bodily configurations to the study of human information behavior and subsequently to information practices. It was a small step to broaden the interest to non-human bodily configurations but the resulting questions were anything but small. Dr. Lueg believes that glimpsing across the species barrier to get at least some idea of what select non-human animals may be seeing will allow us to make more informed decisions when engaging with non-human animals, whether it is in domestic settings, farming, urban design projects, or any other traditionally human-prioritizing activity that impacts on the multi-species environment that we are part of.

Dr. Dirk van der Linden is an Assistant Professor in the Department of Computer and Information Sciences at Northumbria University. His research intersects the human side of requirements engineering, cyberpsychology, and animal-computer interaction. He is co-founder of the Tech4Animals Lab, an international multi-disciplinary research team developing and studying technology for animal science, welfare, well-being and the human-animal relationship. He is a steering member of the International Conference on Animal-Computer Interaction, and served on the organization committee of the International Summer School on Animal-Centered Computing. His work has been covered in press in multiple languages, informed policy briefings distributed among governmental and public bodies on e.g., pet data protection, and led to expert commentary in popular media.

Dr. van der Linden will offer a technological view of human-animal relationship on how technology could change the multispecies contexts for better and worse. He will argue that such technologies need to be understood and designed not as isolated technologies per se, but through an information systems perspective that incorporate an explicit focus on designing for the “Dignity” of the animals affected by those systems. He would display some of their project(s) in the Tech4Animals Lab which critically re-assess how the current trajectory of technology in the companion animal domain needs to be reinvented, and how (AI) data-driven technologies can improve animal welfare and inform professionals of how to understand and behave towards animals in a variety of caring settings.
Professor Steve Fuller is Auguste Comte Professor of Social Epistemology at the University of Warwick, UK. Originally trained in history, philosophy and sociology of science. Fuller is best known for his foundational work in the field of ‘social epistemology’, which is the name of a quarterly journal he founded in 1987 as well as the first of his twenty-five books. His most recent research has focused on what he calls ‘Humanity 2.0’, which concerns the sustainability of ‘humanity’ as a concept in light of emerging ‘trans-’ and ‘post-human’ tendencies in politics, society and culture.

As the commentator to speak, he will offer his view about the nature of animal-based information from the animal rights perspective, which focuses on how the information is gathered and represented. Is consent of the animals required, and if so, what would that look like? What does it mean to ‘do justice’ to the animals in a researcher’s text?

Professor Jenna Hartel (website) is an Associate Professor in the Faculty of Information, University of Toronto, Canada. Her scholarly career has been motivated by the question, "What is the nature of information in the pleasures of life?" To that end, she explores information in pleasurable and profound contexts and she is an expert on visual and creative research methods. Professor Hartel is the creator of INFIDEOS, a YouTube channel of educational videos, where she shares her passion for information in outrageously playful ways. She has published extensively across the Information Science literature and is a recipient of Library Journal/ALISE’s Excellence in Teaching Award (2016) and the ASIS&T/SIG-USE Outstanding Contribution to Information Behavior Award (2022).

At last, Professor Hartel will offer an example of animal-centered narrative in Information Science from her YouTube channel. INFIDEOS' deep collection of material on Information Science history, theory, methods, pedagogy, and practice has created an alternative narrative for Information Science. By design, this new, dynamic, and larger vision of Information Science has a superabundance of animals. A short-list of multispecies actors at INFIDEOS include fish, whales, butterflies, dogs, cats, reindeer, and mountain goats. In fact, most of the 82 videos at INFIDEOS associate Information Science with the flora and fauna of our Earth (and beyond). Indeed, INFIDEOS' mascot is a ring-necked dove named BIBBLE, who is named after Marcia Bates' "Search Tactics." Professor Hartel will display some of these animals in sample video snippets, and then she will delineate five ways our non-human friends uplift and enrich the narrative of Information Science.

Then, the session will turn into a discussion about the potential and implications of including multispecies in Information Science between the panelists and the audiences. There would be provocative reflections on the questions included below but are not limited to:

- What is multispecies information?
- Why is this relevant to Information Science?
- How is this concept unfolding in other fields?
- How multispecies would turn the theory and methodology in our field?
- In what ways the life-word of non-human animals could be studied in Information Science?
- What are a nightmare scenario and a dream scenario of information studies within multispecies?
- How multispecies information behavior could help explore human information behavior?
- What codes of ethics should be made?
- What categories of animals would capture the most attention in Information Science?
- What biases it would make in Information Science?

ACKNOWLEDGMENTS
Thank you to Dr Tim Gorichanaz, Dr Rebecca Noone, Dr Maja Krtalic for their insightful comments on the panel proposal. There was a photography exhibition within this panel about the information experiences of multispecies daily life which is cancelled and will be displayed digitally.

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From Data to Action: Leveraging Open Data to Drive Knowledge-Based Intelligent Governance

Wang, Fang  
Nankai University, China | wangfangnk@nankai.edu.cn

Zhu, Hongzhi  
Nankai University, China | 1120201116@mail.nankai.edu.cn

Wu, Yejun  
Louisiana State University, USA | wuyj@lsu.edu

He, Daqing  
University of Pittsburgh, USA | dah44@pitt.edu

Liu, Xiaozhong  
Worcester Polytechnic Institute, USA | xliu14@wpi.edu

ABSTRACT
Leveraging open data to drive knowledge-based intelligent governance is crucial because it enables evidence-based decision-making, improves service delivery, increases transparency and accountability, and enhances citizen engagement. However, there are challenges associated with the use of data and technology in intelligent governance, including departmental data sharing and openness, practicality and user engagement of government platforms, and security issues. Therefore, our panel invited experts from multiple universities to discuss and provide solutions to these theoretical and practical challenges. We aim to deeply analyze the existing problems in theory and practice, and provide solutions to promote the development of knowledge-based intelligent governance. The importance of this panel lies in the promotion of evidence-based decision-making and the development of innovative digital public service capabilities to improve government responsiveness and citizen trust.

KEYWORDS
Open Data; Intelligent Governance; Data governance.

INTRODUCTION
Knowledge-based Intelligent Governance is a concept that emphasizes the use of knowledge and intelligent technologies to improve governance processes (Kartajaya et al., 2016). “Knowledge-based” refers to the utilization of data, information, and expertise to make informed decisions, enhancing the scientific and accurate nature of decision-making. “Intelligent” refers to the use of advanced tools such as artificial intelligence, machine learning, and data analytics to conduct scientific analyses and provide problem-solving solutions, leading to cost savings and improved decision efficiency (Ma, 2020; Yigitcanlar et al., 2020). This governance approach enables policymakers to make evidence-based decisions that align with citizen needs and preferences (Son et al., 2023). While devolving decision-making power, governments also empower the legitimacy of these decisions at a higher level of complexity (Berggruen & Gardels, 2013).

Knowledge-based intelligent governance is a powerful tool that can be utilized to create data and knowledge-based decisions, which have a good social and economic impact (Chang et al., 2018). One of the main advantages of this approach is improved service delivery, which can raise citizen happiness and trust in the government (Chen et al., 2021). Two further significant benefits of knowledge-based intelligent governance are increased accountability and openness. By making data more available to the public, governments can show their dedication to openness and enable people to hold them responsible for their actions. This can support the growth of public trust in the government, which can result in more wise and effective policy choices (Repette et al., 2021). Furthermore, knowledge-based intelligent governance can improve citizen involvement by giving citizens access to data and information that will allow them to participate more actively in decision-making processes. This can result in more informed and effective policy decisions that represent citizens' needs and preferences (Guenduez et al., 2020).

However, there are also challenges associated with the use of data and technology in intelligent governance. Within the government, there are obstacles to cross-departmental government data sharing and government data openness. Due to concerns about the negative consequences of data usage, some departments have chosen to delay responding to data requests from other departments (Wang, 2018). The government needs to update its understanding of technology and services internally to improve the practicality and user engagement of government governance platforms (Janowski, 2015). The security and ethics issues in the construction of digital government also require corresponding response strategies and technical solutions (Yang et al., 2019).

With the arrival of the COVID-19 pandemic and related turbulence, the government's digital transformation is not an option, but a necessary condition for the government to handle the crisis (Eom et al., 2022). On the one hand, governments around the world are strategically utilizing new digital technologies and developing innovative digital public service capabilities to respond to and overcome this pandemic (Agostino et al., 2021; Xie et al., 2020). On the other hand, the particularity of pandemic prevention and control highlights the difficulties and paradoxes in the construction of intelligent governance. For the sake of public security, the debate about how much data and digital...
technology can penetrate into daily life, and how citizens negotiate the rapid digital transformation of the country, has become increasingly fierce (Gerli et al., 2022; Yoon et al., 2021).

The authors of this panel proposal are five researchers from different countries. Prof. Fang Wang, one of the panelists, has been conducting Open Data research for many years, investigating subjects such as the hazards connected with government data release and the development of an emergency management ontology. She also works for the Chinese Academy of Sciences' literature and information department, where she performs research on scientific data management and protection. Dr. Yejun Wu employs chatGPT for exploratory analysis of open datasets, specifically focusing on digital document collections. By utilizing chatGPT, several example datasets will be examined to showcase the potential applications of this approach. This preliminary exploration will offer valuable insights into how chatGPT can be effectively employed for analyzing open datasets, thereby contributing to data-based intelligent governance. Prof. Daqing He is interested in assisting the public in accessing and utilizing government open data. He works on human data interaction framework and related data literacy requirements, which enables the identification of important contextual information for accessing government datasets. His discussion contributes to intelligent governance from the access and usability of government datasets. Dr. Liu Xiaozhong’s research focuses on the fields of metadata and computational social sciences. His research enables more people to access, understand, and utilize data by ensuring its accessibility. In addition, his research also focuses on racial bias in artificial intelligence. Identify and correct biases through the development of algorithms and technologies, as well as promote the formulation of relevant policies and guidelines. Hongzhi Zhu, a doctor candidate. Her research focuses on personal privacy protection in government information disclosure. By bringing together professionals from multiple universities, it has created a collaborative platform for knowledge exchange and aims to advance initiatives for open data in support of knowledge-based intelligent governance.

OPEN DATA IN GOVERNMENT

Open data plays a crucial role in knowledge-based intelligent governance, where it serves as a catalyst for transparency, accountability, innovation, and decentralized decision-making (Dawes, 2010). Open data refers to data that is freely available for use, reuse, and redistribution by anyone for any purpose (Veljović et al., 2014). This data is typically made available in machine-readable formats and can be accessed through APIs, web portals, or other tools, which allows it to be easily accessed and reused (Roman et al., 2018).

Governments, academic institutions, and private companies are key sources of open data, with the public sector being significant producers and holders of information (Aichholzer et al., 2005). In the past few years, the number and types of open data released by public administration departments around the world has significantly increased. Making public sector information available as open data has the potential to create significant value, catering to a broad range of stakeholders, including businesses, NGOs, developers, and everyday citizens. It is believed that wider and simpler dissemination of public datasets could lead to interesting and unforeseen uses, even for commercial purposes (Vickery, 2011). Furthermore, it could enhance transparency in public institutions (Gunawong, 2015) and promote a more decentralized approach to understanding complex phenomena (Janssen et al., 2012). With the extensive application of open data in knowledge-driven intelligent governance, it will greatly change our way of thinking and decision-making processes.

BENEFITS OF OPEN DATA FOR GOVERNANCE

Open data plays a critical role in driving knowledge-based intelligent governance. By enabling real-time access to high-quality data, governments can make better-informed decisions and policies based on empirical evidence rather than conjecture, which benefits public health and social welfare (Jetzek et al., 2019).

Open data enables the pooling and analysis of massive volumes of data across different areas, such as health, education, and public safety, allowing government authorities to discover insights and trends that might otherwise go unreported. This can aid in the formulation of more focused policies and interventions customized to specific needs and demographics (Fan et al., 2020; Decerf et al., 2021).

Furthermore, the application of artificial intelligence (AI) and machine learning (ML) algorithms can expand open data's potential for intelligent governance. Many of the data analysis procedures can be automated and streamlined using these technologies, allowing for more efficient and accurate decision-making (Pi, 2021; Margetts et al., 2022). Predictive analysis algorithms, for example, can forecast the rise and pandemic tendency of COVID-19, allowing government officials to take proactive measures before the problem worsens (Tuli et al., 2020).

Governments can take a more proactive and data-driven approach to governance by harnessing open data and cutting-edge technologies such as AI and ML, resulting in more successful policies and programs that are personalized to the individual requirements of the population. This can assist in improving service delivery, enhancing public trust, and increased overall societal well-being.
CHALLENGES AND RISKS ASSOCIATED WITH OPEN DATA FOR GOVERNANCE

While open data offers many benefits for governance, there are also several challenges and ethical considerations that need to be addressed. The rapid growth of government data poses challenges to ensuring the accuracy, timeliness, and completeness of data quality. The unclear dependency relationship between data and algorithms can easily lead to deviation or skewness in the results of AI algorithms, thereby affecting the accuracy of decision-making (Janssen et al., 2020).

Another challenge lies in the interoperability of Open Government Data (OGD) and legacy systems, where valuable data remains trapped due to a lack of compatibility (Lodato et al., 2021). In a sense, the arrival of COVID-19 has accelerated the pace of government digital construction. To ensure the efficient and effective use of pandemic data, the government must ensure interoperability and accessibility between different systems (Coelho et al., 2022). The application of new technologies and algorithms has promoted government decision-making based on knowledge intelligent management (Legido-Quigley et al., 2020).

However, the COVID-19 pandemic also revealed difficulties associated with open data for governance. On the one hand, it has revealed the existence of significant disparities in access to healthcare, education, and social support, which are exacerbated by unequal access to information. Open data initiatives may exclude individuals or groups who lack the necessary digital skills, language proficiency, or internet access to benefit from them (Van et al., 2020). On the other hand, the release of open data can lead to the exposure of personal information, which can compromise privacy (Baack, 2015). The threat to democracy does not stem from the information itself but rather from how it is utilized. This includes the government's capacity to handle the use and misuse of information, policies regarding the dissemination of information, and the design of information systems that enable such dissemination (Janssen et al., 2015). In order to reconcile the possible contradiction between government information disclosure and personal information protection, Wang and others analyzed the flow survey report of the local government of China on COVID-19 and proposed a classification framework of personal information disclosure for major public emergencies, with a view to providing guidance and reference for the government to disclose personal information (Wang et al., 2022).

Considering these challenges, utilizing open government data for knowledge-based intelligent governance is a complex system work. While open data holds significant potential for knowledge-based intelligent governance, it is vital to address challenges related to data quality, interoperability, and ethical considerations. Striking a balance between information disclosure and privacy protection is crucial to ensuring equitable access, safeguarding individual rights, and upholding democratic values in the use of open data for governance.

ABOUT THE PANEL

The roundtable aims to engage in insightful conversations regarding the role of open data in evidence-based decision-making, ethical considerations in data governance, and strategies to overcome challenges in data quality and privacy protection. Through knowledge sharing and collaborative discussions, the participants will highlight successful case studies and best practices in utilizing open data to address societal challenges and improve public services. The discussion will foster an environment of learning and collaboration, aiming to establish networks and partnerships that promote the utilization of open data for knowledge-based intelligent governance, ultimately leading to more informed policies and better outcomes for society. The session will take the style of a roundtable discussion, with each invited speaker having 15 minutes to express their insights on the prospects and problems of open data research, as well as provide potential solutions. Following that, there will be a 45-minute interactive Q&A session during which the audience will be able to interact with the panelists. Two questions have been set to guide the discussion: 1. How can governments ensure inclusivity and accessibility in open data initiatives to ensure that all segments of society can benefit from the knowledge-based intelligent governance approach? 2. What are the key strategies to address privacy concerns and maintain data security while promoting open data sharing for governance purposes? Professor Fang Wang of Nankai University in China will oversee the roundtable discussion and ensure that all points of view are heard.

ANELISTS' BIOGRAPHIES

Fang Wang, professor of Information Science and director of the Center for Network Society Governance at Nankai University's Business School in China. She was a Fulbright Scholar at UMASS Amherst in 1999-2000 and has led over 40 research projects funded by the NSFC and other foundations. She has authored more than 170 papers and 11 books or chapters on topics such as government data openness and sharing, scientific data curation, knowledge discovery, and diffusion. Her research center has hosted over 10 academic meetings or seminars with more than 2300 participants, and she is currently chairing her second Major Program of National Social Science Foundation of China on "Intelligent governance of digital government based on data sharing and knowledge reuse."

Yejun Wu, associate professor in the School of Information Studies at Louisiana State University. His research is focused on knowledge organization systems (such as taxonomy, thesaurus, topic map, and ontology) and their
applications in facilitating learning, information retrieval, and knowledge discovery. He also works on digital repositories and digital libraries.

Daqing He, professor at School of Computing and Information (SCI), the University of Pittsburgh. His research interests are primarily focused on text mining and natural language processing, human centered computing and intelligent system design. He also works on human data interaction and scholar data management.

Xiaozhong Liu, associate professor at data science, Worcester Polytechnic Institute. His research focuses on knowledge management, natural language processing, and computational social science. His recent project investigates pandemic social preparedness/inequity for different communities.

Hongzhi Zhu, a doctoral candidate in Information Science at Nankai University's Business School in China. Her research interests are government information resource management and text mining.

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Digital Inequalities to Digital Inclusion in Online Learning: Viewpoints of LIS Educators Seeking to Bridge the Disparities

Warraich, Nosheen  
University of the Punjab, Pakistan | nosheen.im@pu.edu.pk

Caidi, Nadia  
University of Toronto, Canada | nadia.caidi@utoronto.ca

Mehra, Bharat  
University of Alabama, USA | bmehra@ua.edu

Ekmekcioglu, Cansu  
Univ. of Toronto, Canada | cansu.emekcioglu@mail.utoronto.ca

Ali, Irfan  
Government College University, Lahore, Pakistan | irfanalipu@gmail.com

ABSTRACT
Academics argue that the COVID-19 pandemic has limited students' ability to learn, with significant digital inequities occurring between students from the global North and the global South. Students and academics from developing nations encountered particular challenges and difficulties with the move to online learning. Much like their colleagues from developed countries, they were unprepared for this predicament, but on top of the crisis context, deeper issues were having to do with digital inequalities and disparities that were exacerbated by the inadequate digital infrastructure (smart devices/gadgets, internet access, and speed) and online interaction abilities and practices. The goal of this panel is to address the pressing issue of digital inclusion in online education, specifically the broader challenge of ensuring that online education is accessible to all. As information researchers continue to work towards enhancing online learning, it is crucial to address the disparities in the sharing of information and knowledge and to bridge the gaps that exist across communities and nations. The panelists (three of whom work in developed countries and two in developing countries) will relate their experiences and viewpoints thus bringing their knowledge to bear in examining the concepts of digital inequality and digital inclusion. The rest of the session will be devoted to discussions and brainstorming with attendees around these issues, with special attention being given to perspectives that seek to bridge the disparities and promote inclusion in education.

KEYWORDS
LIS Education; Online Learning; Digital inequalities; Digital Inclusion; Inclusive LIS Education

INTRODUCTION
Digital inequality refers to the disparity in the access, distribution of technology, and information because of various socioeconomic and cultural factors (Reynolds et al., 2022, Welser et al., 2019, Livingstone and Helsper, 2010). Appropriate technological infrastructure, facilitating the use of suitable technological tools, and providing adequate training for online educators are important for online learning (Livingstone, 2012).

The panelists will talk about the online learning experiences of different student populations, including the rural and disadvantaged ones. This panel discussion will establish the critical challenges and obstacles that distant students face with online learning during the COVID-19 pandemic lockdown. The panelists are from both developing and developed nations, so their knowledge will be useful in understanding the issue of digital inequality and how it is harnessed and potentially transformed into digital inclusion. Inadequate technology, an unfamiliar academic atmosphere, digital disconnect, physical well-being, learning preference disconnects with instructional delivery, diversions due to the medium, and digital illiteracy skills of both teachers and students are some of the challenges academics and students experience in online learning. The panelists will also highlight the challenges in online learning including issues of disconnectedness, social isolation, and separation (both temporal and geographical) during the pandemic, and how these challenges contributed to amplifying the challenges students faced. Indeed, digital inequity is not only about having access to new equipment and software, information, and services; it is also about acquiring the appropriate digital literacy training and the skills and means to properly utilize these services. Furthermore, it is essential to understand the digital learning environment of students so that instructional delivery can be optimized.

The panel discussion will help to bridge gaps in conversations around online education and identify the needs of the academic community's less privileged members. The disparity in effective access to information and knowledge through online learning is a major cause of continued marginalization within certain communities, and a timely and critical agenda for information researchers who are working to counteract it.

PROPOSED PANEL
Goals
This panel idea originated from a series of discussions with ASIS&T (and other) colleagues about the disparities in online learning systems in the developing and developed world. Indeed, LIS schools in developing countries were faced with the need to take up online teaching and learning during the COVID-19 pandemic as a means of...
addressing their academic responsibilities. Not surprisingly, there were differences in the online learning experiences and practices between countries and within local/regional contexts. We deem it vital to have this conversation so that developing nations can share their experiences, lessons learned, and strategies used to cope with these challenges. This approach is well suited for an ASIS&T meeting, and this panel is a timely effort to engage our broad and diverse information science community with these critical issues of digital inclusion in online education, and specifically the broader challenge of ensuring that online education is accessible to all—with colleagues from developing nations leading the conversation.

Panelists
This 90-minute panel will be led by five LIS researchers: Dr. Nosheen Warraich, Chair-Elect of SIG-InfoLearn, Dr. Nadia Caidi (also a Past President of ASIS&T), and Dr. Bharat Mehra, as well as two doctoral candidates, Cansu Ekmekcioğlu (Ph.D. candidate, New Leader, and first-generation international student), and Irfan Ali (a recent Ph.D. graduate living and working in Pakistan). All the panelists have experience teaching and/or learning online. They will present both the instructors’ and students’ perspectives of life under COVID along with issues about developing and developed countries’ scenarios.

Biographies of Panelists
Nosheen Fatima Warraich is a Professor and Director at the Institute of Information Management, University of the Punjab, Lahore-Pakistan. She received her Ph.D. from the University of the Punjab in 2011. Dr. Warraich was a Fulbright Fellow/Scholar and completed her postdoctoral research at the University at Albany, State University of New York (SUNY) in the United States. She is active in international professional associations such as ASIS&T where she was awarded the ASIS&T New Leader Award (2017-19). She has been serving as Chair-Elect, SIG-InfoLearn and Co-Chair Elect, SIG-III. She is the recipient of an ASIS&T James M. Cretsos Leadership Award for 2023

Nadia Caidi is a Professor at the Faculty of Information, University of Toronto, Canada. Her research focuses on human information behavior in the context of global migration. She has also examined the changing conceptions of diversity, equity, and inclusion in the LIS fields. Her book, "Humanizing LIS Education and Practice: Diversity by Design" (with Keren Dali), was published by Routledge in 2021. Dr. Caidi was the 2011 President of the Canadian Association for Information Science (CAIS), and the 2016 President of ASIS&T. In 2019, ALISE awarded her the Pratt-Severn Faculty Innovation Award.

Bharat Mehra is EBSCO Endowed Chair in Social Justice and Professor in the School of Library & Information Studies at the University of Alabama, Tuscaloosa, USA. His research focuses on diversity and social justice in LIS and community informatics or the use of ICTs to empower minority and underserved populations to make meaningful changes in their everyday lives. He has applied action research to further community engagement while partnering with racial/ethnic groups, international diaspora, sexual minorities, rural communities, low-income families, small businesses, and others, to represent their experiences and perspectives in the design of community-based information systems and services.

Cansu Ekmekcioğlu is a doctoral candidate at the Faculty of Information, University of Toronto, Canada. Her research investigates the role of emerging technologies in humanitarian and immigrant settlement contexts in Canada. Her studies encompass human-computer interaction, public policy, information science, critical data studies, and migration studies. She is the recipient of an ASIS&T New Leader Award for 2023.

Irfan Ali recently completed his doctoral degree from the University of the Punjab in the field of Information Management. His area of research is personal information management and archiving. Currently, He is serving as a librarian at Government College University Lahore-Pakistan.

Structure
1. Panel - Sharing Experiences (30 minutes):
   - The moderator/ principal author provides an in-depth introduction to the panel topic, contextualizing the challenges of online learning in diverse educational settings.
   - The panelists share their own experiences, highlighting the challenges they have faced in online learning and any innovative solutions they have implemented.
   - Participants engage in open and reflective discussions, sharing their own experiences and perspectives.

2. World Café Round 1 - Digital Inequalities and Digital Inclusion (20 minutes):
   - In small groups, the panelists then shed light on the digital inequalities prevalent in online learning, drawing upon their diverse backgrounds and representing both developing and developed country contexts. They examine how the sense of disconnectedness and isolation, temporal and geographical
separation, can compound the difficulties faced by students and the Faculty, exacerbating the strain on their educational and teaching journeys.

- The audience is invited to share their own experiences and perspectives on digital inequalities in online learning.
- A facilitated discussion allows for the exchange of ideas and collective exploration of how digital inclusion can transform these challenges into digital inclusion opportunities.

3. **World Café Round 2 - Promoting Digital Inclusiveness in LIS Education (20 minutes):**

- In small groups, informed by the interactions with the audience and enriched by their encounters, the panelists converge to elucidate strategic pathways for nurturing digital inclusion within the domain of LIS education amidst the realm of online learning.
- By acknowledging the amplified challenges students faced during the pandemic, including the aforementioned sense of disconnectedness, isolation, and temporal and geographical separation, the panelists embark upon a journey of insight-driven exploration.
- The panelists endeavor to forge innovative solutions that address these challenges head-on, fostering digital inclusiveness and paving the way for a more equitable and supportive online learning environment in LIS education.

4. **Whole Group Synthesis and Closing Remarks (20 minutes):**

- Participants reconvene as a whole group, and the facilitators from each small group present a summary of the discussions and key recommendations for promoting digital inclusiveness in LIS education.
- The moderator facilitates a final discussion, allowing panelists and audience members to contribute additional insights and reflections.
- The panel concludes with closing remarks from the moderator, emphasizing the importance of digital inclusion in online learning and the value of collective efforts in addressing the challenges identified during the panel.

**EXPECTED OUTCOME**

The last 60 minutes of this panel will generate a lively discussion on the challenges of online learning and how LIS educators bridge these disparities. It is expected that based on discussion and brainstorming sessions with participants, a journal article will be published by identifying the ways to manage digital inequalities. In this way, the findings will be shared with a wider audience. Moreover, the principal author is interested to share the recommendation with her university and higher education authorities to develop a policy document as a guideline to better engage with online teaching and learning and encourage digital inclusion.

**CONCLUSION**

The goals, structure, and expected outcome of this proposed panel align with the theme of the 86th ASIS&T Annual Meeting – Making a Difference: Translating Information Research into Practice, Policy, and Action”. This panel will be a small step to translate our knowledge and experience toward policy-making in developing countries. This panel and the expected outcome can meet the growing demand of LIS educationists in developing countries for guidance to overcome digital inequalities and to be more inclusive for diverse students.

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Information Science in Europe: Current Perspectives

Webber, Sheila
University of Sheffield Information School | s.webber@sheffield.ac.uk

Aparac-Jelusic, Tatjana
Retired Distinguished Professor, University of Zadar, Croatia | aparact@gmail.com

Pestana, Olivia
CITCEM, Faculty of Arts and Humanities, University of Porto, Portugal, | opestana@reit.up.pt

ABSTRACT
This panel aims to discuss and critique the position of Information Science (IS) in European countries. This will be achieved through panel presentations and through critical discussion of key questions amongst the participants in the session. The introduction to the panel will identify issues that emerge from studies of IS in European countries, and in particular points that emerged from two previous ASIS&T annual meeting panel sessions. Presentations on the current situation of IS in the United Kingdom, Portugal, and countries from the former Yugoslavia will be given and briefly compared. The focus will then move to session participants, whose views on the state of IS in their own country will be solicited in a structured manner. The academic value will be in providing insight into current IS development and challenges in countries with varying histories of IS engagement. The practical value will be in the exchange of views through participation and the ideas that can be generated for future activities of the ASIS&T European Chapter.

KEYWORDS
Information Science; Europe

INTRODUCTION
The aim of this panel is to reflect on, and critique, the position of Information Science (IS) in European countries, to stimulate critical discussion on Information Science's international role in a developing information society. After an introduction highlighting issues across Europe, the panellists will focus on the situation in countries in three different European regions: the United Kingdom (UK) (Northern Europe), Portugal (Southern Europe) and the countries of the former Yugoslavia (Central and Eastern Europe). As well as representing different geographic regions of Europe, Information Science is at a different stage of development in the three countries, and has varying cultural influences.

BACKGROUND
Following the panellists' contributions, participants will be invited to contribute with their perspectives of IS in their own countries. They will be asked to reflect on distinctive national characteristics, country-specific challenges and opportunities, and the relationship of IS with documentation, librarianship and more recent fields such as data science and misinformation studies. Participants will also be prompted to identify cross-boundary issues, particularly in the European context.

European countries have varied and rich development paths of documentation and Information Science, which are only patchily investigated and documented (Ibekwe, 2019). In their bibliometric study of information science Larivière et al (2012, pp.999) identified that "the journals and topics that dominate the scholarly landscape of one country may not exercise the same influence elsewhere: geography, language, and political systems shape what is published and read". The complexity starts with the name of the discipline: Ibekwe et al. (2019) trace how IS has been perceived and named in different countries. It could be added that information science is still a contested concept with various approaches taken in order to define its content, research problems and boundaries, although some European authors have made a significant contribution in the discipline’s development (for example, Capurro & Hjørland, 2003, Ibekwe, 2019).

Whilst most literature on IS development focuses on one country, or a small group of closely related European countries, Ibekwe’s (2019) landmark work provides insights into IS in seven countries (France, Spain, Portugal, Denmark, Sweden, Norway and Yugoslavia) and Ibekwe urges scholars to tackle further comparative studies of IS development. A panel at the 2010 ASIS&T annual meeting (Ibekwe-Sanjuan et al., 2010) revealed the different disciplinary landscapes, intellectual forces, political policies and educational structures that influence different European countries. In a subsequent ASIS&T annual meeting panel (Aparac-Jelušić et al., 2014) contributors concentrated on interdisciplinarity, and the theoretical and methodological boundaries of information science in European countries.

PANELLISTS’ CONTRIBUTIONS
Sheila Webber will start the panel by noting issues touched on in the introduction (above), and highlighting conclusions from the previous panels Ibekwe-Sanjuan et al. (2010) and Aparac-Jelušić et al. (2014).

Webber will then critique the current state of IS in the United Kingdom (UK), using her own review of the situation 20 years ago (Webber, 2003) and Robinson & Bawden (2013) as starting points. Webber (2003) argues that IS is a
soft-applied discipline, and she is inspired by Brookes (1974, pp.149) interpretation that “life is a continuous information process in which physical, genetic, sensory, and cognitive component all act together”, seeing the ‘information’ component of IS extending beyond exosomatic information. Whilst information Science in the United States and the UK has been seen as similar (as implied by use of terms such as Anglo-Saxon or Anglo-American, e.g. Ingwersen, 1997), the discipline had distinctive trajectories in the two countries. This has become even more notable since the merger of the Institute of Information Scientists with the (UK) Library Association to form CILIP in 2002, meaning that there is subsequently no professional association focused on Information Science or documentation in the UK, and no UK-based Information Science conference. This period also coincides with a decline in the number of library and information schools, whilst departments and programmes containing the phrase “Information Science” have not increased from the minority described in Webber (2003).

Robinson & Bawden (2013, pp.756) propose five particular characteristics for IS in the UK including “its broad approach to information and information science; its status as an academic subject with a strong professional remit; its involvement with, but distinction from, information technology”. These characteristics will also be examined to consider how they both strengthen and weaken IS.

**Tatjana Aparac** will contribute with her views on connections, permeations, and influences of/ on information professionals in German-speaking and Slavonic countries, especially former Yugoslavia. Her approach is comparative in nature and reflects on the development of documentation, its relationship to librarianship and the growth of a new discipline of information science. She draws on work in progress (Aparac-Jelusic & Mandl) and previous scholarship on this topic (e.g. Pehar & Aparac-Jelusic, 2012).

**Olivia Pestana** will give perspectives on Information Science in Portuguese academic and professional settings. This presentation will focus on the Portuguese evolution of Information Science, highlighting education, research and professional impacts of this scientific field. The construction of the field of Information Science in Portugal began at the end of the 19th century, when the first training programme was created: The Higher Programme for Librarians and Archivists in 1887.

At that time, the emergence of information science as we call it today was not yet apparent, as identified by Borko (1968). This was reflected in the creation of new university programmes which, while including the applied aspects of library and archives studies, took a broader and more comprehensive view of work in a business context, but always with a defined object of study: information and its phenomena. These new programmes appeared in the first decade of this millennium and include, in whole or in part, the IS designation.

The requirements of accreditation/evaluation procedures of academic programmes had a deep impact on Portuguese academic education. In recent years, there has been a severe reduction in the number of programmes available, and the approval of new programmes requires the university/faculty to have robust research structures and a stable faculty staff with a consolidated academic career.

IS as a science has a clear representation in academic education. In line with Webber (2003), it is found to be used in most academic departments and not in professional associations, with the focus remaining on libraries and archives. As the training is geared towards applied IS, while maintaining a solid grounding in theoretical principles, the high employability rates of graduates show the vitality of the programmes.

The panellists’ contribution will finish by summarising similarities and differences in the country presentations.

**PARTICIPANT ENGAGEMENT**

Following panellists' contribution we will ask audience members to provide their own responses to questions relating to information science in their own country, for example:

- What was the impetus that enabled the development of IS in your country/region?
- Where does the main influence for the IS in your country/region come from and have influencing factors changed over time?
- Do you feel that IS is developing or declining in your country?
- What do you see as the rising or dominant information/ documentation disciplines in your country?
- What are the important and unexplored questions or issues concerning IS in your country?
- Are IS researchers and practitioners making a contribution to policy in areas such as sustainability, decolonisation and combatting misinformation?

We will engage participants in three ways. First, we will use an instant response application (e.g. Mentimeter) to answer more straightforward questions, such as which countries are represented, and whether participants see IS as
thriving or declining in their country. This will enable panellists and participants to start to get a broad picture of their colleagues in the panel session. Secondly, we will ask people to discuss a couple of more complex questions (such as influencing factors on IS, and unexplored questions in IS) with their neighbours and respond during the session orally or via a digital board such as a Padlet. Thirdly, both for those who have anxieties about group discussion and feedback, and for those who want to record more of their ideas, we will set up a Google form which enables them to select and respond to the questions that interest them. The panel will facilitate feedback from participants at the end of the session, and will also make the digital responses available after the panel’s conclusion via ASIS&T iConnect.

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Conceptualizing Data Behavior: Bridging Data-centric and User-centric Approaches

Zhang, Pengyi  
Peking University, China | pengyi@pku.edu.cn

Gregory, Kathleen  
University of Vienna, Austria | kathleen.gregory@univie.ac.at

Yoon, Ayoung  
Indiana University Indianapolis, USA | ayyoon@iupui.edu

Palmer, Carole  
University of Washington, USA | clpalmer@uw.edu

ABSTRACT
With the development of technologies in big data and AI, data has become more and more central to users for various tasks in different contexts. Yet the concept of data behavior, an emerging concept that captures the actions and interactions of individuals with data in various contexts and situations is not explicitly defined and framed. Data behavior focuses on the observable actions and reactions of users when they encounter, discover, seek, use, or create data for individual or collaborative tasks, while data practice encompasses the entire spectrum of how people work with data, from creating and managing to sharing and reusing data, as well as the intentional and strategic decisions and actions involved in these processes. This panel proposes a conversation and discussion about the concepts of data practice and data behavior by drawing on literature in data practice, data curation, and information behavior. This panel aims to discuss, compare, and bridge data-centric and user-centric approaches to conceptualizing data behavior. It will also present some examples of data behavior research in different domains and scenarios. The panel will highlight the challenges and opportunities of data behavior research for information science and practice.

KEYWORDS
Data behavior, data practice, data needs, research data, open data, data curation and stewardship

INTRODUCTION
Data has become the foundation of various activities in the age of AI. How people interact with data is often referred to as “data practice”, which describes the work (activities and decisions) of generating, managing, sharing, and reusing data (Chao et al., 2015; Palmer et al., 2009). Data practice includes various aspects, such as data management, data collection and generation, data processing, data analysis interpretation and abstraction, data presentation, data sharing, data citation, and data publication. Further, a practice encompasses multiple activities. For example, data processing involves preprocessing, data cleaning, data transformation, and so on (Chao et al., 2015). Data practice in research data sharing and reuse (Tedersoo et al., 2021; Yoon & Kim, 2017, 2020; Kim & Nah, 2018) has drawn a lot of attention.

Another commonly used concept is “data lifecycle” when studying data management or curation. The lifecycle model is often used to plan the workflow of data management or curation activities in a project (Christopherson et al., 2020; Cox & Tam, 2018; Higgins, 2008), so that the data maintains its authenticity and reliability throughout its entire cycle from generation, storage to acquisition and use (Pennock, 2007). The data lifecycle includes data-related activities such as planning, data collection, data processing and analysis, data publishing and sharing, data preservation, data discovery, and data reuse (Gupta & Müller-Birn, 2018; UK Data Service, 2019); the data curation lifecycle model also includes activities such as data appraisal and storage that are performed by librarians and data managers (Higgins, 2008).

Previous efforts focus more on understanding “practices” rather than individuals’ behaviors. Existing research tend to emphasize “communities”, such as disciplinary contexts and data types, than individuals. Individual users’ data needs, and data search, use, and reuse may be better understood through a behavioral lens (Li & Zhang, 2022). Table 1 compares three perspectives to conceptualize data-related activities, including data lifecycle, data practice, and data behavior.
Data Lifecycle | Data Practice | Data Behavior
---|---|---
**Perspective** | **Data** | **Group and community** | **Individual**
**Research focus** | The authenticity, reliability, integrity, and usability of data throughout its lifecycle. | The general actions and experience within a group, community, or organizational institution. | The individual behaviors under a specific context or task.
**Potential implications** | Data management, data preservation, data curation, etc. | Development of data infrastructure, data policy, data management, etc. | Design of data platforms and tools, data collections, data management, etc.

| **Table 1. Comparison of Different Perspectives to Conceptualize Data-related Activities** |

There seems to be an increasing need to describe these data-related activities from the users’ perspective and call for the conceptualization of data behavior. This panel hopes to invite a discussion and conversation to better understand the user-centered concept of data behavior by drawing analogies between information and data, and between information behavior and data behavior. There has been research linking behaviors such as finding data with information seeking behavior (Gregory et al., 2020; Rolland & Lee, 2013; Zimmerman, 2007), relating data sensemaking to information sensemaking (Koesten et al., 2021), and comparing the process of data reuse with the ISP model (Wang et al., 2021). Studies on scholars’ information behaviors also encompass their interactions with data (Meho & Tibbo, 2003). However, data behavior is not a well-defined or well-understood concept, and there is a lack of consensus and clarity on its definition, scope, dimensions, and measurement. It may be feasible to construct a conceptual framework of data behavior by bridging the data-centric and user-centric approaches and building on the concepts and theoretical models in information behavior research.

This panel has three objectives:
1. to compare and bridge data behavior and data practice in different domains and scenarios;
2. to conceptualize data behavior from data-centric and user-centric approaches, and
3. to propose a framework for data behavior research and practice.

The panelists are researchers from different domains related to data behavior or data practice and each contributes a unique perspective and content to the session. The four presentations will together provide a comprehensive overview of data-centric and user-centric conceptualizations:
- The first presentation will compare and connect the concepts of data behavior and information behavior, discuss their similarities, differences, and interactions.
- The second presentation will focus on the starting point of data behavior, namely data needs, and explore how they can be conceptualized, especially in research contexts.
- The third presentation will examine another aspect of data behavior, namely data reuse, in scientific and community data contexts, to show how understanding individuals’ data behavior can inform data policies, education, management, and infrastructure.
- The fourth presentation will discuss the essential role of data practices research to inform and improve discipline responsive curation and stewardship, asserting the field’s responsibility to pay attention to data integrity and data potentials.

**FORMAT AND STRUCTURE**
The panel will last for 90 minutes, divided into three parts. The first part will last for 50 minutes. After a 2-minute introduction, each panelist will give a 12-minute presentation (including 2 minutes for Q&A) on their views and insights on data practice and data behavior. The second part will last for 30 minutes. The moderator will pose questions to the panelists and invite them to share their opinions and feedback on each other’s points. The panelists will also engage with the questions and comments from the audience. The third part will last for 10 minutes. The panel will end with brief summary reflections from each panelist and closing remarks from the moderator.

**Part 1: Panelist presentations (50 minutes)**
**Data behavior vs. information behavior: similarities, differences, and interactions.** Zhang will discuss the emerging concept of data behavior and how it relates to information behavior. It will compare and contrast the two concepts in terms of definitions, models, theories, and research methods. It will also examine the interactions between data behavior and information behavior in various contexts and situations. The presentation will highlight the implications of data behavior research for information science and practice.
Conceptualizing (researchers’) data needs. Gregory will draw on the concept of ‘information needs’ and empirical work with researchers across disciplines to consider how ‘data needs’ can be conceptualized in the study of data behavior and data practices – and why it is important to do so. The presentation will briefly review how data needs have been studied in the existing literature, their relationship with metadata and documentation, and the socially situated nature of data needs themselves.

Data reuse behavior: comparative views in the context of scientific and community data. Yoon will present data behaviors of two different data reuser groups, social scientists who are reusing research data and citizens who are reusing community/open data. This presentation will first illustrate the process of data reuse in those two contexts with reusers’ needs and motivations. It will then discuss the factors that influence their data behaviors at different levels: individual (skills, characteristics), community/organizational, social, and infrastructural levels. The presentation will demonstrate the importance of understanding the data behavior of individuals for designing and implementing effective data policies, educations and trainings, data management strategies, as well as data infrastructure systems.

Data practices research for discipline responsive curation and stewardship. Palmer will discuss the essential role of data practices research in response to data services trends within the academic research enterprise. She will argue for a robust understanding of the dynamics of disciplinary research methods and associated data practices, contrasting her current work on data stewardship to support Indigenous scholarship with ongoing studies of data curation for cross-disciplinary convergence research. Offering her perspectives on the unique contribution of discipline-responsive data practices research, she will assert the field’s responsibility to invest in fundamental knowledge and expertise in data integrity and data potentials.

Part 2: Discussion (30 minutes)
The panel will engage in a systematic and comprehensive discussion among the panelists, and invite the audience for questions and comments for discussion on the following themes and issues:

- What are the motivations and challenges for studying data behavior?
- How does data behavior differ from or relate to information behavior?
- How to define and operationalize data behavior as a distinct concept from other related concepts such as data practice, data lifecycle, data literacy, etc.?
- How to foster a collaborative and interdisciplinary dialogue on data behavior research and practice across different disciplines?
- What are the implications of data behavior research and practice for data curation and data infrastructure?
- What are the future directions and opportunities for advancing data behavior research and practice?

Part 3: Conclusion (10 minutes)
The panel will conclude by summarizing the main insights and implications of the presentations and discussions for both theory and practice. The panelists will reflect on how their perspectives and experiences contribute to a better understanding of data practice and data behavior in different contexts and domains. They will also discuss the key challenges and opportunities for conceptualizing data behavior from a data-centric and user-centric approach. Finally, the panelists will suggest future directions or actions for research or practice on data behavior, such as developing new frameworks or methods for studying data behavior, designing interventions or policies to support data behavior, or creating communities to share best practices and lessons learned.

CONTRIBUTIONS
We expect to make the four contributions to the field.

First, this panel will provide a stimulating and informative discussion on data practice and data behavior, two concepts that capture the complexity and diversity of human-data relations.

Second, it will compare and connect the data-centric and user-centric approaches to conceptualizing data behavior, and discuss their strengths and limitations, through examples of data behavior research in different contexts and scenarios.

Third, it will highlight the challenges and opportunities of data behavior research for information science and practice, such as developing new frameworks or methods for studying data behavior, designing interventions or policies to support data behavior, or creating communities or networks to share best practices and lessons learned on data behavior.

Fourth, it will engage the audience in a lively and interactive conversation that will enhance their understanding of data practice and data behavior, and inspire them to explore new directions or actions for research or practice on this topic for advancing this area of inquiry.
AUTHOR BIOGRAPHIES

Dr. Pengyi Zhang is an associate professor at Department of Information Management, Peking University. She holds a Ph.D. and a MLS from College of Information Studies, University of Maryland. Her research expertise include information and knowledge organization, information/data seeking and sensemaking, and user-centered design and evaluation. She is particularly interested in how people seek for and make sense of data and information. Her recent research investigates the interaction between information behavior and data behavior in the context of digital scholarship. She has received grants from National Science Foundation of China, Chinese Library Association, and OCLC/ALISE Library and Information Science Research Grant.

Dr. Kathleen Gregory is a postdoctoral researcher at the University of Vienna and the Scholarly Communications Lab at the University of Ottawa and is a guest researcher at the Centre for Science and Technology Studies (CWTS) at Leiden University. She holds a PhD in in Science & Technology Studies, a Master of Science in Library and Information Science, and a Master of Arts in Education. Her research focuses on data practices in scholarly and science communication, particularly practices of data management and what those practices afford. Her past and current projects investigate, e.g., how people discover, make sense of, and reuse research data in academia and in public life.

Dr. Ayoun Yoon is an associate professor at Department of Library and Information Science, Luddy School of Informatics, Computing, and Engineering, Indiana University Indianapolis (IUPUI). She holds a Ph.D. from the University of North Carolina at Chapel Hill and M.S.I. from the University of Michigan. Her research areas include data curation, open data, and data sharing/reuse. She is particularly interested in building community capacity for constructing an equitable data ecosystem through proper curation practices. She has received multiple grants from the Institute of Museum and Library Services (IMLS), Research Data Alliance-US (RDA/US), and Indiana University.

Dr. Carole L. Palmer is a Professor and Associate Dean for Research at the Information School at the University of Washington. In research and teaching, she specializes in data curation and digital research collections, with a focus on the reuse value of data across disciplines and emerging best practices in data services. She is currently PI on the Data Services for Indigenous Scholarship and Sovereignty project (DSISS), funded by the Mellon Foundation, co-PI on the NSF Qualitative Data Repository initiative, and led the recent IMLS Open Data Literacy project, aimed at advancing open data for the public good through education, engagement, and research. She holds a Ph.D. in Library and Information Science from the University of Illinois at Urbana-Champaign. Before joining the Information School at the University of Washington, she was founding Director of the Center for Informatics Research in Science & Scholarship at the School of Information Sciences at the University of Illinois.

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Storytelling for Translational Research Impact

Gonzalez, Sarah  
University of Tennessee-Knoxville, USA | sarahgo@utk.edu

Liu, Ying-Hsang  
Uppsala University, Sweden | ying-hsang.liu@abm.uu.se

Syn, Sue Yeon  
Catholic University of America, USA | syn@cua.edu

Makri, Stephann  
City, University of London, UK | stephann@city.ac.uk

Connaway, Lynn Silipigni  
OCLC, USA | connawal@oclc.org

Given, Lisa M.  
RMIT University, Australia | lisa.given2@rmit.edu.au

Hartel, Jenna  
University of Toronto, Canada | jenna.hartel@utoronto.ca

McDowell, Kate  
University of Illinois, Urbana-Champaign, USA | kmcdowel@illinois.edu

Members of the ASIS&T Research Engagement Committee  
Bartlett, Joan (McGill University); Budd, John (University of Missouri); Dali, Keren (University of Denver); Kraft, Donald (Colorado Technical University); Liu, Jiqun (University of Oklahoma); Rafiq, Muhammed (University of the Punjab); Wang, Fang (Nankai University)

ABSTRACT
Translational research converts research knowledge into practical wisdom for a community (What is Translational Research, n.d.). Storytelling for translational research means that the researcher knows the audience, crafts a narrative, sticks to the plot, and imparts wisdom in a meaningful way — all elements of a good story from a good storyteller. In this hybrid panel and workshop, led by Stephann Makri and other members of the ASIS&T Research Engagement Committee, our successful researchers/storytellers will illustrate how a good translational research impact story is structured. Then, our storytelling experts will help participants craft their own research narratives to put translational research storytelling into practice for their own research stories. Dr. Kate McDowell, panelist and storytelling expert, teaches both storytelling and data storytelling courses, and is the 2022 recipient of the ASIS&T Outstanding Information Science Teacher Award. She states: “When research successfully translates into legislative or policy changes, it always comes down to a shared narrative experience. The story emerges in the dynamic interaction between the teller and the audience.” The aim of this session is to create confident storytellers.

KEYWORDS
Translational Research, Impact Stories, Storytelling, Research into Practice

INTRODUCTION
Once upon a time, a group of researchers asked each other: how can storytelling amplify translational research impact? In this 90-minute hybrid panel and workshop, we will help ASIS&T Annual Meeting attendees craft their own translational research stories. In the first 30 minutes of the session, attendees will see examples of stories from our experts. After that, attendees will break into smaller groups to talk through how they can craft their own research narratives to translate their research to suit their audience, from community members to policy makers. As translational research impact moves beyond quantitative measures, such as impact factors, information researchers are identifying how well researchers can engage with the end-users of research in the community. Research funders are now requiring indications on how the research will be translated into practice. Storytelling is an integral part of information science, and Dr. Kate McDowell outlines that storytelling extends the data, information, knowledge, and wisdom (DIKW) pyramid (McDowell, 2021). Storytelling can create a narrative impact that leads to translating research outcomes into logical narratives that will allow the audience to fully comprehend the data and lead to a greater wisdom. From Dr. McDowell: “I am a data storyteller, which means that I think in narrative and structural terms about how to use data, translated ethnically as information, and make it meaningful as knowledge that suggests actions that need to be taken. With an aspiration toward wisdom, we can also incorporate missions or values regarding what social impacts research should have.”

Questions to be addressed in this session:

- Why is storytelling an excellent medium for translational research impact?
- How can researchers connect with their audience to move research to practice and beyond?
- What tools and techniques does a researcher need to craft their own story?

RESEARCH TRANSLATION IN NARRATIVE

Researcher as Narrator of the Story
In the research proposal, the research storyteller thinks about the audience and creates an introduction, a narrative, and an impact statement that demonstrates how the research findings will impact multiple audiences. In the traditional scholarly publishing system, the linear storytelling mechanism will allow the researchers to demonstrate the life of the project, from beginning to end (and beyond), typically measured by publishing in journals with high
impact factors. There is a movement in academic research assessment to evaluate research outcomes beyond the paper citations (Given et al., 2015), such as the impact case studies within the UK Research Excellence Framework (REF, n.d.) and the engagement narratives in Excellence in Research for Australia initiatives (ERA, n.d.). A researcher with the tools to tell a translational research story will create a narrative beyond literature, commercialization, and technology transfer. Aligning research impact with the “good” of the stakeholders will allow stakeholders to evaluate the research in context (Frodeman, 2017). The storyteller may also continue the research story, preview future research work, and apply the research beyond the community to change public policy. As Lisa Given and colleagues conclude in their article, “Bracing for Impact: The Role of Information Science in Supporting Societal Research Impact,” information science professionals need support and training in communication with non-academic audiences as funders place emphasis on measuring societal impact (Given et al., 2015). In essence, researchers, including information professionals, may need assistance in translating their research to meet the needs of their audience. We suggest that the researcher use storytelling as the mechanism for conveying translational research impact.

**Researcher as Hero of the Story**
The heroes of this workshop session are our panelists. The first 30 minutes of this session will be devoted to research impact stories and storytellers. Panelists will be allowed to present their own research stories and must include visual mediums. Our panelists/storytellers are:

**Lynn Silipigni Connaway, Executive Director of Research, OCLC.** Lynn Silipigni Connaway has numerous journal publications, is an international speaker, and is co-author of the 4th and 5th editions of *Basic Research Methods for Librarians* and the 6th and 7th editions, *Research Methods in Library and Information Science*. Lynn was President of ASIS&T and received the 2019 ASIS&T Watson Davis Award for Service. For more information about Dr. Connaway’s work, go to www.oclc.org/research/people/connaway-lynn_silipigni.html and follow her on Twitter @LynnConnaway. Lynn will discuss her experiences as a researcher and lead consultant on research that is used for internal R&D and research that is disseminated within the professional and scholarly communities. Lynn will share ways that she integrates storytelling and engagement when sharing research design, methods, and findings. Lynn states:

> It is critical to know the purpose of the presentation and the implications of the research and findings for the target audience. You need to identify how the research relates to the interests of the audience to create excitement for adoption into practice and product development as well as replication of the study, the methodologies, and the frameworks for research.

**Lisa M. Given, Director, Social Change Enabling Capability Platform and Professor of Information Sciences at RMIT University in Melbourne, Australia.** Lisa’s interdisciplinary research in human information behaviour brings a critical, social research lens to studies of technology use and user-focused design. Her studies embed social change, focusing on diverse settings and populations, and methodological innovations across disciplines. A former President of the Association for Information Science and Technology, Lisa is a Fellow of the Academy of the Social Sciences in Australia and has served on the Australian Research Council’s (ARC’s) College of Experts. She holds numerous grants funded by ARC, Canadian Institutes for Health Research, and Canada’s Social Sciences and Humanities Research Council, working with university and community partners across disciplines. She is Editor-in-Chief of the *Annual Review of Information Science and Technology* and lead author of the forthcoming 5th edition of *Looking for Information: Examining Research on How People Engage with Information*. You can follow her on Twitter @lisagiven and read more about her work at lisagiven.com.

In her Director role, Lisa supports researchers in all disciplines to translate their research for communities, businesses, and government. In her own words, she explains how storytelling enables translation for impact:

> Storytelling sits at the heart of translation of research outcomes. It’s a critical tool for persuading individuals and organizations to implement positive social change in their daily lives and work contexts.

> Stories embed the humanity that sits behind our data. Storytelling gives voice to the people affected by their world, and provides potential pathways for change. A strong narrative engages readers and listeners deeply, drawing them into the data. This is a key step to foster societal impact, such as policy and practice change.

**Jenna Hartel, Associate Professor, Faculty of Information, University of Toronto.** Jenna is a master of storytelling through multimedia and the creator of the YouTube channel, INFIDEOS, which contains 80+ educational videos about Information Science (Hartel, 2022a). She conducts research in three related areas: 1) information and the higher things in life that are pleasurable and profound; 2) visual and creative research methods; and 3) the history and theory of Information Science.
Dr. Hartel does translational research by adapting the intellectual capital of Information Science to multimedia formats (Hartel, 2022b). Her videos are used to teach and inspire students, educators, researchers, practitioners, scholars in other fields, and the general public.

In her own words, Jenna outlines how she uses storytelling to translate her research for different audiences:

> Storytelling is at the heart of what I do, on multiple levels. First, I turn aspects of Information Science into stories in my videos, for our field has a rich and compelling history that should be better known. Second, my video-making project is cast as a personal story of my career, so that it can stand alongside conventional research programs and narratives.

At both levels, I mobilize storytelling techniques, such as: creativity, human interest, knowledge, playfulness, suspense, and drama. For example, having multiple intriguing avatars of myself; controlling my voice; employing beautiful imagery and catchy music; making occasional personal revelations; having jokes, surprises, secrets and a friendly mascot (the dove, BIBBLE); invoking novel themes such as sensuality and nature; referencing popular culture; approaching Information Science with a sense of excitement and celebration; while channeling kindness and inclusivity. Importantly, my video “stories” are right-sized and fast-paced for potentially short or fragmented habits of attention that mark many audiences today.

Kate McDowell, Associate Professor, School of Information Sciences, University of Illinois Urbana-Champaign. Kate McDowell regularly teaches both storytelling and data storytelling courses and is the 2022 recipient of the ASIS&T Outstanding Information Science Teacher Award. She researches and publishes in the areas of storytelling as information research, social justice storytelling, and what library storytelling can teach the information sciences about data storytelling. Her projects engage contexts such as libraries, non-profit fundraising, health misinformation, social justice in libraries, and others. Dr. McDowell has worked with regional, national, and international nonprofits including the Pan-American Health Organization (PAHO, part of WHO), the Public Library Association (PLA), and the Research Institute for Public Libraries (RIPL). Her nationally-funded project Data Storytelling Toolkit for Librarians with co-PI Dr. Matthew Turk is under development (https://imls.gov/grants/awarded/re-250094-ols-21). Her storytelling research has involved training collaborations with advancement with both the University of Illinois at Urbana Champaign and the University of Illinois system (Chicago, Springfield), storytelling consulting work for multiple nonprofits including the 50th anniversary of the statewide Prairie Rivers Network that protects Illinois water, and regular storytelling workshops for the Consortium of Academic and Research Libraries in Illinois (CARLI). She formerly served as Interim Associate Dean for Academic Affairs and Assistant Dean for Student Affairs and has led multiple transformative projects for the School.

In her own words, Dr. Kate McDowell outlines why storytelling is an essential part of communicating translational research impact:

> Never underestimate “the room where it happens” (to quote the musical Hamilton). When research successfully translates into legislative or policy changes, it always comes down to a shared narrative experience. People vote for proposals for both informational and emotional reasons, which makes story an ideal medium for communication. Stories combine informational and emotional content in narrative structures.

Some storytelling outcomes from Dr. McDowell:

> I have published about great storytelling strategies for fundraising, and those strategies, at their most fundamental level, involve thinking about data curation as a guide for where a group is in relation to the process of having a shared story emerge. Data collection itself starts with an idea about what might result, whether a conjecture or formal hypothesis. Sometimes the process of putting data collection in place is itself a story to be told to stakeholders. The life cycle of data in story form means that it is very important to consider when a story will be retold, not just how we craft the story but how others would retell the story that we have crafted.

Some lessons learned about storytelling impact:

> There is no story without an audience who listens and RETELLS. This is one of the central insights of my work. We do not go off alone and craft effective data or research stories, that approach routinely backfires. We must have audiences involved in the development of stories from the very beginning, and the best way to involve a rehearsal audience is to ask that audience to listen to your story and then tell back to you what they heard. Simply put, audiences are not an afterthought or a strategic target, they are human listeners and people with minds and memories who, like all humans, think in story. We must leverage the dynamic
Dr. McDowell has created a data storytelling toolkit for librarians with templates for creating arguments, evidence, tone, and other storytelling tactics. The participants in this workshop will benefit from these tools to create their own translational research impact stories that they can take home with them.

**Researcher as Author of their Own Story**

After an introduction to storytelling with the panelists, we want our audience to think about how they can create their own translational research impact stories.

This will transition into an interactive session. This means that our audience will play a crucial participatory role. We will break into smaller groups to discuss applying storytelling in real life scenarios provided by audience members. The participants will see real life impact stories and will have templates and other resources to encourage them to impart their own wisdom to their own research audiences. The moral of the story will be the tangible benefits of the research on the audience members in this session and beyond. Through engagement with the stories, the participants will be empowered to translate their research impact through qualitative not just quantitative impact factors, being able to effectively communicate research findings with the aid of narrative structure, visual mediums, and audience engagement. Knowing the audience is a crucial piece for the storyteller, and we hope that the participants will attend the session with an audience already in mind. Before the session, we would like to send a short questionnaire to the participants to gauge their experience in communicating about their research. We will also provide instructions on information that each participant should bring to the session, including examples from their own research that could be translated for their specific audience.

**CONCLUSION**

Researchers enter a social contract with their audience when they receive funding. The audience may be a funding agency, a university administrator, or a member of the community, and each researcher will measure impact, large or small, based on a variety of factors. Thinking of the audience will help the researcher create a narrative of knowledge that may be transformed into a story, not a fictional or fanciful story, but a story that introduces research concepts, processes, and conclusions based on evidence. During our workshop session at the ASIS&T Annual Meeting we will not create stories for each participant, but our panelists will provide examples and tools to turn the participants into authors for their own effective stories. Translational research means moving beyond traditional impact factors to touch the heart of the listeners of each story. The researchers and their listeners might not live happily ever after, but they will connect with each other through the medium of story to come to a shared understanding of the value of the research.

Outcomes for the participants in this session:

- Understand the audience for their translational research story
- Build a narrative based on evidence that will touch the audience
- Craft a conclusion to the story that moves the research impact into translation to practice

There once was a group of researchers who wanted to find an effective mechanism for communicating translational research impact. They found heroes of information science who each bring a special talent. Their talents combined created a special storytelling power. Each participant of this session will be granted this power by our heroes. The power to tell their own translational research impact story with confidence.

A quick epilogue: Our intent is that the stories created in this interactive session may be published electronically for the benefit of future storytellers. A story has more power when it is shared. To reiterate the wisdom from Dr. McDowell, “There is no story without an audience who listens and RETELLS.” Translational research means practice and application. We would like to create a collection of translational research stories from information science storytellers that will live and be retold after this session. Finally, we anticipate creating an *Information Matters* article after the ASIS&T Annual Meeting to reach a broader audience. The article will feature a storytelling template and some of the example stories from this session.

This event was devised, developed, and is sponsored by ASIS&T’s Research Engagement Committee.

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Messages and Calls Ignored?  
A Survey of Four Thousand Smartphone Users on Non-Response Behavior

Agarwal, Naresh Kumar  
Simmons University, USA | agarwal@simmons.edu

ABSTRACT
We are living in a world where a lot of people maintain constant connectivity through sending and receiving messages and calls. Contemporary research has focused on how smartphones disconnect us from our physical environment. Yet, in a digital disconnect, almost daily, people choose not to respond to certain messages or calls, which can make the sender anxious and adversely affect their communication. The first phase of this project consisted of an interview study of 24 participants which led to publications covering the sender and receiver perspectives. A follow-up large-scale survey of 4,001 respondents was carried out to investigate the receiver’s reasons for not responding including the role of power, the psychological impact on the sender, and other communication. Theories on information avoidance, power, interpersonal deception, and emotions inform this study. Preliminary findings are shared here. The findings will inform the fields of information science, communication, psychology, and mental health, and should help software designers build tools to help users communicate their context to each other.

KEYWORDS
Smartphone communication, non-response behavior, ignoring, power, anxiety

INTRODUCTION
A lot of people spend their free time staring at their smartphones (Choi, 2016) - texting (Coyne et al., 2011; Schade et al., 2013; DiDonato, 2014), and engaging in other activities like viewing photos, watching videos, playing games, and going on social media (Pew Research, 2017). This ubiquitousness of smartphones and mobile computing apps has fundamentally changed the way people communicate. Social media has connected us in ways where we don’t have a full context (Agarwal, 2018) of the other person’s situation or mood, changing previously understood communication patterns of attention, social contact, and inter-dependencies (Kiesler & Sproull, 1992) and underlying phenomena manifest themselves through technological channels (Flanagan, 2020). However, what happens when you get used to this “constant connectivity” through smartphones and a person you relate to chooses not to message or call back within your reasonable expected time? The receiver might have different reasons for not responding. They might be busy or tired or base their non-response on factors such as the importance, urgency, or purpose of the message or the reply, their current location, sensitivity of response content, etc. The relative sense of power (Guerrero et al., 2017) that the receiver feels over the sender can play a role in whether they respond to the message or call by the sender.

Prior Work – Phase 1 Interview Study
Based on two internal grants from Simmons University, 24 interviews of smartphone users were carried out. The resulting data led to several publications: the sender perspective (Agarwal & Lu, 2020; this paper was awarded the ASIS&T SIG USE Best Information Behavior Conference Paper Award, 2020); the receiver perspective (Agarwal, Mitiku, & Lu, 2022); and the technology perspective (Agarwal & Lu, 2019; Agarwal & Lu, 2021).

The study found that people go through immense emotional and psychological states when their phone calls and messages are ignored, especially when the non-response is from a close person to whom the sender is attached. From trying to understand the receiver (as perhaps being busy) to doubting themselves, senders go through various emotional states, ranging from anger, anxiety, shame/resignation, and sadness to confusion, especially when their repeated messages are ignored (Agarwal & Lu, 2020). The receiver’s reasons for non-response included (Agarwal, Mitiku, & Lu, 2022) needing time to be alone, especially if they are tired or overwhelmed. The type of message (length, casualness, urgency, etc.), and the time of the day (very late or early in the morning) would influence the receivers’ decision to respond or not. Also, the receiver might delay or forget to respond if the person is busy when the message is received. The findings also suggest that different relationships impact people’s non-response behavior. The study found that people respond to coworkers, their boss, and those friends and family whom they need to keep “in good books” in a timely manner. However, in relationships that people take for granted, or where they feel the sender needs them more, the receiver will time the response based on mood and convenience, as the person might think the message is “unimportant”. Thus, while receiver factors (such as being busy, tired, or relaxed) will impact non-response, this can be moderated by the power relationship between the sender and the receiver.

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Objectives – Phase 2 Survey Study
A large-scale follow-up study was needed to ascertain if the findings can be generalized, and to investigate the role of power (Guerrero et al., 2017) and the COVID-19 pandemic on the receiver’s reasons for non-response. The objective of the survey study was to further investigate non-response or ignoring behavior in smartphone-based communication. The specific research questions are: RQ1) What are the receiver’s reasons for not responding to messages or calls? RQ2) What is the role of power in the receiver’s non-response? RQ3) Is there any impact of the COVID-19 pandemic on non-response? RQ4) How does non-response impact the sender and their relationship?

RESEARCH MODEL
The figure shows a research model with 8 hypotheses. It focuses on a subset of receiver factors that affect non-response, and sender factors that moderate the impact on the sender. Important variables are the receiver’s perceived power over the sender, the degree of deception (Pak & Zhou, 2014) that the receiver thinks they can get by (“I was away from my phone), and the receiver’s mental and physical state represented by valence (happy versus sad) and arousal (excited versus tired) (Russel, 1980). The study will investigate the effect of these factors on non-response. If the sender is attached to the receiver, non-response might affect them more. The sender’s mental and physical state might also affect how they deal with the receiver’s non-response behavior.

METHODOLOGY
The population that this study seeks to generalize its findings to is people who use smartphones daily. The target population was smartphone users aged 18 and above. The survey instrument was designed based on the prior interview study, as well as other studies. The instrument was pre-tested, revised, and approved by the Simmons University IRB. The final survey questionnaire was created using Google Forms and can be accessed at https://tinyurl.com/nonresponsesurvey As an incentive to participate, each participant was given a $10 Amazon gift card (subject to the first 299 participants, with participants still invited to complete the survey beyond this number). Invitations to participate were sent using the Simmons University listservs, IFLA mailing lists, ASIS&T Open forum, and posted on Facebook and Twitter. There was a tremendous response to the survey with a continuous stream of responses coming in. Data was gathered during a 2-month period from end-May to end-July, 2022. The survey was closed after 4,001 responses came in.

DATA ANALYSIS AND PRELIMINARY FINDINGS
The survey data is gathered in Excel and will be analyzed statistically using SPSS. 50.8% of the respondents identified as male, 48% female and 0.9% preferred not to specify their gender, 33.5% had Masters, and 6% had doctoral degrees. In a day, 48% reported having 6-9 hours of free time, 41% 1-5 hours, and 11% had more than 10 hours of free time. 38% reported using their smartphones all the time, 33% more during work hours, and 28% used more during evenings and weekends. The top used messaging apps (ranked from most used) were Facebook messenger 67%, iOS messages 47%, Whatsapp 45%, Instagram messenger 38%, Telegram 27%, WeChat 24%, Snapchat 23%, and Google Hangouts 21%, followed by other apps.

34% didn’t respond promptly to a friend, 29% to a colleague, 29% to a family member, and 7% to a spouse/partner. 36% said that the other person usually contacts them (calls/texts) more often. 38% either agreed or strongly agreed to letting messages/calls from this person go unanswered, and purposely taking a longer time to respond to some messages. 41% agreed or strongly agreed to not responding because they were tense, angry, annoyed, or frustrated, 39% because they were sad, miserable, or tired, 31% because they were calm or relaxed, and 41% because they were happy or excited. 38% agreed or strongly agreed that the person’s message isn’t important or requires a timely response, 32% that they receive too much communication and have stopped taking them seriously, 36% that they can afford not to respond to the person, 45% that they are not responsible for how the person feels if they don’t respond, 43% that the person needs them more than they need them, and 39% that they have power over the person. While there were mixed reactions to the impact of COVID-19 on non-response behavior, many participants expressed being more understanding of people's situations and of themselves.

CONCLUSIONS AND FUTURE WORK
Only a small subset of the findings is listed. Detailed findings will be submitted to a journal. By better understanding individual reactions to non-response, the study will recommend solutions and a framework for effective communication using smartphones. It will inform the youth, parents, teachers, employers, system designers, and the society as a whole, as we embrace changes brought about by smartphone-mediated communication.
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Information Sharing for Academic Purposes: A Mixed Method Investigation into the Use of Social Networking Tools for Learning among Undergraduate Students at Kuwait University

Alsaeedi, Farraj
Kuwait University, Kuwait | F.Alsaeedi@dist.ku.edu.kw

ABSTRACT
This study uses an exploratory, sequential mixed method design to explore how Kuwaiti students share academic information using social media. Phase I involved in-depth, semi-structured interviews with 12 undergraduates; in Phase II, 683 students completed online questionnaires. Extensive use of social media, especially WhatsApp groups, was discovered, and the main patterns were providing information, exchanging information, and non-sharing. Before sharing, students evaluated information accuracy, provided instructions, and reviewed information with others. Motivations for sharing were enjoyment in helping others, mutual interest, enhancing one’s reputation, and reciprocity; reasons for non-sharing included self-doubt, fear of information being used for cheating, and competition. Class news, summaries, class notes and materials were shared for group projects, written assignments, presentations, and exams. Online leering used during COVID-19 accelerated sharing behaviors, and older students shared more actively and in more diverse patterns. A new conceptual model was drawn to explain these complex behaviors, and recommendations were provided for supporting them.

KEYWORDS
Information sharing, social media, academic purposes, undergraduate students

INTRODUCTION
One of the key information behaviors that is supported and promoted by social media is information sharing. It has become an essential information behavior carried out by college students in the current learning environment, in which students take advantage of such digital platforms to exchange information related to their academic and learning tasks for both collaborative and individual learning (Alsaleem, 2013; Bouhnik and Deshen, 2014). However, despite the prevalence and the importance of understanding information sharing, information sharing behaviors have attracted limited attention in the literature of human information behaviors (HIB) as compared to information seeking behaviors (Koh et al., 2015; Pilerot, 2012; Savolainen, 2019; Wilson, 2010). There have been only a modest number of empirical studies investigating students’ information sharing behaviors (Almehmadi et al., 2014; Chidiebere, 2014), and research studies focusing specifically on students’ information sharing behaviors for academic purposes (especially on social media) are particularly scarce (Khoo, 2014; Mastley, 2017). Hence, concentrated on how undergraduate students in Kuwait share information on social media for academic purposes, identifying the factors and challenges that motivate or hinder students during the information sharing activity.

LITERATURE REVIEW
The topic of students’ information sharing behaviors for academic purposes has been approached from different angles in the literature. Some researchers, such as O’Farrell and Bates were interested in the collaborative learning environment and found that students engaged in information sharing behaviors during group project assignments. They also found that electronic sources were considered more useful than print resources and that group project assignments provided opportunities for students to gain experience with strategic sharing and collaborative information seeking. Other studies focused on what motivates or hinders students’ information sharing behaviors for academic purposes within physical and online settings such as Yuen and Majid (2007) Chidiebere (2014) Hall et al. (2010) Sharabati (2018). For instance, Yuen and Majid (2007) found that tutorials, laboratory sessions, and group assignments were situations that involved more information sharing among students, while individual assignments involved less sharing. Lack of relationship depth among students, pressure to outperform others, and individual fears were identified as factors that decreased information sharing behaviors. However, Yuen and Majid (2007) reported that the primary motivations for sharing were to learn from or help fellow students and to receive rewards or recognition. Another study by Wangpipatwong (2009), found that competition among students had a negative influence on information sharing, while personal factors and environmental conditions had a positive impact.

MEHTODLOGY
This exploratory study employed a mixed method research design and generated both qualitative and quantitative data to better understand college students’ information sharing behaviors on different types of social media platforms. The goal is to gain a more holistic picture of the types of information sharing behaviors among college students and to identify the students’ motivations and challenges when sharing information for academic purposes on social media. This research involved two phases of data collection. In Phase 1, a semi-structured interview was
used as a tool to collect qualitative data. For Phase II, the online questionnaire was distributed to all undergraduate students at Kuwait University.

RESULTS
The results indicated that information sharing was embedded within the college students’ daily interactions and was taking place mainly on social media platforms such as WhatsApp. By integrating the results from both phases of the study, a conceptual model was developed to describe the process of students’ academic information sharing using social media (Figure 1). The model shows competing forces (motivations and challenges), pre-steps of information sharing, and different information sharing behavior types and sub-types.

![Figure 1. Model of College Students' Information Sharing Behaviors (ISB) on social media](image)

The newly developed model shows that information sharing among students was affected by competing forces that determined whether or not students engaged in the sharing activity. If information sharing occurred, it was driven by a range of motivations, as shown at the top of the diagram in Figure 1.1: enjoyment in helping others, mutual interests, reputation, reciprocity, and other motivations. However, acquiring information or possessing relevant information did not necessarily lead to sharing it with other students; sometimes, although participants thought about sharing information, they engaged in non-sharing patterns where they retained and withheld information due to several challenges shown at the top of the model: lack of self-efficacy, cheating, competition, and other challenges.

When the students decided to engage in the sharing activity, there were some steps they went through before sharing information with others: evaluating information accuracy, providing instructions on the shared materials, seeking review from colleagues, choosing the best time for sharing, and seeking permission to share the information. When information sharing happened, it could take the form of a one-way process in which information was provided to other students either in response to a request or proactively, or it could take the form of an interactive process where information was collaboratively or directly exchanged while completing collaborative tasks or during active interactions between students about a class topic or matter. The resulting model is an attempt to summarize the results and describe the process and experience of sharing information for academic purposes among college students, while focusing on how and why they shared information.

CONCLUSION
This research study comprehensively investigated information sharing behavior of undergraduate students for academic purposes on social media and provided insightful results related to how students share information, what steps they take before sharing, why they decide whether or not to share information with other students, what types of information they share, and when their sharing happens. The study’s model was designed to provide a holistic view of students’ information sharing information behaviors to encourage instructors, librarians, and educators support to help students achieve an optimal information sharing experience. First, when designing learning tasks that require information sharing and collaboration among students or when developing resources and services to support undergraduate students’ learning, it is important that both instructors and academic librarians consider the different ways in which students share information and which materials and information resources are shared the most. Additionally, it may be useful to provide targeted assistance to students during the learning tasks where most of their sharing activities happen. Importantly, the findings reveal that competition among students and a fear of having their shared information used for cheating are two factors that may prevent students from sharing information. Knowing this, instructors and librarians can work together to develop programs that raise students’ awareness of the importance of collaborative learning, and they can organize workshops to address the issue of cheating and educate students to avoid plagiarism.
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Data-Driven Decision-Making Practice in Higher Education Institutions in Ethiopia

Asfaw, Zelalem | Jimma University, Ethiopia | zelalmasfaw428@gmail.com
Alemneh, Daniel | University of North Texas, USA | Daniel.Alemneh@unt.edu
Jimma, Worku | Jimma University, Ethiopia | worku.jimma@ju.edu.et
Ferede, Bekalu | Jimma University, Ethiopia | feredebekalu@gmail.com

ABSTRACT
This study investigates the practice of data-driven decision-making in higher education institutions in Ethiopia. It presents the results of a mixed-methods investigation that was conducted at two public universities in Ethiopia. Data was collected via a survey questionnaire from 91 faculty members, nine ICT experts, four higher education registrar experts, and 194 graduating undergraduate students. The study also involved interviews with two directors from the university's education program relevance and enhancement office and four senior officers from library departments. The findings revealed that the majority of the instructors used manual data analysis and basic software, such as MS Excel, to analyze student performance, achievement, and assessment data. Institutions use many disconnected in-house systems for different activities without intelligent tools or data warehouses to support data analytics. The results indicate deficiency in activities that promote data analytics and data-driven decision-making, such as capacity-building training and leadership support within institutions.

KEYWORDS
Data-driven decision-making; data analytics; data-driven education; higher education

INTRODUCTION
Data has become a pivotal tool in driving progress and is now seen as a crucial component of the worldwide development agenda, often referred to as the "data revolution" (Custer et al., 2018). Segueda et al., (2018) further emphasizes that data is integral to steering and managing educational systems in every country. Schildkamp (2019) suggests that educational institutions globally should leverage data for monitoring their performance, pinpointing areas of improvement, and making data-informed decisions that efficiently and effectively improve education quality. However, even with African governments' efforts, their educational sector continues to grapple with quality, accessibility, and inequality issues, a situation evident in Ethiopia (Majgaard & Mingat, 2012). There is an initiative for digital innovation in Ethiopia (MinT, 2022). Although data-driven decision-making (DDDM) isn't a panacea for the challenges confronting higher education and student learning, it can contribute to resolving some problems in developing nations. DDDM can help accomplish goals such as personalized learning, evidence-based instruction, institutional efficiency, and ongoing innovation (New, 2016).

Drawing from the literature, a conceptual framework was devised featuring six key categories and numerous subcategories. These categories encompass: technical data infrastructure, analytical capability, a culture of data-informed decision-making, involvement of institutional research (IR), policy considerations, and resource investment (Webber & Zheng, 2019; New, 2016; Dahlstrom, 2016; Gill & Box, 2014; Mandinach, 2012; Hamilton et al., 2009).

STUDY OBJECTIVES
The primary aim of this research is to scrutinize the present application of data-driven decision-making in Ethiopian higher education institutions. Specifically, it sought to answer the following research questions (RQs):

RQ1: Are data-centric educational analytic technologies, policies, and practices employed by academic institutions to enhance the quality of education in Ethiopia?

RQ2: How are data analysis techniques incorporated into teaching and learning activities within the identified educational establishments?

RQ3: What kind of support services for data usage and data-informed decision-making are provided to faculty members by academic institutions in Ethiopia?

METHODS
This research adopted a mixed-methods approach, integrating both qualitative and quantitative techniques. The concurrent embedded strategy has been selected for this study owing to its ability to facilitate the collection of both qualitative and quantitative data simultaneously, as well as to provide a wider range of perspectives by utilizing multiple methods instead of relying solely on a single dominant method, as noted by Cresswell (2009). Moreover, this particular design has been deemed suitable upon careful evaluation of its alignment with the study's objectives and the requisite data needed to attain them. Two prominent, first-generation Ethiopian universities were...
purposefully chosen due to their larger student and faculty demographics and superior ICT infrastructure in comparison to newer universities (Ferede et al., 2022). Four departments from the Faculty of Computing and Informatics were selected with the aim of leveraging ICT in teaching and learning activities. The questionnaires were shared with faculty members, ICT specialists, registrar experts and students, via email and direct interaction. Out of the 309 participants selected based on Kothari's (2004) sample size determination formula and fourteen purposively selected participants, 298 completed the questionnaire, yielding a response rate of 92.26%. The questionnaire, designed based on literary references, was divided into four sections querying data use, data infrastructure, data analytics, and practices of data-driven decision-making. Some questions were open-ended to allow for detailed responses. Additionally, in-depth semi-structured interviews were conducted with two directors from the universities’ education program relevance and quality enhancement office and four senior library officials. Furthermore, data was also collected through observation. Data was collected between February 7, 2023, and March 16, 2023. The gathered data was analyzed using both qualitative and quantitative techniques. We identified 23 basic themes that are categorized into six major themes. Thematic analysis was employed for the qualitative data: the interview data was first transcribed and prepared for analysis, then reviewed, coded, and searched for themes and relationships before refining these themes prior to reporting. Descriptive statistics were used for the quantitative data analysis.

This study was approved by the Research Ethics Review Committee of the College of computing and informatics, Jimma University, Jimma, Ethiopia.

RESULTS
The study's findings suggest that educational institutions often use disjointed in-house systems, such as student registration platforms, for tasks like enrolment and grade submission. These systems are mandatory for both teachers and students and have proven effective. The majority of respondents reported using Moodle Learning Management System (LMS), while a substantial number did not utilize any learning management system. Although LMSs were somewhat used during the COVID-19 pandemic, their effectiveness is now in question. The institutions lack intelligent analytic tools, data warehouses, and methods for managing large volumes of data, including social media data, to use for educational purposes. Respondents indicated that no efforts have been made to provide professional training in data analytics or to develop data analytics support systems. There was also no formal training given on data usage, data analytics, data tools, or data-driven decision-making. Most ICT expert respondents (77.77%, n=7) were unaware of the benefits of a data warehouse. A significant portion of instructors (34%, n=31) manually analyzed data, while 30.76% (n=28) used basic software like MS Excel, 23.07% (n=21) used statistical software packages like SPSS, and the rest (12.08%, n=11) utilized data analysis tools like Python or Weka. Many participants reported that their institutions lacked a culture of using data for informed decision-making. There seemed to be no clear vision or strategy for implementing data-driven decision-making. Furthermore, most respondents felt that their institutions did not have strong leadership advocating for data-driven decision-making. No initiatives promoting this practice exist within these institutions, and no collaboration with external organizations or universities focusing on data utilization has been established. There are no established policies for data collection, processing, quality management, access, sharing, or data-driven decision-making, except for open access and research data sharing. However, a majority of respondents (53.07%, n=57) strongly agreed that their institutions were willing to allocate resources and make substantial investments in improving digital infrastructure.

CONCLUSION
The results of this research suggest that genuine data-driven decision-making practices are lacking in Ethiopian higher education institutions. Despite the increased recognition of building an advanced data warehouse platform as a pre-requisite for sophisticated analytics, the data indicates a knowledge and awareness gap concerning the use of data analytics and intelligent tools for implementing data-driven decision-making to enhance educational quality. There is an apparent need for forward-thinking leaders in higher education institutions who understand the value and application of data, particularly data analytics. In light of these findings, it is recommended that data-related policies concerning collection, usage, sharing, and data-informed decision-making be established at both the institutional and national levels. The successful integration of data-driven decision-making for superior education depends not only on the willingness and awareness of leaders but also on the knowledge and expertise of ICT and other professionals skilled in intelligent data analytics technology. Future research can explore the extent to which top institutional leaders are aware of data-centric education and its potential to enhance education quality.

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Zooming into the Future: Implementing Theory into Practice for Educational Crisis Times

Ayalon, Ayelet
Bar-Ilan University, Israel | ayelet8811@gmail.com
Aharony, Noa
Bar-Ilan University, Israel | Noa.Aharony@biu.ac.il

ABSTRACT
The abrupt transition from face-to-face classes to online learning during March 2020 occurred as a result of the Covid-19 pandemic. Teachers were forced to shift to online teaching with no prior training, while students had to adapt to a new learning format. The physical distance between students and teachers led to changes in interactions. The current study examines the instructional approaches used for online teaching and learning during the Covid-19 crisis. The research focuses on using the Covid-19 pandemic as a case study to explore crisis events and their impact on education system. The study uses a qualitative approach, with three junior and high schools participating. Thirteen teachers were interviewed, and 27 students participated in three focus groups, one from each school. The study's theoretical framework is based on the Transactional Distance Theory (TDT) and the Connectivism Learning Theory (CLT). The main finding focuses on teachers' use of autonomy to vary their teaching approaches, while students felt they did not know how to cope with the autonomy given to them and even felt neglected by their teachers. Therefore, in order to strengthen learners' autonomy, teachers need to design and monitor the scaffoldings by both structure (curriculum) and dialog (teacher-student and student-student).

KEYWORDS
Transactional Distance Theory, Connectivism Theory, Online learning in times of crisis.

INTRODUCTION
The COVID-19 pandemic forced an abrupt adaptation to online learning. The transition to the Zoom platform changed interactions between teachers and students, curriculum structure, as well as students' autonomy. The current study examines teachers' and students' perceptions of the online learning experience in light of the theoretical frameworks of Transactional Distance Theory (TDT) (Moore, 1973) and Connectivism Learning Theory (CLT) (Siemens, 2005; Downes, 2012). TDT presents the interaction among three variables: dialogue, structure, and learners' autonomy, and its effect on the intensity and quality of the transactional distance (Moore, 1993). According to Siemens (2005) and Downes (2012), CLT represents a changing environment in which individuals, groups, systems, nodes, and entities are interconnected using information and communication technologies. TDT highlights the importance of technology in bridging the psychological and communication gaps between learners and teachers, while CLT emphasizes the role of technology in creating nodes of learning.

RESEARCH QUESTIONS
1. How was the information transferred by teachers and processed by students through the digital platform? Which instructional approaches did teachers use?
2. How did teachers and students experience the transition to the Zoom platform?
3. How did teachers and students cope with social distance and its effect on the teaching and learning process?

METHOD
Research Population
Three Israeli middle and high schools were selected from the same socioeconomic status; cluster 7, ranked by the Israeli Central Bureau of Statistics (2020). Thirteen Israeli teachers and 27 students participated in three focus groups, one from each school. The average age of the teachers was 37.7 (SD=9.35), and their average teaching seniority was 11.5 years (SD=9.7). The average age of the students was 15.4 (SD=1.05). To ensure anonymity, interviewees are assigned a two-letter code: the first letter represents "S" for Student or "T" for Teacher, followed by a school indicator (A, B, or C) and a serial number.

Research Tools
The current study is based on qualitative research methods, consisting of semi-structured, in-depth interviews with teachers. Additionally, three focus groups (FG) were conducted to measure how students perceived the transition to the online learning platform.

Data Analysis
The data collected from the interviews and FG were analyzed using the categorization technique to provide a broad perspective of the experiences of teachers and students (Shkedi, 2014). After analyzing and mapping the interviews and discussions, several major categories emerged. In the next phase, the researcher built a research framework addressing three major categories: Teaching/Learning, Personal-Emotional, and Social.
Credibility and validity of the research
In order to explore the reliability of the analysis, two coders (the researcher and another coder who is a Ph.D. candidate) analyzed the interviews. When the researcher and the coder disagreed, they discussed it until they reached full agreement, resulting in a reliability score of 0.90.

FINDINGS
The first research question (RQ1) relates to the instructional approaches used by teachers to transfer content. Findings revealed that teachers used three main instructional methods: autonomous learning, project-based learning, and collaborative methods. All methods focus on students' autonomy, which determines the goals, learning experiences, and evaluation decisions of the learning program (Moore, 1973). However, according to the teachers, the purpose of using these instructional methods did not stem from a pedagogical base to provide opportunities for their students to learn autonomously or find meaning and relevance in what they learn, but rather to "vary the teaching methods" (TB12). Moreover, according to the teachers, they neither mentored nor guided students in nurturing their autonomy. As a result, students felt they did not know how to cope with the autonomy given to them and even felt neglected by their teachers. One student stated, "They throw projects on us" (SB20). Regarding RQ2, which deals with teachers and students' personal experience with the Zoom platform, teachers felt uncomfortable with their professional mission, as expressed by TA7: "Distance learning for a teacher is like a carpenter working without nails, or like a tailor sewing without a needle." Students' experiences revealed gender differences; while some female students felt anxious and stressed during this period, male students were more learning-oriented, focusing on its advantages. The following citation (SA8) exemplifies the experiences of male students, "You can decide when you learn, and you are responsible for your schedule". RQ3 examined how teachers and students coped with social distance and its effect on the teaching and learning process. Teachers used breakout rooms to reduce social distance and create teamwork and collaborative learning. By doing so, they actually built social connections, as expressed in the Connectivist learning theory. However, students perceived the Zoom rooms ambivalently. One student said, "When you work with your friends, it's fun, but when you're sharing a room with students you don't know, it's embarrassing" (SB21).

DISCUSSION, RECOMMENDATIONS AND LIMITATIONS
Similar to previous studies conducted during the pandemic (Batita & Chen, 2022; Sevnarayan, 2022), the current research revealed that both TDT and CLT emphasize the significance of learner autonomy and social context in the learning process. The findings reveal that teachers provided limited guidance to create autonomous learners. To strengthen learners' autonomy, teachers need to design and monitor scaffoldings using both structured (curriculum) and dialogical (teacher-student and student-student) approaches. Although teachers used the collaborative Connectivist learning approach, it sometimes led to embarrassment among students. Thus, teachers should pay more attention to the challenges students may face when utilizing digital tools. Moreover, teachers should understand the role of social networks in supporting collaborative online learning based on the CLT to facilitate student-student and student-teacher interactions. To pave the way for a positive future of the educational system, it is recommended to incorporate both theories when introducing online learning, in both crisis and non-crisis situations. However, since Covid-19 received extensive media coverage in Israel and worldwide, it is possible that this coverage influenced the interviewees' thoughts, opinions, and feelings, and this should be taken into account as a limitation of the study.

REFERENCES


Generative Artificial Intelligence (GAI) Divide: An Empirical Examination of the Micro-Macro Factors that Predict GAI Knowledge and Use

Ball, Christopher  
University of Illinois Urbana-Champaign, USA  |  drball@uiuc.edu

Huang, Kuo-Ting  
University of Pittsburgh, USA  |  timhuang@pitt.edu

ABSTRACT
Generative artificial intelligence (GAI), a branch of AI capable of generating new content from human input has the potential to impact every aspect of our society. However, as with any emerging technology, the benefits and detriments of GAI may not be evenly distributed, leading to digital inequality. Aspects like AI access, effectively usage, and usage outcomes could define this emerging and evolving GAI divide. To fill the current research gap on GAI inequality, this study aims to empirically explore the factors that may contribute to a GAI divide to ensure that the benefits of this technology are distributed equitably throughout society. To address these challenges, an online survey will be conducted to examine both macro- and micro-level factors that may potentially proliferate and ameliorate the GAI divide.

KEYWORDS
Digital Divide, Digital Inequality, Generative Artificial Intelligence (GAI)

INTRODUCTION
The recent widespread proliferation of artificial intelligence (AI), and especially Generative AI (GAI), is reshaping our world by redefining how we live, work, communicate, and create (Hacker, Engel, & Mauer, 2023). AI typically refers to a field of computer science with the goal of performing tasks usually associated with humans. GAI, a branch of AI, is known for its capability to generate new content (such as text, images, video, etc.) based on human prompts (Hacker et al., 2023). For example, Chat Generative Pre-Trained Transformer (ChatGPT) can generate human-like text. Similarly, DALL·E 2 can generate digital images with only a prompt from a human.

GAI models have existed for decades; however, recent advances, such as the introduction of massive training data sets and improvements in computation power, have led to a resurgence of interest in these tools (Cao et al., 2023). The uses for GAI are expanding rapidly, and it has already begun to affect countless fields ranging from journalism and education (Baidoo-Anu & Owusu Ansah, 2023; Lim, Gunasekara, Pallant, Pallant, & Pechenkina, 2023; Pavlik, 2023). GAI will undoubtedly have a disruptive impact on many fields and businesses which may even necessitate regulation (Dwivedi et al., 2023; Hacker et al., 2023; Houde et al., 2020). However, GAI will also have an equally massive impact on individuals, resulting in the need for new GAI-related literacies and skills.

While the implications (both positive and negative) of GAI are vast, as with any emerging technology, we must acknowledge that the benefits and detriments of this technology may not be equally distributed throughout society, otherwise known as the digital divide. The "digital divide" definition has evolved from merely representing discrepancies in access to computers and the internet to embody a broader spectrum of inequalities brought about by the rapid proliferation of information and communication technologies (Robinson et al., 2020). Therefore, our understanding has evolved tremendously over time to become more nuanced and inclusive. Despite this progress, the rapidly changing socio-technological landscape presents continuous challenges. Hence, we must continue examining emerging technologies' implications, such as GAI, on individual digital inequality and inclusion.

The potential ramifications of AI, especially GAI, could exacerbate existing inequalities (Lutz, 2019). A small but growing body of literature has begun to explore the digital inequality implications of related domains such as algorithms (Yu, 2020). For instance, research indicates the presence of an emerging algorithmic knowledge gap that has formed around key digital divide demographic variables such as age, gender, and education (Gran, Booth, & Bucher, 2021). Importantly, algorithmic knowledge is also driven by first-hand experience. In other words, algorithms are "experience technologies" that are better understood by actually using the technology (Cotter & Reisdorf, 2020). The digital inequality research surrounding algorithms provides a valuable starting point from which we can begin to explore the implications of GAI.

Unfortunately, there is currently a lack of studies examining the potential ramifications of AI in general and GAI in particular related to digital inequality (Aissaoui, 2022). One pioneering study theoretically modeled and conceptualized the AI divide which spans all three levels of the digital divide. The first level involves access to AI technology, the second level consists of the ability to use AI effectively, and the third level addresses the outcomes of AI use (Carter, Liu, & Cantrell, 2020). However, a current limitation of the AI divide literature is a lack of empirical studies which are essential “to quantify and generalize individual’s understanding of an interaction with

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algorithms. (Lutz, 2019) Therefore, researchers need to empirically explore the factors that may contribute to an emerging GAI divide (Carter et al., 2020).

Based on the previous literature, we treat the access, skills, and outcomes of GAI as potential factors contributing to the widening of existing divides and propose a conceptual model along with the following two research questions:

RQ1: From a macro-level perspective, how do sociological factors (including demographic and economic characteristics), socio-technical elements (including skills and digital literacy), and technical aspects (such as infrastructural availability and quality) influence individuals’ GAI access, skills, and outcomes?

RQ2: From a micro-level perspective: how do psychological factors encompassing individual experiences, self-efficacy, risk perception, trust, and beliefs shape individuals’ GAI access, skills, and outcomes?

METHODS
Sample and Study Design
To answer our research questions, we will conduct an online survey with an expected sample size of 400 participants, which is determined based on the effect size of digital divide studies using similar scales. Participants will be recruited through stratified random sampling from multiple online platforms for survey research, including CloudResearch, Centiment, and Amazon Mechanical Turk. We aim to recruit a diverse sample that represents the demographic characteristics of the United States, as these are an essential part of our macro-level predictors. Each participant will be compensated with $1. The data collection is expected to be complete by late 2023.

We will use a structured survey questionnaire comprising both macro- and micro-level predictors to gather our data. The macro-level predictors offer a perspective of how structural determinants may drive the GAI divide. Based on a conceptual model developed by Carter et al. (2020), we included three main dimensions: (1) demographic and economic factors such as education, ethnicity, race, gender, & income, (2) socio-technical elements such as GAI skills and digital literacy, and (3) infrastructure availability, including internet availability, broadband speed, and device ownership. These dimensions will be assessed through validated questions developed from previous digital divide studies (e.g., Van Deursen, Helsper, & Eynon, 2016) to gauge the macro-level determinants of GAI adoption.

The micro-level predictors provide insight into how individual factors could describe and shape GAI digital divides. We include the following components mentioned in Venkatesh (2022)’s recent study on AI and technology adoption and use: (1) individuals’ risk perceptions and trust in GAI, (2) awareness of and attitudes towards GAI adoption, and (3) personal experiences with GAI applications. These variables will be measured using a series of questions adopted from previous research on technology acceptance and adoption (e.g., Lin, Ho, & Yang, 2022), which help us uncover personal factors that contribute to the digital divide in AI.

The outcome variables of the study include access, capacity, and outcomes related to AI digital divide. When discussing access, we emphasize motivational access and AI-related knowledge. In terms of capacity, our focus is on users' GAI skills. Lastly, the digital-divide outcome we measure is users' intention to use GAI. These outcome variables will be assessed using validated survey items that effectively capture the complexity of these concepts.

Analytic Technique
First, we will report a descriptive analysis of the variables of interest. Second, a series of ordinary least squares (OLS) regressions will investigate the proposed research questions. Lastly, we will use PROCESS macro to perform path analyses to examine potential indirect and interaction effects. The PROCESS path-analysis macro is an application that Hayes (2018) developed for estimating models with multiple dependent and independent variables. Analyses will be performed using SPSS 29.0.

CONCLUSION
This study aims to address the need for empirical support for emerging conceptual models that articulate the possibility of a new AI divide. By analyzing micro-level variables such as individuals’ risk perceptions and trust of GAI, their awareness of and attitudes toward GAI, and their experiences with GAI applications, we hope to provide a nuanced understanding of the psychological factors influencing the GAI divide. Moreover, by investigating macro-level variables including socio-technical elements, infrastructure availability, internet skills, digital literacy, and attitudes we can examine the broader structural factors that shape disparities in GAI access, skills, and outcomes. The findings presenting GAI divide's multi-layered complexity will inform future investigations and interventions to address both micro and macro-level determinants to narrow this emerging dimension of the AI digital divide. Ultimately, this study aims to contribute to a broader theoretical and practical understanding of the emerging GAI divide to ensure more equitable access to and benefits from this influential technology.
REFERENCES


Using Critical Race Theory to Inform a Multi-Session Information Literacy Workshop Series for First-Year Students of Color

Ball, Heather  University at Buffalo SUNY, USA | hfball2@buffalo.edu

ABSTRACT
This research investigates individualized information literacy instruction (ILI) for different student populations in higher education and its impact on engagement and student learning outcomes (SLOs), specifically first-year students of color. The study is designed as a QUAL+quan convergent mixed-methods study, and utilizes critical race theory as its theoretical framework, as well as a participatory action research approach. It is designed as a multi-session IL workshop series delivered outside of the traditional classroom, and is comprised of six one-hour sessions: an initial focus group, four IL sessions focusing on specific aspects of the research process, and semi-structured interviews. Data collected through discussions, open-ended worksheets with rubrics, and pre- and post-surveys are analyzed to measure whether the instructional series impacted SLOs, and is significant as it’s the first to specifically address the systemic racial achievement gap coupled with a multi-session IL workshop series, and can serve as a model for other institutions.

KEYWORDS
Information literacy; information literacy instruction; students of color; critical race theory; participatory action research

INTRODUCTION
The past two decades have seen a transformation in the way that information literacy (IL) instruction is delivered in higher education, both through technological advances and the shift away from predominantly task-based learning to higher-order thinking skills (Gross et al., 2018). This shift in focus was solidified in 2016 when the Association of College and Research Libraries (ACRL) rescinded their Information Literacy Competency Standards for Higher Education (ACRL Task Force on Information Literacy Competency Standards, 2000), which described information literacy practices through a checklist of five tangible tasks (such as “Evaluate the Information”) and replaced them with the Framework for Information Literacy for Higher Education (ACRL, 2016). The new Framework centers less on tasks or tangible steps to take in the research process and more on concepts within the research environment that will give its users a deeper understanding of and more agency in the information creation process and scholarly conversation. Within the Framework there are six “frames” that were created around core threshold concepts central to information literacy, and each has defined knowledge practices and dispositions that address different dimensions of learning and offer ways for learners to demonstrate their increased understanding of the concepts (ACRL, 2016). Through these new frames, information literacy instruction has become more nuanced, creating more of a dialogue between instructor and student to deepen learning and engagement.

A growing awareness of racial and cultural inequalities, both in general society and the educational system, has paralleled changing instructional methods (Hammond, 2015). Critical race theory was born out of the inadequate representation of race in critical legal theory during the 1980s at Harvard University by Derrick Bell and his students (Delgado & Stefanic, 2012), and its formal introduction into education by Ladson-Billings in the late 1990s gave educators the tools to more specifically address the aforementioned inequalities (Ladson-Billings, 1998). Employing critical race theory in any instructional session is vital in order to mitigate for and remediate the racial achievement gap caused by the systemic disparities inherently built into the educational system for students that identify as a racial or ethnic identity/identities other than white (Bandy et al., 2021; Kozol, 1991). Much work has been done to examine the efficacy of different instructional modalities and the inclusion of equitable and inclusive practices in the field (Lowe et al., 2015; Rutledge & LeMire, 2017; Sullivan & Porter, 2016), though few have investigated multiple IL sessions for specific student groups outside of a specific course. This study focuses on the following research question: does a multi-session information literacy workshop series delivered outside of the traditional college classroom setting impact learning outcomes for first-year students of color?

METHODOLOGY
The study is designed as a QUAL+quan convergent mixed-methods study, and uses critical race theory (CRT) as its theoretical framework, as well as a participatory action research (PAR) approach. The study is formatted as a multi-session IL workshop series delivered outside of the traditional classroom, and is comprised of six one-hour sessions: an initial focus group, four IL sessions focusing on specific aspects of the research process, and semi-structured interviews. Several instruments are used for data collection: pre- and post-series surveys of information literacy experience with research, in-session formative and summative activities with session-
specific rubrics for the submitted activities, as well as a focus group prior to the workshop series, and semi-structured interviews with participants after its completion. Recruitment of student participants is done in collaboration with the university’s mentoring network for students of color, with the participant number capped at 30 students of color in their first year of higher education, and gift cards being offered as incentives. Though this study is not expected to harm participants engaged in the series content or delivery, several steps were taken to protect participants. Ethics approval was obtained through participating institutions’ IRB offices, all data are kept anonymized through the use of student ID numbers, and triangulation, member-checking, thick descriptions, and bias clarifications are employed as validity strategies for trustworthiness (Creswell, 2014).

**PRELIMINARY RESULTS AND SIGNIFICANCE**

Preliminary findings from this in-progress study will be shared in the poster. This study is significant because it will be the first study to specifically address the systemic racial achievement gap coupled with multi-session IL workshop series delivered outside of the traditional classroom and can serve as a model for institutions in similar situations. Secondly, the explicit incorporation of both critical race theory (CRT) and participatory action research (PAR) into an extended IL learning environment (i.e., more than one session) external to a specific course will contribute to the field’s understanding of the value of these theoretical frameworks.

**CONCLUSION**

This mixed-methods study uses PAR alongside the theoretical framework of CRT to collect data relating to the participants’ understanding of information literacy concepts. The findings collected through the quantitative data (pre-/post-series surveys and rubrics) alongside the qualitative data (initial focus group, session observations, and post-series interviews) will be integrated to provide a comprehensive perspective on any changes in the participants’ IL conceptual understanding. This study explores whether using critical race theory to design IL learning environments for first-year students of color impacts their learning outcomes. While these data alone cannot prove a direct causal relationship between the workshop series and comprehension of IL concepts (as other mitigating variables cannot be assessed or controlled for, such as variables within participants’ personal, financial, or academic lives outside of the workshop), it can serve to show if a correlation exists between multi-session IL workshops delivered outside the traditional classroom setting and the learning outcomes of first-year students of color.

**REFERENCES**


Developing Critical Information Literacy Pedagogies in the Face of Scholarly Misconduct

Batool Shahid, Syeda Hina
Sinnamon, Luanne
University of British Columbia, Canada | syeda.shahid@ubc.ca
University of British Columbia, Canada | luanne.sinnamon@ubc.ca

ABSTRACT
Drawing on the need to shift from competency-based information literacy instruction to critical information literacy instruction, this study examines scholarly communication and scholarly misconduct in the health sciences based on literary evidence. We report on a qualitative systematic review of forms of scholarly misconduct in the health sciences and participants' attitudes towards these phenomena, with the goal of developing new, critical, approaches to information literacy instruction. The data synthesis process indicates there are four major areas of misconduct in health science research: in conducting research, publishing, following research protocols and determining authority. This categorization informs a framework for critical information literacy dispositions and pedagogies for researchers across health disciplines and geographies.

KEYWORDS
Critical information literacy; scholarly communication; scholarly misconduct; health sciences

BACKGROUND
The increased pace of scholarly communication means that researchers are expected to produce more publications in more global outlets, which is a driver of misconduct (Poduthase, Garza & Wood, 2018). In the face of such systemic pressures, library instruction programs need to move beyond traditional skills-based learning to support the development of informed researchers, authors and consumers of health information. Digital environments have led to an increase in both knowledge creators and information users (Reed, 2018). This changing landscape calls for broader approaches to IL, including CIL (critical information literacy), which requires teaching about the information production process (who creates it, how and why?) and the social, economic and political factors affecting knowledge creation, publication and dissemination. Building on the need to take practical steps towards CIL in connection with scholarly communication, this poster reports on the first phase of a larger study, in which evidence of different forms of scholarly misconduct in the domain of health sciences is being collected through a qualitative systematic review. “Scholarly Misconduct” is conduct that breaches the scholarly standards and practices that are generally accepted within the relevant scholarly field” (University of British Columbia, 2019, p.3). In the second phase, empirical evidence will be gathered through interviews and focus groups with researchers. The data collected in both phases will provide the foundation for developing CIL-informed training frameworks for use within the practice of health librarianship. This work will build upon, update and extend existing tools, such as the Association for College and Research Libraries (ACRL) Framework for Information Literacy (2016).

METHODOLOGY
We conducted a qualitative systematic review, which is rare in the health sciences than a quantitative review, and more challenging in some respects. It provides more flexibility and freedom to apply suitable data analysis techniques to interpret the phenomena holistically. To develop a study protocol, a PICo (population, phenomena of interest and context) (Table 1) approach was used. This is widely used in health settings and recommended for qualitative reviews (Boland, Cherry & Dickson, 2017; Fane, 2017; Butler, et. al., 2016).

<table>
<thead>
<tr>
<th>Review Question</th>
<th>What are the common forms of scholarly misconduct in the domain of health sciences?</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(population)</td>
<td>PhD students/researchers/faculty/postdocs/industry researchers</td>
</tr>
<tr>
<td>I(interest)</td>
<td>Views about scholarly misconduct forms/experiences/factors</td>
</tr>
<tr>
<td>Co(context)</td>
<td>Academic/Research process/publishing phenomenon</td>
</tr>
</tbody>
</table>

Table 1. PICo: present study protocol

A search of qualitative evidence was made across three major databases: ‘Web of Science’, ‘Scopus’ and “PUBMED” in January 2023. As we are interested in current forms of scholarly misconduct, including recent technological, social and scientific trends, the search is limited to the past decade (2013-2022). We developed a systematic search strategy (query), which retrieved a total of 519 articles across the selected databases. After excluding duplicate articles (308) and the initial screening (280), 28 studies remained for quality checks.
FINDINGS
The researchers adopted the thematic data synthesis meta-ethnography technique (Boland, Cherry & Dickson, 2017) to collect evidence from the final pool of studies (Table 2). The selected studies were initially scanned to find all forms of scholarly misconduct (Column 1, Table 2) mentioned by the study participants. The data synthesis process resulted in the broader classification (Column 2, Table 2) of four major areas. These broader areas further guided researchers to identify the needed CIL skills and dispositions, i.e., ways of thinking and behaving, for health sciences researchers (Column 3, Table 2).

<table>
<thead>
<tr>
<th>Common Forms of Misconduct</th>
<th>Data synthesis: Areas of Misconduct</th>
<th>Needed Skills and Dispositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data fabrication, Falsification (selective data analysis - “cherry picking”, mixing data from multiple experiments), Image manipulation, Lab misconduct, “Spin” (over-selling results)</td>
<td>Manipulation in the conduct of research process</td>
<td>To develop basic knowledge and skill sets on research data analysis and representation, critical consciousness about the research process (such as identifying bias, misconduct, manipulation etc.) and application of research ethics and values</td>
</tr>
<tr>
<td>Duplicate publication, “Salami” publishing (multiple papers from a single study), Text recycling, Plagiarism</td>
<td>Manipulation in the publishing process</td>
<td>To develop knowledge and a skill set to define and practice personal responsibility as a researcher, based on ethical standards and values</td>
</tr>
<tr>
<td>No ethical approval, Fake consent forms, Fake peer review, Poor storage of original data, misuse of financial resources/ misappropriation of funds</td>
<td>Violation of research process protocols</td>
<td>To develop knowledge and a skill set to effectively manage research processes, records, and instruments used in research; ethical standards for use of data</td>
</tr>
<tr>
<td>Repression of collaborators, Authorship manipulation - ghost, gift, coercion, mutual support authorship</td>
<td>Authority related manipulation</td>
<td>To develop knowledge and a skill set to question authorship practices and develop research protocols and emotional intelligence to avoid manipulation</td>
</tr>
</tbody>
</table>

Table 2. Summary of findings related to forms of scholarly misconduct and desired skills and dispositions

IMPLICATIONS
The literature-based findings make a contribution in identifying the common practices of scholarly misconduct. One limitation is that the impact of cutting-edge technologies such as ChatGPT may not yet be reflected in published studies. The collected evidence guided us to identify the desired dispositions of health sciences researchers framed through the lens of critical information literacy. The results inform the need to develop contextual critical information literacy standards, pedagogies and instruction methods, that are specific to the context of health librarianship and in the face of the growing incidents of academic misconduct. Findings will serve as input for the next stage of this study, which will include interviews with health science researchers and graduate students. The longer-term goal is the construction of a framework for CIL-informed instructional programs for use in academic and health libraries.

ACKNOWLEDGEMENT
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Enabling Historical Thinking through Interorganizational Cooperation

Bossaller, Jenny
University of Missouri, USA | bossallerj@missouri.edu
Witt, Steven
University of Illinois, USA | swwitt@illinois.edu
Aparac-Jelušić, Tatjana
University of Osijek, Croatia | aparact@gmail.com

ABSTRACT
This poster problematizes selected presentations and outcomes of an IFLA satellite conference on the history of professional organizations of librarians and information scientists. Representatives from organizations, including ASIST and library associations around the world from four continents (Europe, North America, Asia, Africa) will meet at the Mundaneum in Mons, Belgium. The theme of the conference is “Preserving our origins: Approaches to the organization, curation, and historiography of the record of national and international organizations in libraries, information, and documentation.”

An irony within information science is that its many professional associations often fail to identify and preserve their own history. Their work is documented, but often not well preserved, and hidden from a wider audience. Born digital materials are especially vulnerable to loss (Neal, 2015). This poster identifies problems and best practices in managing the documents of historical value of volunteer-led associations and invites ASIST members to contribute to the historical work of the association.

The goal is to identify common problems in preserving association histories. The poster will present several projects discussed at the IFLA satellite conference, as well as proposed ways forward that will advance historical work for the information professions.

KEYWORDS
Library and Information Science History; Oral History; Collaboration; Digital Libraries; Digitization

INTRODUCTION
Information-centric organizations, including ASIST, have led developments that define the “information society” and have been instrumental in preparing the workforce driving the knowledge economy. The work of professional associations, made up of both academic and professional members who often do this work outside of their main jobs and as volunteers, occurs in both informal or ephemeral spheres such as committees and interest groups in addition to its formal communication spaces such as conferences and journals. Developments within the field happen within the context of the work of committees, working groups, special interest groups, etc.; therefore, tracing development of ideas that arise in these groups is not merely solipsistic navel-gazing, but also a means to review alternate paths that are found in lesser-known, untold, and unsuccessful projects. Tracing and interpreting the past might lead to different results and possibly point towards new areas of research. Examining the past can help us see forks in the road, rectify wrongs, and discover new paths to advance. However, without preserving and making the history of individuals and groups available to the widest group possible, alternate paths will be lost and remain unexplored.

PAST AND ONGOING PROJECTS OF INFORMATION ORGANIZATIONS
The IFLA satellite conference (Mons, August 16-19, 2023) provides a means to create a joint project that exposes common problems with historiography and access to historical materials. Representatives from current IS/LIS organizations, including ASIST; the American, Italian, and Japanese Library Associations; the Vatican Library; the Chartered Institute of Library and Information Professionals (UK), and IFLA will present projects exploring stories and problems. The wider subject of inaccessibility of historical materials will also include the now defunct organization, the International Federation for Information and Documentation (FID) (1895 -2002), which has papers of high interest to scholars of bibliography and documentation but whose archives are currently inaccessible.

ASIST has gone through several name changes and is now in its 85th year. ASIST began as the American Documentation Institute, which was a member of the FID. It has evolved to become an international organization, which presents opportunities for wider collaboration and international representation. The History Committee has engaged in several projects to document members’ work or to make historical materials more widely accessible. One example is the Pioneers of Information Science project, which was begun by Robert Williams in 1996. Data is currently being transferred to a wiki in order to preserve and make his work widely available while also opening opportunities for expansion of the original project.

The International Federation of Library Associations and Institutions (IFLA), similarly, has a Library History SIG which has recently taken steps to ensure the preservation of IFLA’s historical record and working across the association to document IFLA’s history. This has included an ongoing oral history project that is the focus of the
SIG’s 2023 conference session. Additionally, the SIG is preparing to celebrate IFLA’s 100th anniversary through a five-year series of activities that will culminate in an edited book which will represent a global history of IFLA. Other organizations such as The American Library Association, now nearing its 150th anniversary, has a well-developed archive and digital institutional repository (ALAIR), to which users can contribute their files and documents.

**STRATEGIC AND ACTION PLANS**

As the IFLA Satellite Conference intends to demonstrate, documenting the activities and work of the representative associations is a widespread problem. Organizations mature and evolve. Strategic, actionable plans to document and organize activities becomes ever more imperative. ASIST addressed this problem by creating a Curator position and a History Committee. The Curator (a position created in 2018 upon the recommendation of the History Committee), working with the Knowledge Management Task Force and the History Committee, is asked to employ historical thinking: looking at the documents of the association with the aim of considering what will be useful for people in the future. Relatedly, the purpose of ASIST’s History Committee is to make doing historical work easier. Some of the ongoing strategic actions that the committee has engaged in recently include: (1) Creating a bibliography of all known publications of ASIST and its predecessors, (2) opening access to publications that were previously available only through proprietary databases, including ARIST, which was published by ASIST (1966 – 2011; 2021 – present) (3) the aforementioned Oral History project and the (4) Pioneers of Information Science projects, including the new wiki project, are related. These will be discussed at the IFLA satellite meeting and will be represented on the poster.

Bringing ASIST’s projects together with those of other international IS organizations will enable researchers to find areas of overlap and divergence in the organizations, providing both new lines of research and critical studies of interrelated organizations.

**CONCLUSION**

This poster will provide a summary and visual representation of the outcomes of the IFLA Satellite meeting. The three-day IFLA Satellite meeting at the Mundaneum, which is being co-hosted by the ASIST History Committee and the IFLA Library History SIG, focuses on historical preservation of LIS organizations and the historiography of information professions. It brings together related projects aimed at increasing access to primary source materials and instilling further interest in the history of these organizations. One goal is to propose methods of merging or bridging the historical assets of the organizations by employing best practices of storage and usability of digital systems.

However, the more important objective of the poster is to provide specific means for ASIST members to contribute to historical projects. In 2024, ASIST is moving out of its physical building, and its archival materials are being transferred to a university with an LIS program (location to be determined). Both the History Committee and the Curator position were decommissioned in 2023. These moves indicate a need for greater involvement by membership in preserving the association’s history.

This poster presents current efforts to capture and make openly available the work of individuals and groups within information organizations. In August 2023 IFLA’s History section will host a satellite conference attended by representatives from IFLA and ASIST, as well as national associations (e.g., Japan, Vatican, UK, Australia).

The location provides an intellectual backdrop for this work. The Mundaneum is the home of Paul Otlet and Henri La Fontaine’s turn of the 20th century project that sought to gather and organize all the world’s knowledge, using the Universal Decimal System (UDC) (Rayward, 1994; Wright, 2014). Additionally, Otlet and La Fontaine sought to network the world’s growing number of professional and academic associations. It is apt to bring together current projects that preserve the work of worldwide information organizations, their members, and committees as well as individuals who provided vision and energy to sustain and advance the organizations.

**ACKNOWLEDGMENTS**

This was made possible through the efforts of numerous current and past ASIST Curators Katherine LaBarre (Curator 2018 – 2021) Deanna Hall (Curator 2021 – Present); and History Committee members, especially Michael Buckland, History Chair 2021 – 2022.

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The COVID-19 Pandemic’s Impact on Credibility of Health Sources Among Undergraduate Students

Bowen-Ziecheck, Aaron  McGill University, Canada | aaron.bowen-ziecheck@mail.mcgill.ca
Bartlett, Joan C.  McGill University, Canada | joan.bartlett@mcgill.ca

ABSTRACT
The following poster reports the preliminary results of a comparison between a 2017 survey on health information and the same survey administered in 2023. The primary research question is: How did the COVID-19 pandemic impact undergraduate students’ judgement of credibility in health information sources? Recent research has shown that student health information seeking has changed around the COVID-19 pandemic. However, the research has not noted whether the pandemic has had a lasting impact on credibility of sources during health information seeking at the presumptive tail end of the pandemic in 2023. The original study in 2017 surveyed the undergraduate population of McGill University. The same survey was readministered in 2023, with COVID-19 specific questions added. The preliminary analysis suggests that the COVID-19 pandemic impacted students’ judgement of credibility in health information sources. There were negative changes in the perceived credibility of family/friends, well-known websites, wiki, blogs/forums, and social media for both everyday life health and COVID-19 information from 2017 to 2023. Conversely, government/university, scholarly books/journals, and TV/radio all saw increases in perceived credibility for both everyday life health and COVID-19 information.

KEYWORDS
health information, credibility, everyday life information seeking, information behavior, COVID-19

INTRODUCTION
The COVID-19 pandemic disrupted the world in a profound way. Particularly, the pandemic was politically charged and divisive, leading to many conflicting reports on information and many instances of mis/disinformation. According to a report by the Council of Canadian Academies, misinformation cost an estimated 2,800 lives and $300 million in hospital expenses between March and November of 2021 in Canada (Major, 2023). Given the prevalence and impact of misinformation around the pandemic, it is important to understand which health information sources people judge as credible.

The following poster reports on a comparative analysis of a 2017 survey on health information sources to the same survey administered in 2023. This comparative study is used to answer the primary research question: How did the COVID-19 pandemic impact undergraduate students’ judgement of credibility in health information sources? Preliminary results and analysis are presented here.

LITERATURE REVIEW
Recent research has shown that student health information seeking has changed around the COVID-19 pandemic. Students often used satisficing techniques, the tradeoff between time to access and accuracy of information, for health information seeking before the pandemic (Sin, 2015). These satisficing techniques were also observed in students during the early stages of the pandemic (Abdoh, 2022). A key indicator of satisficing, many students did not pay attention to where health information came from or the accuracy of the sources (Bartlett & Bowen-Ziecheck, 2022). However, the pandemic brought fake news and misinformation to the front of students’ minds during health information seeking (Amiri, Moulaei, Bahaadinbeigy, Ghaemi, & Sheikhtaheri, 2022). Politics played a critical role in perception of COVID-19 health information (Chen et al., 2022). Some international students reported being more skeptical of government sources of COVID-19 information (Bartlett & Bowen-Ziecheck, 2022). Research during the height of the pandemic noted that many students made mistakes in their COVID-19 information seeking because they were overconfident in their health literacy skills (Patil et al., 2021). Literature has not yet noted whether the trends such as satisficing, fake news, skepticism of government, and information literacy skills have had a lasting impact on credibility of sources during health information seeking at the presumptive tail end of the pandemic.

METHODS
This poster reports data from a larger study on undergraduate students’ academic, everyday health, leisure, news, and COVID-19 information seeking habits. For each of the categories, students were asked questions on frequency of use, credibility, search tools, and information sharing. Not including demographic questions, 54 Likert-scale questions resulted from the combinations of categories and sub-categories. This survey, minus the COVID-19 questions, was administered in 2017 among the entire undergraduate population of McGill University, yielding 3,565 usable responses. The same survey was readministered in spring 2023, with COVID-19 specific questions added, yielding 1,420 complete responses. An initial descriptive analysis is reported below.

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FINDINGS

This poster reports on the analysis comparing credibility answers in the categories of everyday life health and COVID-19 information from the 2017 and 2023 surveys. Table 1 shows the preliminary results comparing the average perceived credibility students reported for the various information sources included in the surveys for everyday life health information seeking (ELHIS) and COVID-19 information seeking (COVID-19 IS).

<table>
<thead>
<tr>
<th>Source Used for Health Information Seeking</th>
<th>2017: Average Credibility Rating for ELHIS</th>
<th>2023: Average Credibility Rating for ELHIS</th>
<th>2023: Average Credibility Rating for COVID-19 IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family and friends</td>
<td>4.6</td>
<td>3.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Experts</td>
<td>4.3</td>
<td>4.5</td>
<td>4.3</td>
</tr>
<tr>
<td>Well-known websites</td>
<td>3.9</td>
<td>2.9</td>
<td>2.7</td>
</tr>
<tr>
<td>Wiki</td>
<td>3.6</td>
<td>2.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Peers, students</td>
<td>2.8</td>
<td>2.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Blogs, forums</td>
<td>2.8</td>
<td>2.2</td>
<td>1.9</td>
</tr>
<tr>
<td>Government or university</td>
<td>2.8</td>
<td>3.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Scholarly books, journals</td>
<td>2.7</td>
<td>4.2</td>
<td>4.1</td>
</tr>
<tr>
<td>Social media</td>
<td>2.6</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Popular books, magazines</td>
<td>2.2</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>TV, radio</td>
<td>2.0</td>
<td>2.5</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Table 1. Comparing 2017 to 2023 Credibility Ratings (1=Not Credible, 5=Very Credible)

The COVID-19 pandemic has seemingly had an impact on students’ judgement of credibility in health information sources. While there is more analysis to be done, preliminary results show that there were negative changes in the perceived credibility of family/friends, well-known websites, wiki, blogs/forums, and social media for both everyday life health and COVID-19 information from 2017 to 2023. Conversely, government/university, scholarly books/journals, and TV/radio saw increases in perceived credibility for both everyday life health and COVID-19 information. There was seemingly little difference between the ELHIS and COVID-19 credibility ratings of most information sources during this preliminary analysis. The only source category that seems to have been little affected between 2017 and 2023 was expert sources.

CONCLUSION

The changes noted in the preliminary data may be ascribed to the heightened awareness of mis/disinformation as noted in the literature on COVID-19 information seeking. In contrast, the lack of change may suggest that experts (e.g., healthcare practitioners and researchers) maintained a steady credibility among undergraduate students between 2017 and 2023. Similarly, there was less variation among perceived credibility from the 2023 survey answers on everyday life health versus COVID-19 information. The lack of difference may suggest that COVID-19 information has become so integrated in everyday life as to have impacted the credibility of sources of everyday life health information. A limitation of this study is that it is contextualized around undergraduate students at a single Canadian university. Findings may not hold true for other geographic and demographic contexts.

ACKNOWLEDGMENTS

The authors would like to thank the PhD committee (Dr. Max Evans and Dr. Genevieve Arsenault-LaPierre) and the Information Interaction Group at the McGill School of Information Studies for their support. The work is funded by a SSHRC (Social Sciences and Research Council – Canada) Insight Development Grant to Jamshid Beheshti, and a SSHRC Insight Grant to Joan Bartlett.

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Translating Research into Practice: Plain Language and Writing for Machine Translation Guidelines

Bowker, Lynne  
University of Ottawa, Canada | lbowker@uottawa.ca

ABSTRACT
Scholars seek to translate research into practice through science communication, but the overwhelming use of English makes it challenging for some local community actors to access research findings. Machine translation (MT) tools can help, but the underlying data-driven approach does not work equally well for all languages and domains. If plain language summaries can be rendered more MT-friendly, this could make it easier for speakers of other languages to access research. This poster compares guidelines for plain language and guidelines for writing for MT to determine their compatibility and potential usefulness for creating reader- and MT-friendly summaries.

KEYWORDS
Information literacy; digital literacy; science communication; plain language; machine translation

INTRODUCTION
Two important trends are unfolding in scholarly communication. First, researchers are increasingly encouraged to participate in outreach or science communication, which means translating their research findings into a format that is accessible to groups beyond the academic community, such as policy makers, funders, or community partners (UNESCO, 2021; Science Europe, 2022). Secondly, there is a recognition that the domination of English for scholarly communication has some negative effects, including reduced uptake of research findings in local communities, where local actors may not be fluent in English (Amano et al., 2016). Groups such as the Helsinki Initiative (2019) are calling for greater linguistic diversity in both scholarly and science communication. Ideally, researchers would make their findings available in a popularized format in many languages; however, this may not always be practical given the time and cost of professional translation (Ramírez-Castañeda, 2020), as well difficulty foreseeing exactly which or how many languages will be needed. Can automatic machine translation (MT) tools (e.g. Google Translate) or tools using Large Language Models (e.g. ChatGPT-4) help to make research available in more languages? What can researchers do to set these tools up for success? This poster will examine these questions.

We begin by explaining how data-driven tools work and why this approach poses challenges for translating highly specialized texts in some languages. Next we consider whether combining plain language and MT can be a stepping-stone to help make science communication more multilingual. To do this, we compare existing guidelines for plain language writing and writing for MT before proposing an integrated list that researchers can use to prepare plain language summaries of their research that are both reader friendly and MT friendly.

DATA-DRIVEN MACHINE TRANSLATION
Since the 1950s, various approaches have been used to try to get computers to translate; however, current MT tools use a data-driven approach combined with artificial-intelligence-based techniques such as machine learning (Koehn, 2020). Tool developers gather enormous parallel corpora, which are collections of texts that have already been translated by professional translators. These texts are aligned at the sentence level with their translations, and they are used as a training corpus of examples from which the machine can learn. To be effective, data-driven systems need vast quantities of data (e.g. millions of pages of previously translated texts). However, quantity is not enough; the texts also need to contain the right kind of data (e.g. relevant topics, text types). While it can be easy to gather huge corpora for widely used languages and common topics, it is challenging to find parallel corpora that contain translations between less widely used languages and that deal with specialized topics (e.g. cutting-edge research). Therefore, MT tools tend to perform less well for lower-resource languages and domains (Koehn & Knowles, 2017).

In trying to improve early linguistics-based MT tools, researchers found that constraining the input could improve translation quality. Controlled languages (e.g. ASD, 2021) restrict the terms and syntax that can be used; however, this approach does not suit all text types, and it is difficult to apply controlled language skillfully. Moreover, Marzouk and Hansen-Shirra (2019) found that combining controlled language with data-driven tools lowers translation quality because controlled language is not well represented in training corpora.

PLAIN LANGUAGE
Using plain language means writing a text in a way that is easy for a reader to understand the first time that they read it. Plain language use is growing in many contexts, including in administrative texts, legal texts (e.g. contracts), and health texts (e.g. patient information) (Maaß, 2020). In addition, plain language is used in science communication to make research accessible to non-experts (Stoll et al., 2022). Unlike controlled language, which has strict rules about authorized and non-authorized forms, plain language has guidelines for clarifying content (e.g. use short sentences, use the active voice, avoid jargon). Plain language is closer to standard language and therefore closer to the contents...
of the training corpora used by data-driven MT. While plain language can make text more accessible for readers, can it also improve the translatability of a text? There exist other sets of guidelines on writing for (machine) translation.

**WRITING FOR (MACHINE) TRANSLATION**

Language is inherently ambiguous, and poorly written source texts are hard to translate for both professionals and MT tools. However, humans can compensate for some issues in the original text (e.g. fixing typos or punctuation, using context to interpret intending meaning, making educated guesses, doing additional research), while MT tools cannot. Therefore, organizations such as the Translation Centre for the Bodies of the European Union (2021) have developed guidelines on writing for MT because eliminating problems in the original text is faster and cheaper than fixing a problem in all the translations. Our project compares writing for MT guidelines with plain language guidelines to see whether they can be combined to facilitate the translation of plain language summaries via MT.

**METHOD**

Some academic publishers (e.g. SAGE, 2023; Taylor & Francis, 2023) encourage plain language summaries and they offer guidelines to help authors create them. Space precludes us from reproducing all these guidelines, as well as those from the above-mentioned Translation Centre (2021) on writing for MT. However, we made a detailed comparison of the two types of guidelines to identify similarities and differences. Using this information, we then compiled a set of integrated guidelines that can be used to create reader- and MT-friendly plain language summaries.

**RESULTS AND DISCUSSION**

The two types of guidelines are complementary not contradictory. While some plain language guidelines also figure in guidelines for writing for MT, other issues pose problems for MT systems but not for readers. Therefore, the following integrated set of guidelines can help to ensure that a text is useful not only for readers who will access the text in the original language but also for readers who will use MT tools to consult the text in other languages:

- Avoid jargon. If you must use technical terms, explain them and then use them consistently.
- Avoid acronyms and abbreviations. MT tools may process abbreviated forms as words.
- Use the active voice.
- Avoid very long sentences (e.g. more than 50 words) and very short sentences (e.g. fewer than 7 words). Long sentences can be difficult for readers and MT tools to process; MT tools also have trouble with short sentences which may omit clues that can help to clarify the relations between different sentence elements.
- Break up strings of three or more nouns (e.g. instead of “sensitive protein function monitoring system”, use “a sensitive system that monitors protein function”) to clarify the relations between the elements.
- Use pronouns sparingly. MT tools process one sentence at a time and may not be able to identify the noun that the pronouns is replacing. This is particularly problematic in languages that have grammatical gender. Where possible, repeat nouns instead of using pronouns.
- Avoid writing in all capital letters. MT tools use case to help disambiguate text.
- Avoid special symbols and use words instead (e.g. use “and” not “&”). Some special symbols may not be part of the character set of another language and could be mishandled by MT tools.
- Avoid culture-specific idiomatic expressions (e.g. “to hit it out of the park”).
- Avoid unnecessary hard line breaks. MT tools treat material separated by a hard return as separate units.
- Punctuate the text properly. MT tools use punctuation to disambiguate the text.

**CONCLUSION**

Achieving a more linguistically diverse scholarly communication ecosystem will require a multipronged and multistage approach, but creating MT-friendly plain language summaries in any language, including English, can help in a few ways. Greater availability of MT-friendly summaries will make it easier for readers to access research results in their own language via MT, which can in turn facilitate the uptake of these results in local communities. Moreover, the creation of additional plain language summaries on specialized research topics will contribute to the volume of texts available for training corpora, thus potentially improving the translation quality of MT tools for specialized content. This first stage of our research has demonstrated that guidelines for plain language and for writing for translation are complementary rather than contradictory, and so they can be integrated into a single set of guidelines for creating reader- and MT-friendly summaries. Next steps will include testing the usability of the guidelines as well as evaluating the translation quality of summaries produced using these guidelines.

**ACKNOWLEDGMENTS**

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Making Ends Meet in a Pandemic: African Library Initiatives During COVID-19

Bugre, Charles  
University of Washington, USA | cbugre@uw.edu
Jowaisas, Chris  
University of Washington, USA | chrisjow@uw.edu
Young, Jason C.  
University of Washington, USA | youngjc2@uw.edu

ABSTRACT
This poster captures the initiatives of African community and public libraries in the early stages of COVID-19. This is part of an ongoing research on the impact of the COVID-19 and long-term implications for African libraries. We conducted 11 interviews in 9 countries using both purposive and snowball sampling. We analyzed the recorded data through a thematic analysis approach. Arising from the data, we found that librarians employed empathetic information interventions using widely available information technology tools to deliver critical information to promote the well-being of their communities. The libraries initiated social cohesion talks to foster unity among families. They also used WhatsApp to send snapshots of study materials to examination candidates and to point people to social services. This work contributes data to scant literature about the initiatives of African community and public libraries during the COVID-19 and how low resource libraries can support their communities in crisis.

KEYWORDS
Initiatives; public libraries; community libraries; COVID-19; Africa

INTRODUCTION
Public libraries are essential institutions in society—crucial not only for a strong literate society but also to expose the citizenry to the vast pools of information for economic growth, well-being, and social coexistence (Albanese, 2021; Holcomb et al., 2019; Johnson, 2012; Lenstra & D’Arpa, 2022; Mansour, 2020; Okojie & Okiy, 2019). Many public libraries struggled for the first few months of COVID-19, but then quickly initiated services to serve clients and minimize the spread of the disease (Robert et al., 2021; Xin, 2022). Public libraries in Asia introduced contactless services using smart devices, set up book corners in isolation centers, and organized live mental health broadcasts (Guo et al., 2022; Kou et al., 2021; Xin, 2022). Similarly, in the Americas, Europe and Australia, libraries promoted online yoga, live musical concerts, free Wi-Fi hotspots, and virtual community engagement platforms to assist people to cope with the pandemic (Chase, 2021; Freudenberger, 2020; Goddard, 2020; Goek, 2021; Wilson, 2021). There is, however, relatively little empirical research on the initiatives that African community and public libraries undertook during the pandemic (Shonhe, 2022). The few published articles that exist largely focus on challenges encountered, on theoretical recommendations, or on academic libraries. Little work reviews the empirical practices of community and public libraries. For instance, Otike et al. (2021) highlights the challenges that Kenyan and Moroccan public libraries faced during the pandemic such as Internet connection issues, low digital literacy skills and low access to digital technologies. They recommended possible opportunities and encouraged librarians to find innovative ways to help patrons access credible information. Similarly, Chisita and Ngulube (2022) and Joel and Camble (2021) provide general recommendations describing what libraries should have done. It is only the African Library and Information Associations and Institutions (AfLIA 2020; Chigwada 2021; Shonhe 2022) whose research hints that public librarians were assisting patrons via messaging platforms such as WhatsApp and Facebook. But even this was a fairly limited review focused largely on academic libraries. The current study focuses on the research question: What initiatives did African community and public libraries undertake during the early stages of the COVID-19 pandemic? This period is significant because most institutions were closed for in-person services and had to question their current practices, be creative, empathetic, and adaptable to meet urgent needs of their clients. Secondly, public/community libraries in most African states are less resourced than academic libraries.

METHODS
We conducted virtual one-on-one semi-structured interviews from March to April 2023 with head librarians of community and public libraries across the 5 subregions of Africa using Zoom. We found interviews to be better suited than questionnaires as they allow for more complex questions and follow-up on responses (Adam & Cox, 2008). Only English-speaking participants were recruited using both purposive and snowball sampling via a mailing list from a related research project (see, e.g., Young, et al, 2019). We interviewed 11 head librarians from 9 countries which covered both urban and rural settings; regional and community-level libraries; and least and better-resourced libraries. The participants were from South Africa, Zimbabwe, Kenya, Uganda, Ghana, Nigeria, Sierra Leone, Egypt, and Democratic Republic of Congo (DR Congo). Four of the participants interviewed were also heads of the community and public libraries associations in their provinces. While no generalized claims are made on this study, we believe that the insights are valuable to show less-resourced libraries how they can support their communities in crises using simple and available tools. The interview instrument was reviewed by eight Master of
Library and Information Science (MLIS) students, two senior research scientists, and two MLIS instructors. It was also pre-tested with two librarians from University of Washington, United States of America. Interviews asked participants what tasks/services the libraries were able to do when they were closed or restricted to the public due to the pandemic; and what were the tasks/services they started which they were not previously doing prior to the pandemic. Interviews were recorded with participants’ permission, transcribed, and sent to participants to verify accuracy (Birt et al., 2016). They were then coded using a thematic analysis approach (Braun & Clarke, 2006).

RESULTS AND DISCUSSION
The initial findings of the interview confirmed that many community/public libraries in Africa could not support remote services, did not have social media handles, and had many staff that lacked IT skills (e.g. AfLIA, 2020). However, all head librarians interviewed disclosed that despite these challenges, they were able to initiate some empathetic (that is, kind and compassionate) information services to assist in the wellbeing of their patrons. In most cases, they used their personal resources. These interventions include:

Social Cohesion Talks and Social Services
Social cohesion - the sense of solidarity and strength of relationships among people - has great influence on health outcomes (Kawachi & Berkman, 2000; Thoits, 2011). COVID-19 lockdowns weakened this sense of cohesion in family units due to restrictions on movement and other stressors. Our interviews revealed that public libraries with expert social workers and psychologists organized virtual and radio talks to help foster unity and strengthen social relationships. For instance, Interviewee 5 disclosed that they organized talks to foster social relationships among family members because “children and parents were beginning to hate each other”. Librarians believe this initiative contributed significantly to minimize the friction among the family members and thus they believe “it was a great investment”. Similarly, other public libraries were concerned about feeding needy children when school reopened. As Interviewee 9 puts it: “...the school gives a meal to ...children but only once a day. So, we...help those children every morning on the way to school... have porridge as well.” Some community libraries organized bike races to help their community members keep fit. These initiatives demonstrate how information professionals contributed to social cohesion, happiness, and well-being during a pandemic.

Digital Literacy Trainings and Virtual Services
Digital literacy became a must-have skill during the COVID-19 pandemic for independent information seeking and sharing. Unfortunately, at the onset of the pandemic, many librarians and their patrons had little or no digital literacy skills. Most public libraries offered their staff and patrons access to online digital literacy training such as software applications like word processors, emails, video conferencing software and many more. For instance, Interviewee 3 disclosed that they “organized literacy classes, … between one to two months on digital basics, for example, opening a Gmail, typing with the computer, parts of the computer, then also on how to use… smartphones” However, the problem was not only lack of digital skills, but also poor internet connection, intermittent power supply, and financial constraints to participate in these initiatives. Thus, some libraries used WhatsApp to share storytelling videos with parents for their kids, to share scanned or snapshots of learning materials with examination candidates and to refer people to government social services such as grants or food that were shared during the pandemic. For instance, Interviewee 2 revealed that they tried “…to engage the communities as much as possible [by] collecting data such as phone numbers, and so forth…that ... go into [creating] WhatsApp groups because WhatsApp is cheaper”. Similarly, some other well-resourced public libraries developed e-library apps, introduced mobile payment systems, installed solar power systems, and improved their Internet connectivity. For instance, Interviewee 7 revealed that patrons “used to pay by cash. But after COVID, … [the library] introduced MPesa payment system.” All these initiatives show that despite the scant digital resources and staff skills at the disposal of community/public libraries in Africa, they took steps to make ends meet as one librarian noted: “if you're closed for six months, and you're not giving any service really, are you necessary?” (Interviewee 2).

CONCLUSION
In brief, this poster captures empirical evidence which shows that amid the lack of virtual service tools and resources in early COVID-19, African community and public libraries managed to improve their communities’ well-being through social cohesion training, social service referrals, digital skills and sporting activities. This work contributes data to how low resource libraries can support their communities in crisis. Now that the COVID-19 disease is no longer a pandemic, one wonders what lessons community and public libraries in Africa learned from the pandemic. What opportunities can they derive from it? How do they intend to improve their operations and facilities to better cope in similar future situations? These questions are important because as one participant put it, most public libraries in Africa “were almost rendered useless” (Interviewee 2). These questions will guide our deeper analysis of the rest of the interview data that we recorded to further examine a set of community engagement frameworks that less-resource libraries can use to support their communities in crisis and beyond.
REFERENCES


Performance and Organizational Characteristics of Analytics Teams in Healthcare and Population Health: Methods and Preliminary Observations

Buie, Ronald W. University of Washington, USA | buierw@uw.edu
Zachry, Mark University of Washington, USA | zachry@uw.edu
Chen, Annie T. University of Washington, USA | atchen@uw.edu

ABSTRACT
Existing models of the work of analytics teams and how they impact health organizations do not describe the activities, nor their relationship to the organization, in sufficient detail for optimal decision making. This poster reports on an ongoing study of the work of healthcare and population health analytics teams to rectify this gap. We are interviewing members of analytics teams in healthcare and population health organizations to gather data on the processes, deliverables, downstream and upstream stakeholders, and artifacts that the teams rely on to conduct and manage their work. The primary analysis uses a grounded theory approach, with a secondary activity theory analysis of relationships between the analytics team, identified cognitive artifacts, and intended outcomes. In this poster, we intend to present the methods, participants, and some preliminary observations. We hope that this presentation will solicit feedback that leads to improvements in the study.

KEYWORDS
Information behavior, health informatics, analytics teams, grounded theory, activity theory

INTRODUCTION
Gaps in our understanding of how business analytics systems impact organizations leads to waste and inefficiencies in their use (Sharma, Mithas, & Kankanhalli, 2017). This inefficiency, combined with the high stakes of human life, have made the improvement of our use of analytics in health services a priority (Institute of Medicine & Committee on the Learning Health Care System in America, 2013). To improve our understanding of how analytics teams perform in healthcare and population health organizations, we wish to understand the activities, products, and stakeholders of these teams. Existing models of how such teams work and how they impact their organizations do not describe the activities, nor their relationship to the organization, in sufficient detail for optimal decision making (Côrte-Real, Ruivo, & Oliveira, 2014). For example, in extant work comparing models of information behavior in collaborative environments, Ndumbaro (2023) notes that models of Collaborative Information Behavior (CIB) generally agree that increased informational complexity correlates positively with increased CIBs, but that the specifics of what constitutes CIBs are not congruent across models. This heterogeneity was attributed to the contexts of the models’ origins, each being aimed at a particular industry or job description. Of the models analyzed, only that proposed by Reddy and Jansen (2008) was developed in the scope of the healthcare industry, and it relies on observations from care teams, rather than analytics teams. Analytics teams deployed in healthcare and population health organizations are likely to present different priorities, opportunities, and stakeholder needs than that of other collaborative work units within or outside of healthcare and so may warrant their own investigation and the development of models specific to these teams (Deloitte Center for Health Solutions, 2015; Harwich & Laycock, 2018; The Lancet, 2018; Ward, Marsolo, & Froehle, 2014).

METHODS
To address the need to better understand the work of analytics teams in healthcare and population health, and the lack of models specific to these teams, we propose a constructivist grounded theory approach to studying the work of direct contributors and managers of these teams. Grounded theory is a family of investigation and analysis approaches whose resulting concepts and theories are intended to be derived from the collected data (Corbin & Strauss, 1990). Collected data, such as interviews and direct observations, are abstracted into higher order concepts and relationships among those concepts that lend themselves to being developed into formal theories of the observed phenomenon. Constructivist grounded theory asserts that the researcher’s circumstances, perspective, and approach are integral to the results, and that, unlike other grounded theory approaches, the researcher is said to actively construct theory as a pragmatic (for the researcher’s interests) abstraction of reality, rather than discover theories believed to be inherent to the phenomenon (Charmaz, 2014).

In addition to a grounded theory approach, we propose a distinct study of the artifacts of cognition utilized by these teams. The work of analytics teams is often facilitated through the use of artifacts such as dashboards, calendars, spreadsheets, and documentation that serve to develop, and assert shared cognition and collaboration of tasks between humans and humans-and-machines (Fiore & Wiltshire, 2016). Analysis of these cognitive artifacts may serve as a basis for further understanding and measuring the work of these teams. Precedent for this approach is

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noted in other areas of health services research, such as the work of Nemeth, O’Connor, Klock, and Cook (2006) examining how mapping of cognitive artifacts to the care coordination processes they are used in could allow researchers to predict the existence and features of coordination of care processes for a given team. Similarly, study of the uses of personalized auxiliary documentation, “paper brains,” among nursing staff, has been used to identify deviations from expected process and deficiencies in electronic health record documentation for case management and communicating information across shift changes (Blaz, Doig, Cloyes, & Staggers, 2016).

Our primary data are interviews with members of analytics teams serving population health and healthcare organizations. These interviews are approximately one hour long, semi-structured sessions, asking the participants to discuss their work in the context of one or more projects or job duties. For each project, the participant is asked to share details about the specific work they and their team members engage in, the tools and resources relied on to conduct the work, and the stakeholders, collaborators, and recipients of the team’s work. Additional questions have explored issues of quality control, management, and negotiation of the work, products, and stakeholders. Participation is currently scoped to direct contributors and managers of teams specialized in analytics work on behalf of public health or health services delivery organizations.

**Use of Activity Theory in Artifact Analysis**

Separate from our grounded theory analysis, we propose an analysis of the artifacts of cognition that is rooted in Activity Theory. Engestrom’s work in Activity Theory provides a flexible framework for describing the components of human activity conducted in service of an outcome (Engestrom, 2000). This framework subdivides an activity into the Subject (primary actor), instruments used, rules, community of actors, division of labor among actors, object of the activity, and how these features, and their interactions with each other, lead to outcomes.

![Figure 1. Diagram of proposed data collection and analysis processes](image)

**PARTICIPANTS**

To date, the study has enrolled 3 participants from analytics teams in a large county health department and is negotiating participation from 3 additional staff in the same health department, and 2-4 staff from a medical analytics consultancy. These participants include 2-4 managers, with the remainder being direct contributors to their projects. The projects covered include all-payor-claims (a standardized data set of medical insurance claims from all insured medical cases in a state) analytics support, quality of care analysis, and population health outcomes reporting and communications.

**PRELIMINARY OBSERVATIONS**

For this poster, we plan to share a description of the topics we have encountered so far, along with preliminary findings. Topics encountered so far include project management/pipeline development tracking, quality control processes, what motivates accepting projects, capacity building of stakeholders, and the role of contracting structures and outreach in facilitating multi-stakeholder collaboration.

**CONCLUSION**

We have outlined the methods and theoretical underpinnings of a study currently underway. In addition, we have provided a description of participants currently, or soon to be, enrolled, and a description of topics discussed in our first interviews. In doing so we have two goals: first, to solicit feedback and discussion that may further inform our methods and thinking, and second, to raise awareness and possible interest, helping to expand the breadth of participants and representativeness of the sample. We expect that completion of this work will lead to the development of frameworks and rules-of-thumb for building and managing analytics teams.
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Productivity and Institutional Mobility of Recipients of Sloan Research Fellowships during Their Academic Career

Chang, Yu-Wei
National Taiwan University, Taiwan | yuweichang2013@ntu.edu.tw
Ling, Cheng Min
National Taiwan University, Taiwan | mindyling.c@gmail.com

ABSTRACT
This study determined that 18.6% of 199 recipients of Sloan Research Fellowships in Mathematics between 1955 to 1979 did not change institutions during the first 40 years of their academic careers after obtaining a doctor of philosophy degree. The results indicated no significant difference in the average productivity per researcher when they were categorized by their number of home institutions. However, average productivity differed significantly between recipients with and without international mobility. The results indicated an increasing trend in annual average productivity for all groups of researchers with international mobility except for researchers with one home institution. The inconsistent findings for the four main groups merit further investigation of the relationships between the number of home institutions, international mobility status, and productivity.

KEYWORDS
Scientist mobility; International mobility; Productivity; Award; Academic career

INTRODUCTION
Studies have reported that researchers who have worked at multiple institutions have higher productivity than nonmobile researchers (Cañibano et al., 2008; Horta et al., 2010). Other studies have asserted that researchers with international mobility had higher productivity than researchers without international mobility (Fangmeng, 2016; Filippo et al., 2009). However, the results of some studies do not support the aforementioned results (Bolli & Schlafper, 2015; Hunter et al., 2009; Li & Tang, 2019); such results may be affected by differences in disciplines, various motivations for mobility, or other factors (Horta et al., 2018). In addition, some studies have not accounted for the stages of participants’ academic careers and the resulting variations in productivity (Fangmeng, 2016; Franzoni et al., 2012; Horta et al., 2018). Therefore, this study examined researchers in a specific field with complete academic careers. Moreover, distinguished researchers were assumed to be mobile researchers because their excellent research performance would increase their likelihood of switching to institutions with additional research resources and a more prestigious reputation compared with that of their previous institution (Gureyev et al., 2020). This study investigated whether researchers with more home institutions tend to have higher productivity than other researchers during their entire academic careers. In addition, this study analyzed whether researchers with international mobility had higher productivity than researchers without international mobility.

METHODOLOGY
A total of 199 recipients of the Sloan Research Fellowships in Mathematics (SRFM) between 1955 and 1979 were selected as the study sample as they were expected to have excellent research performance, which would increase the likelihood they had switched to institutions with additional research resources and a more positive reputation compared to their previous institution. We searched for the curricula vitae (CVs) and other biographical information on the Internet by using their basic information. We gathered information on the recipients’ birth year, the year in which they completed their doctor of philosophy (PhD) degree, and their institutional affiliations. We ensured that the participants had completed or were nearing the end of their academic career. Therefore, we could trace changes in productivity throughout their academic careers. The length of academic career varied by recipient. To mitigate the potential influence of time, we focused on the annual number of publications over a 40-year period after receiving PhD degrees. The bibliographic records of publications by the target researchers were collected from Scopus databases in January 2023. We set the year in which a recipient received their doctoral degree as T0. Home institutions were recorded as the institutional affiliations listed on CVs, excluding temporary institutions that researchers visited for less than 1 year. The recipients with international mobility were identified by determining whether at least one institutional affiliation listed on their CVs or publications was located outside the United States.

RESULTS
Table 1 presents the average productivity per researcher for seven groups of recipients classified by their number of home institutions. The average productivity per researcher for each group ranged between 41.3 and 99.0 publications. Only 18.7% of recipients did not shift to other home institutions during their academic career. Most recipients (53.3%) reported two or three home institutions on their CVs. The results of a one-way analysis of variance revealed no significant differences between the groups with respect to the average number of publications.
[\text{F}(6, 192) = 1.126, p = .349]. Regarding the difference in productivity between researchers with and without international mobility, 59.8% of the researchers were identified as having international mobility, and their average productivity was approximately 2.5 times higher than that of researchers without international mobility (63.5 vs. 25.1 average publications); the results reached statistical significance [\text{t}(141.3) = 7.099, p < .001]. Moreover, over half of the researchers in each group had experiences of international mobility. In each group, the average productivity of researchers with international mobility was considerably higher than that of researchers without international mobility.

<table>
<thead>
<tr>
<th>Number of Home Institutions</th>
<th>Number of Researchers</th>
<th>Average Productivity (AP)</th>
<th>Researchers with International Mobility (IM)</th>
<th>AP With IM</th>
<th>AP Without IM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37 (18.6%)</td>
<td>41.3</td>
<td>19 (51.4%)</td>
<td>59.3</td>
<td>20.0</td>
</tr>
<tr>
<td>2</td>
<td>61 (30.7%)</td>
<td>43.5</td>
<td>33 (54.1%)</td>
<td>62.4</td>
<td>21.3</td>
</tr>
<tr>
<td>3</td>
<td>45 (22.6%)</td>
<td>56.4</td>
<td>31 (68.9%)</td>
<td>71.3</td>
<td>21.0</td>
</tr>
<tr>
<td>4</td>
<td>29 (14.6%)</td>
<td>48.8</td>
<td>18 (62.1%)</td>
<td>63.1</td>
<td>25.4</td>
</tr>
<tr>
<td>5</td>
<td>19 (9.5%)</td>
<td>52.1</td>
<td>10 (52.6%)</td>
<td>65.1</td>
<td>37.7</td>
</tr>
<tr>
<td>6</td>
<td>5 (2.5%)</td>
<td>99.0</td>
<td>5 (100.0%)</td>
<td>94.3</td>
<td>0.0</td>
</tr>
<tr>
<td>7</td>
<td>3 (1.5%)</td>
<td>54.3</td>
<td>3 (100.0%)</td>
<td>54.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>199 (100.0%)</td>
<td>49.8</td>
<td>119 (59.8%)</td>
<td>63.5</td>
<td>25.1</td>
</tr>
</tbody>
</table>

Table 1. Average Productivity per Researcher by Number of Home Institutions and International Mobility

Figure 1 illustrates the annual average productivity per researcher for researchers with one to four home institutions. The horizontal axis indicates time. The vertical line at 0 denotes the year in which the researchers received their PhD degree, the red vertical line denotes the average year in which the researchers received the SRFM, and the blue dashed line denotes the average year in which the researchers began working for their home institution. The number of blue dashed lines is adjusted by graph to indicate the number of home institutions. In general, the researchers with one or two home institutions began their tenure at their first home institution after receiving their doctoral degree. On average, the researchers with three or four home institutions began their tenure at their first home institution slightly before receiving their doctoral degree.

Figure 1. Annual Average Productivity During the First 40 Years After Receiving a PhD Degree by Group

Regarding changes in annual average productivity, the results revealed a common phenomenon among the researchers in all four groups: their research productivity peaked before they received the SRFM and then peaked a second time approximately 15–20 years after they obtained a PhD degree. The results revealed an increasing trend in annual average productivity after receipt of the SRFM for researchers in all groups except for those with only one home institution. In Figure 1, the annual average productivity per researcher with international mobility is denoted by a green horizontal line, and the annual average productivity per researcher without international mobility is denoted by a yellow horizontal line. The results indicated an increasing gap in annual average productivity between the researchers with and without international mobility for all groups except for those with one home institution. In addition, the results indicated a trend of decreasing annual average productivity among the researchers without international mobility.

CONCLUSION

The study results revealed that the researchers with international mobility who switched to other home institutions had increased annual average productivity. Although the researchers with only one home institution and international mobility had higher average productivity than the other researchers without international mobility within the same group, the gap in annual average productivity between the two subgroups consistently narrowed over time. The researchers with international mobility as well as high productivity had two or more home institutions. Future research that incorporates additional factors affecting institutional mobility is required to investigate the relationship between the number of home institutions, international mobility status, and productivity.
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Data Governance Practices Unveiled: Insights from Multiple Data Collection Approaches

Chang, Yun-Chi  National Taiwan University, Taiwan | r09126026@ntu.edu.tw
Lin, Fang-Pang  National Center for High-Performance Computing, Taiwan | fplin@nchc.narl.org.tw
Jeng, Wei  National Taiwan University, Taiwan; National Center for High-Performance Computing, Taiwan | wjeng@ntu.edu.tw

ABSTRACT
The poster discusses varying data collection approaches in investigation of an organization’s data governance practice of a single case study. The aim is to promote transparency in data governance practice on a case-by-case basis and to unveil the circumstances of adapting approaches in data collecting. Four distinct data collecting approaches were utilized in this study, each tailored to diverse needs and scenarios, including group interview, design-thinking workshop, semi-structured interview and field study. Clarifying the rationale of taking certain approaches, the research team aims for providing the benchmark for future data governance research.

KEYWORDS
Data governance, Case study, Data collection practice, Field observation

INTRODUCTION
A 2021 analysis by NewVantage Partners revealed that despite significant investments in data-related development, the management and utilization of data in top US companies remained insufficient (Davenport & Bean, 2021; see also Reinsel et al., 2017). To maximize data benefits, organizations must establish comprehensive standards and processes to minimize possible negative impact within the lifecycle of data. Accordingly, “data governance” has emerged as a way to arranging authority and control over data (Henderson & Earley, 2017) and integrating organizational policies and processes within the data lifecycle (DGPO, n.d.). However, current data governance research and resources mainly focuses on providing the subjects and aspects to be governed, such as data security and data quality, and culture and technology of the organization. Since every organization has its own needs and limitations, the actual practice of data governance would vary from case to case. Despite being the foundation of setting plans and practices for organizations, the practical approaches of gaining a comprehensive understanding of organizations are seldom discussed. Thus, premised on a single case study, strives to develop a data collection strategy and discuss the varying collection approaches for data governance research. The research would be led by two primary research questions:

RQ1: What is the effect and applicable situations of different types of data collection approaches in order to help an organization to develop a tailored data governance strategy?

RQ2: What is the influence of organization culture (e.g., member engagement and the working style of the organization) in the data governance project and what are effective approaches for collecting this related data to inform the development of a data governance strategy?

CASE INTRODUCTION
Our case involves a research institution in Taiwan that is responsible for national information and communication services. It conducts technological research and development through commissioned projects from various sectors and consists mainly of researchers and engineers who form project teams as needed. With a flat organizational structure, 191 researchers are divided into five research groups, which are supervised by five group leaders separately, and the group leaders are led by three deputy directors and a director. Without complicated bureaucracy, the members in the case share similar social status within the organization, and own high autonomy while conducting projects. The case was chosen due to the executive support the research team gained in the organization (see Yin, 2009) and its resemblance to small and medium-sized enterprises (SMEs) in Taiwan. As SMEs constitute the majority of Taiwanese enterprises (Ministry of Economic Affairs, 2022), this poster is expected to provide insights that are widely applicable in similar cultural and organizational settings.

RESEARCH METHODOLOGY
This study’s purpose is to reveal the impact of an organization's social milieu and the adoption of different data collecting approaches within the case, which would be part of our ultimate goal, to build a carefully customized data-governance plan for the organization described above. We conducted several rounds of data collection to foster an in-depth understanding of the case organization’s people, culture, and environment (Brous et al., 2020; Yin, 2014), and adopted approaches including focus group interview, design-thinking workshop, semi-structured interviews and field study. Each is described in turn below.
Group interview for kicking off: We initiated our data collection by conducting group interviews with administrative staff across departments. The staff members were prompted with pre-established questions about their operations, allowing them to present their current working conditions and challenges. In the meanwhile, they are allowed to give feedback and provide supplementary information about others’ content freely, and their presentation and opinion helped us to set the stage for the upcoming investigations.

Design-thinking workshop for gathering thoughts: Based on previous understanding toward the difficulties the members have faced, a design-thinking workshop was held with administrative supervisors and staff members to examine if the workshop participants reach a consensus about the current situation and explore potential solutions to the proposed questions. The workshop employed The Double Diamond Design Process by the Design Council. (The Design Council, n.d.) Through the discussion among workshop participants, they could prioritize the issues that need to be addressed. The members were separated into two teams by their work duty, utilized post-its of colors to demonstrate their working process, and integrated individual work progress into a group one. After that, they pointed out existing problems in the process, and came up with solutions from their perspectives.

Semi-structured interviews for focused topics: Semi-structured interviews were conducted to gather perspectives from executives, group leaders, as well as on-site research fellows – stakeholders less represented in previous stages. Having the conversation with the executives and group leaders, we illustrated the goal and characteristics of data governance and understood the managers and supervisors’ expectations towards the organization and the data governance project as well. As for the researchers, they account for 75% of the organization, with various types of research projects, they would have personal tendencies when it comes to data management and the process of assigned paperwork, which took a significant part of the data lifecycle within the organization.

Field observation for intensive observation and examination: Lastly, we conducted field observations, involving approximately 300 hours of observation and direct stakeholder engagement. During field study, the research team could nurture mutual trust with the members and get the chance to view internal documentations and receive internal information of the organization. Besides, we invited stakeholders to participate in sandbox experiments to examine if the re-designed process matches their current workflow (Birt et al., 2016). Interacting with the members in activities physically helped us take the hint of the surroundings politically and organizationally.

PRELIMINARY INSIGHTS
The combination of mentioned approaches provided us with a comprehensive understanding of the organization's roles, tasks, needs, and constraints. However, it is not necessary to adopt all of them while conducting data governance projects, a research team should modify their data collection approaches based on the conditions of the case. Thus, in the following section we would briefly discuss the pros and cons of different data collecting approaches in data governance research from the single case we’ve collaborated with, and the summary of the approaches are present on OSF: https://osf.io/knwc7/.

Group interview is a particularly useful tool when the researchers are new to the case. Including stakeholders from various departments allows researchers to establish connections efficiently, foster an initial understanding of different sectors, and convey the value and upcoming activities of data governance. However, people may hide their true attitudes due to social-political concerns in a group setting, which may mislead the researchers’ perception and the researchers may underestimate the negative influence of current practice.

Design-thinking workshop facilitates access to consensus within members, which allows us to know the members’ overall tendency of data related work through their discussion. Moreover, these workshops provide a platform for members to know each other’s needs and problems they’ve encountered when it comes to data and data lifecycle. While picking group members, it is important to make sure the participants work in similar fields or departments and check the influence of boss-subordinate relationships. For one thing, the lower the similarity of their work is, the more difficult for participants to come to conclusions; for another thing, the boss and their subordinate may work in the exact same tasks, which decreases the richness of collected data.

Semi-structured interviews are ideal for capturing a deep understanding toward targeted topics and individual opinions while enabling comparisons between members. Also, it is also allowed the research team to make customized interviews according to each member’s character within data lifecycle and even their working schedule. Yet, chances are that the opinion collected conflict with each other, it would make the decision-making toward data governance difficult for the research team.

Field observation is the most powerful among the approaches employed in this research. Since field study allowed the research team to stay at the organization for a long time, it is easier to disclose the implicit and subtle culture, preference and interaction between members and stakeholders. Besides, gaining mutual trust with members encourages them to share their thoughts freely while discussing data related plans and practices. Nonetheless, field study highly relies on the approval of the executives of the case, the collaboration with members and takes higher financial and time efforts of the research team.
FUTURE WORK
To maximize the value and effect of data governance, our emphasis was on offering methodological insights to data governance communities and practitioners. This involved the careful assembly of various data collection approaches, thorough evaluation of the opportunities and challenges inherent to each, with a view to fostering transparency in data governance research. Our ultimate aim is to cultivate a rich, resourceful environment that will catalyze the work of future researchers and practitioners in this field.

ACKNOWLEDGMENTS
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Considering the Role of Information and Context in Promoting Health-Related Behavioral Change

Chen, Annie T.  University of Washington, United States | atchen@uw.edu
Johnny, Shana  University of Washington, United States | sjohnny1303@gmail.com
Chaliparambil, Rahul  Northwestern University, United States | rahule99@gmail.com
Wong, Sharon  University of Washington, United States | swong99@uw.edu
Glass, Joseph E.  Kaiser Permanente Washington Health Research Institute, USA | Joseph.E.Glass@kp.org

ABSTRACT
This poster considers the role that information and context may play in health management. We employ a well-known taxonomy of techniques for promoting behavioral change to consider how social media authors describe their recovery from substance use. We harvest discussion posts from subreddits, or discussion forums, about alcohol, cannabis, and opioids, and perform content analysis to identify behavioral change techniques (BCTs) described in the content. We then consider the role that the context of information use plays in these BCTs, as well as how interventions and technologies might be leveraged to better support the recovery process.

KEYWORDS
Information behavior, context, time, substance use disorder, health behavior

INTRODUCTION
Context is integral to information behavior in various life domains, including but not limited to health. However, the conceptualization of context can be elusive in various respects, including the elements that constitute it, and how contexts change (Courtright, 2007). There are many approaches to modeling context. In Wilson’s conceptualization of the person-in-context, a person with a given information need, experiencing particular physiological, cognitive, or affective states, is embedded in a social and environmental context, and engages in information seeking behavior (Wilson, 1999). Critiques have also been raised of person-in-context models because they do not account for the complexity, variability, and interactions between contextual factors (Courtright, 2007). Still other research has identified the importance of the situation and of temporal and spatial aspects of context (Savolainen, 2006, 2012).

In this poster, we explore how context might be conceptualized to a particular information context – that of persons addressing the challenges of substance use disorder (SUD). Substance use disorder is a public health concern that carries a significant disease burden worldwide (Whiteford et al., 2013), and substance use has increased as people seek to cope with stress and emotions during the pandemic (McKnight-Eily et al., 2021). As such, there is a need to develop interventions that suit the needs of persons with SUDs.

We identify strategies that persons with SUDs use to address challenges they face in substance use recovery. Many of these involve information use, and we illustrate how consideration of the context of use can facilitate the identification of leverage points for future intervention to support substance use recovery.

METHODS
We perform content analysis of a dataset harvested from Reddit, a social platform that features discussion forums, or subreddits, on varied topics. We harvested social media content from Reddit through the pushshift.io API (Baumgartner et al., 2020), focusing on subreddits for three substances of interest – alcohol, cannabis, and opioids – selected to afford a diverse view of substance use experiences. As this study is part of a larger study on stigma affecting those who engage in substance use, we use keyword sampling with words (e.g., shame, guilt, and discrimination) that are more likely to indicate the presence of stigma in the post.

Content analysis involves systematically assigning codes to particular content segments (Hsieh & Shannon, 2005). Our coding scheme involved two main sets of codes; one was adapted from the Behavior Change Technique Taxonomy, a taxonomy of 93 techniques identified as important ingredients in interventions to promote healthy behavior change (Michie et al., 2011). We focused on the higher-level categories of the taxonomy to enhance focus on conceptual underpinnings, as well as facilitate coder consistency. We also identified the temporal context of posts in terms of the participants’ stage of change, as described in the Trans-theoretical Model of Change (e.g., contemplating a behavior change vs. maintaining a change; Prochaska & Velicer, 1997). This theory posits that people are in varying states of readiness to change a health behavior, and that accurately predicting a person’s state of change can facilitate tailoring and personalization of messaging to the stage.

Our content analysis procedure involved two main coders, an adjudicator who sought to reconcile disagreements, and an additional investigator who weighed in on disagreements. The four team members discussed disagreements,
both written and oral, until a clear majority or consensus was achieved on all codes, and all codes were recorded. The procedures for this study were approved by the University of Washington Human Subjects Division.

RESULTS AND DISCUSSION
Among the 400 posts that we have coded, we have identified 11 different categories of behavioral change techniques (BCTs): goals and planning, feedback and monitoring, social support, shaping knowledge, natural consequences, repetition and substitution, and comparison of outcomes, regulation, antecedents, re-framing/identity, and self-belief. Some BCTs involve information that may alter a person’s mental model, such as shaping knowledge and re-framing, whereas others may involve information interactions with one’s surrounding environment (Fig. 1A).

Though many BCTs might be used at multiple points in one’s journey to recovery from SUD, there might also be stages of change in which specific BCTs are particularly applicable (Fig. 1B). For example, goals and planning might be helpful when people are beginning to consider quitting their use of a given substance (the Contemplation stage in the Trans-theoretical Model). Shaping knowledge, including information on how to perform a behavior, information about antecedents (social and environmental situations and events, emotions, cognitions that reliably predict behavior, such as substance use), and information about natural consequences may also help.

As people attempt to stop using substances (Action stage), we observed efforts to engage in repetition and substitution of positive behaviors, as well as restructuring one’s physical and social environment (called antecedents). Often, through feedback and monitoring, people took in information from their bodies and their lives concerning how lifestyle changes that they make help or hinder progress. Other important elements include self-belief (e.g., self-talk), re-framing a problem or seeing the problem in a new light (re-framing/identity), and social support. Some participants posted content to motivate themselves and others. The importance of discussion forums as a venue for exchanging information and social support is well-documented (Chen, 2014; Kingod et al., 2017).

These findings have clear implications for intervention development. Just-in-time adaptive interventions might be used to deliver real-time support tailored to micro-scale changes in a person’s state such as mood or urges, but there is a lack of consensus on how to develop them (Perski et al., 2022). The BCTs observed in this study could be inform the content and framing of messages, which could be delivered via technologies such as wearables or mHealth applications, if appropriate for the target population. We might also consider ways individuals who do not use these technologies might engage in these BCTs. Offline support options include in-person support groups, family, and friends. Digital alternatives include computer-mediated groups and chatbots, though it is important to consider potential harms, such as linguistic biases in language generated by chatbots (Schlesinger et al., 2018).

CONCLUSION
In this poster, we identify uses of behavioral change techniques in social media for substance use and explore how these might be used in interventions for substance use recovery. As a person seeks to decrease or quit their use of a substance, physiological, cognitive, and affective factors can all play a role in shaping their evolving self; it is important to consider these elements of context in information and tool design so that relevant information is available and accessed at opportune times. This work enhances extant knowledge by illustrating how narratives from everyday life can lead to insights concerning the context of information behaviors for health management, and how these insights might be leveraged for intervention design.
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Understanding Deepfake Research and Trends through Topic Modelling

Chen, Chen  
Nanyang Technological University, Singapore | CHEN033@e.ntu.edu.sg

Goh, Dion Hoe-Lian  
Nanyang Technological University, Singapore | ashlgo@ntu.edu.sg

ABSTRACT
Deepfake research has gained traction in recent years. Surveys have been conducted to summarize work on the detection and generation of deepfakes. However, a more comprehensive and quantitative overview that encompasses both technical and non-technical areas is lacking. We address this gap using topic modelling to discover deepfake research topics in academic publications. Our results show that while detection techniques topics dominate the research field, other areas, such as privacy and legal research, offer potential avenues for further exploration.

KEYWORDS
Deepfakes; Topic Modelling; BERTopic; Trends

INTRODUCTION
Since the first deepfake appeared on Reddit, these videos have become popular. Initially, deepfakes emerged as a form of entertainment but were later widely used in revenge pornography, fake political news and other negative celebrity-related content (Dasilva et al., 2021). Thus while deepfakes have positive uses, they can lead to negative consequences on society and individuals, including erosion of trust, privacy and reputation violations (Kietzmann et al., 2020). Unsurprisingly, deepfakes have attracted much research in recent years. To further advance work on deepfakes, it is essential to understand the current state-of-the-art and identify important research directions.

To this end, there are surveys summarizing deepfake detection and generation algorithms. For example, these surveys provide insights into how different deepfake generation architectures work, helping researchers gain a better understanding of deepfake creation (Mirsky & Lee, 2021). Further, research trends on deepfake detectors were summarized for four common facial manipulation groups (face synthesis, identity swap, attribute manipulation, and expression swap (Tolosana et al., 2020). These literature surveys concentrate solely on the technical and algorithmic facets of deepfakes, lacking a comprehensive, longitudinal and quantitative overview of the entire research field, which should encompass social and legal aspects as well.

To address this gap, the present study aims to tackle the following questions: (1) What are the current deepfake research topics? (2) What are their trends?

METHODOLOGY
We downloaded publications from three databases, ACM, IEEE and Scopus, from 2018 to 2023. These are reputable databases offering wide coverage of a vast array of disciplines. The search was conducted using keywords associated with “deepfakes”. Publication data consisted of elements such as the title, abstract, author, keywords, and year. These elements were combined to form our dataset. We then dropped duplicates, removed stop words, and performed lemmatization. Our final dataset comprised 1077 publications from journals and conferences.

We used a recent topic modelling technique, BERTopic, rather than Latent Dirichlet Allocation (LDA Blei et al., 2003) which has been employed in other research. LDA does not consider the semantic meaning of words which is important for understanding document topics. This is handled by BERTopic and it has been shown to have higher coherence scores than LDA (Egger & Yu, 2022).

RESULTS
Six topics were extracted by BERTopic as shown in Table 1. This model had the highest coherence score. Articles in each topic were mutually exclusive from the others. Due to BERTopic's limitation of potentially having redundant words for topic interpretation, we selected the top 10 highest-scoring keywords and abstracts from papers with significant probability values to assign meaningful names to each topic. As expected, both technical and non-technical topics were obtained, although the former category, comprising T1 to T4 had the lion’s share of publications at around 94%. The remainder, T5 and T6, were non-technical areas. For example, T1 focused on state-of-the-art machine learning algorithms for detecting visual deepfakes, accounting for about 65% of the publications. T5 dealt with legal concerns about deepfakes accounting for about 3.3% of the publications. Figure 1 shows topic trends. T1 and T2 emerged earliest and remained the top two topics over the years, with T1 rising fastest. Audio deepfake detection (T3), is increasingly drawing research attention as shown in its 2022 spike. In contrast, T5 and T6 emerged slightly later and still remain relatively under-researched to date.
Table 1. The six topics of the BERTopic model.

<table>
<thead>
<tr>
<th>ID</th>
<th>Topic (No. and %)</th>
<th>Top 10 Keywords</th>
<th>Title Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Video and image detection (696, 64.6%)</td>
<td>Video, detection, face, image, method, use, network, model, deep, fake</td>
<td>Comparative analysis on different deepfake detection methods and semi-supervised GAN architecture for deepfake detection</td>
</tr>
<tr>
<td>T2</td>
<td>Fake news applications (173, 16.1%)</td>
<td>Ai, medium, fake, news, video, social, study, use, technology, fake news</td>
<td>Deepfakes: a digital transformation leads to misinformation</td>
</tr>
<tr>
<td>T3</td>
<td>Deepfake audio detection (81, 7.5%)</td>
<td>Audio, speech, voice, spoof, detection, use, system, feature, audio detection, model</td>
<td>Attack agnostic dataset: towards generalization and stabilization of audio deepfake detection</td>
</tr>
<tr>
<td>T4</td>
<td>Cybersecurity defenses (57, 5.3%)</td>
<td>Attack, adversarial, blockchain, use, video, cyber, learning, medium, security, enf</td>
<td>Adversarial machine learning attacks and defense methods in the cyber security domain</td>
</tr>
<tr>
<td>T5</td>
<td>Laws on deepfakes (36, 3.3%)</td>
<td>Pornography, sexual, technology, online, law, abuse, use, social, revenge, right</td>
<td>The new weapon of choice: law's current inability to properly address deepfake pornography</td>
</tr>
<tr>
<td>T6</td>
<td>Privacy concerns (34, 3.2%)</td>
<td>Privacy, design, face, student, anonymization, image, user, datum, protection, smart</td>
<td>Deepfakes for privacy: investigating the effectiveness of state-of-the-art privacy-enhancing face obfuscation methods</td>
</tr>
</tbody>
</table>

Figure 1. Topic trends from 2018 to 2023.

DISCUSSION
We found that deepfake detection topics (T1 and T3) collectively dominate the field and are in an upward trend. This is unsurprising because deepfakes are now pervasive and as they become seemingly more authentic, there is a need to develop more robust detectors. Interestingly, while visual deepfakes (T1) have drawn more research interest, audio deepfakes (T3) are slowly gaining attention. Next, it is heartening to note that the recognition of deepfakes in fake news generation (T2) was recognized early and continues to be studied. Finally, the potential for interdisciplinary deepfake research is immense, and T5 and T6 represent steps in this direction, focusing on legal and privacy matters respectively. Nevertheless, our results show that these concerns are still lagging behind the technological aspects and there is an urgent need for more debate and research into the negative uses of deepfakes.

To conclude, our findings suggest uneven interest and growth in six aspects deepfake research. Privacy and legal issues as well as other non-technical areas are important and require more effort to be put in. This includes potential new areas such as human-oriented deepfake detection and the impact of deepfakes on individuals and society.

There are some limitations of this research that could be addressed in future work. One is that we only use three academic databases as data sources, and our results may reflect the topic preferences of these databases. It is also worth conducting a bibliometric analysis to provide useful insights into researcher output and impact.

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Flipping Vs. Scrolling in Digital Narratives: Reader Engagement and Reading Patterns in Comic Layouts

Chen, Ching-Shiuang  National Taiwan University, Taiwan | b08302213@ntu.edu.tw
Lin, Yu-Jie  National Taiwan University, Taiwan | b09106039@ntu.edu.tw
Jeng, Wei  National Taiwan University, Taiwan | wjeng@ntu.edu.tw

ABSTRACT
This study investigates the impact of digital reading patterns on comics, specifically examining page-by-page and scrolling formats. We compare the unique layout characteristics of each format and scrutinize the level of reader engagement elicited by these two distinct types of comics. In this study, we conducted a between-subject, eye-tracking experiment and the following semi-structured interviews with 20 reader participants. Results highlighted that readers of page-by-page comics scan quickly, while scrolling comics require navigating through each panel. The research concludes that page-by-page comics enhance reading efficiency but increase cognitive burden, while scrolling comics provide more breathing room but may seem redundant. These findings contribute to understanding reader perspectives on comics reading behaviors, providing insights for the digital transformation of the comic industry.

KEYWORDS
page-by-page comics, scrolling comics, eye-tracking experiment, mixed-methods research

INTRODUCTION
Comics, acknowledged as a unique form of sequential art, blend pictorial and other visual elements to create seamless stories. By utilizing careful panel (i.e., the frame containing a single scene) organization and the strategic placement of gutters (i.e., the space or margin between panels), comics effectively communicate the plot and narrative sequence of their story (Eisner, 2008; McCloud, 1994). Readers interact with comics primarily depend on visual cues within the panels to interpret the meaning behind the arrangement of these visual elements. Therefore, a lack of understanding of comic grammar on the part of the readers or an inadequately detailed storyboard design from the creators can hinder the smooth reading experience of comics. (The comic grammar refers to the conventional ways in which comic creators use visual elements to tell a story. It includes aspects like the arrangement and shapes of panels, the use of gutters, the placement and style of speech bubbles, and the use of symbols or visual cues.)

As reading patterns evolve in the digital age, comics have diverged into two distinct forms. One is page-by-page comics, which are popular in Japan, France and the United States; and the other is scrolling comics, which are South Korea in origin (Liu, 2011; Cho, 2021). Conventional page-by-page comics are rooted in print publications and have developed a complex layout influenced by cinematography (Lee, 2012). On the other hand, web-based scrolling comics are born-digital and deconstruct comic elements to provide a streamlined and convenient reading experience (Jin, 2019). The illustration of two different comic formats is available for better understanding our study at https://osf.io/jkpv6/.

Since previous work has not exhaustively examined the content nature between page-by-page and scrolling comics, we employed a pretest study with an approach of content analysis and found that page-by-page comics contain the characteristics of “information compression,” whereas scrolling comics create a sense of “information dissociation” through the space between panels. While these contrasting characteristics between the two comic formats were brought to light in our pretest’s findings, the reader's perspectives remain largely unexplored. To delve deeper into these variations in comic layout and reader behavior, our study adopts a mixed-methods empirical approach to address the following research questions:
RQ1: How do different layouts influence reading behaviors of comics, in terms of aspects of information density, reading efficiency, attention allocation and readers’ comprehension level, according to an eye-tracking experiment?
RQ2: How do comic readers recognize the differences between page-by-page and scrolling comics through their experience and observation, gained from further interviews?

METHODS
Leveraging a mixed-method approach, this study conducted an eye-tracking experiment following semi-structured interviews, to collect both quantitative and qualitative data. A total of 20 participants at Northern Taiwan were recruited and divided into two groups to read page-by-page and scrolling comics respectively, primarily based on their comics reading habits, average reading time, and relevant background information obtained through the online registration form. "The Summer Temple Fair", a Taiwanese comic available in both page-by-page and scrolling formats, served as the material for eye-tracking experiments, capturing readers’ reading behaviors and gauging their
comprehension levels via a Discourse Comprehension model (Van Dijk & Kintsch, 1983) as the post-test questionnaire. Integrating eye-tracking results and questionnaire responses, the subsequent semi-structured interviews were conducted and gained more understanding of participant perspectives. The full process involving the experiment, questionnaire, and follow-up interview required approximately 40-55 minutes per participant.

RESULTS
In this extended abstract, we delineate the main aspects influencing the comic’s reader engagement and reading behaviors: information density, reading efficiency, attention allocation, and comprehension level. Demographic data on the participants is accessible for review at https://osf.io/jkpv6/?view_only=32b1ba32ae41484fbd5c193872beb5f

Information density
In general, scrolling comics require more space to convey the same storyline compared to page-by-page comics. Our pilot study indicated that scrolling comics take roughly 3.7 times fewer panels per chapter than their page-by-page counterparts. In our eye-tracking experiment, both groups were shown comic materials of 155 panels. However, the page-by-page comics group needed only 13 screen switches to complete their reading, while the scrolling comics group needed 105 for almost the same amount of information. A significant difference in information density was perceived by most participants, with a notable variation in the panel arrangement between page-by-page and scrolling comics (P01, P06, P10, P15, P19). Consequently, information density emerged as a crucial criterion for readers to differentiate between page-by-page and scrolling comics, ultimately impacting their reading efficiency and attention allocation. The results implicate that scrolling comics, the creation of the digital era, inherit the positive nature of “fragmented reading” (Xie, 2019), play a role in reducing reader’s cognitive load.

Reading efficiency
While it appears to be more effective that scrolling comics assist people in digesting the content of the story, experimental results indicate that page-by-page comic readers generally read faster than scrolling comic readers. On average, page-by-page comic readers finished in $M=273.27$ seconds ($SD=69.85$), whereas scrolling comic readers took $M=435.59$ seconds ($SD=107.61$). A T-test was conducted to see whether there was a significant difference of reading speed between two groups of participants, $t(18)=4.001$, $p=0.001$ ($<.05$), suggesting group of page-by-page comics read faster than that of scrolling comics in the significant level. Several participants mentioned in the interviews that they preferred "more information" and stated that they are able to "glance through an entire page as a whole" when reading page-by-page comics (P01, P06, P10). That is, readers perceived page-by-page comics to be more efficient in driving the plot, with the capacity to display a larger number of panels per view. In contrast, scrolling comics require readers to repeatedly scroll, resulting in a redundant time waste. The findings disclose the negative impact of fragmentation in the new media age, which might be associated with the impatience during reading.

Attention allocation & comprehension level
Our eye-tracking experiment revealed that readers typically read text prior to examining images in comics, aligning with previous studies (Kiritely et al., 2018; Laubrock et al., 2018). Specifically, readers of page-by-page comics demonstrated a noticeable concentration of visual attention on dialogue balloons, whereas scrolling comic readers displayed a more evenly distributed focus across other characters or objects of interest. However, no significant differences were observed between the two groups as per the questionnaire results, suggesting that the arrangement of panels may not necessarily affect readers' reading comprehension levels. Additionally, it is worth noting that although the aforementioned results suggest participants’ preference for “information compression” in page-by-page comics in terms of efficiency, interviews revealed that the complex reading sequence of page-by-page comics could cause readers to become disoriented as well (P02, P08, P11, P13). In contrast, the linear flow of scrolling comics was perceived as clearer and more accessible, with fewer reading obstacles as mentioned above.

FUTURE DIRECTIONS
This study strives to explore reading preferences for both types of comics through experiments and interviews. Overall, page-by-page comics afford readers with a relatively high level of efficiency, facilitating a rapid overview of the narrative, whereas scrolling comics resonate with the trend of fragmented reading in the digital era by breaking down visual components and reducing cognitive load. With the digital transformation of comics, we can observe the reshaping of contemporary reading patterns by the virtual environment and delve into the intricate workings of this dynamic mechanism. Based on these findings, we propose three potential directions for future research. Firstly, we recommend that further investigation can be conducted on reader segmentation based on age groups to gain insights into the perspectives of cross-generational comic readers, thereby strengthening the foundation of comparative comic studies. Secondly, as an emerging form of comic production, scrolling comics are closely related to internet reading habits, making them potential subjects for studying cultural phenomena in this generation. Lastly, we encourage the use of mixed methods in comic research as a foundation to recruit a more
diverse and expanded sample of participants, thereby accentuating the possibility of empirical comic study, and enhancing the depth and breadth of comic studies.

ACKNOWLEDGMENTS
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How We Study Disabled People in LIS Research Area: A Systematic Content Analysis

Cheng, Chia-Wen
National Taiwan University, Taiwan | cutehendy@gmail.com
Lin, Weijane
National Taiwan University, Taiwan | vjlina@ntu.edu.tw

ABSTRACT
This study aims to investigate the topics regarding disabled people in library and information science research areas through systematic content analysis, with the intention to profile the critical issue of accessibility and its development in LIS research and practices. 330 research papers in LISA published during 2011-2021 were collected and analyzed to understand the distribution of the research topics, subjects, methodologies, and findings about disabled people. The results showed an extended period of user-oriented research concerns yet very little exploration of service framework issues of policies, legislation, and technical services, in actual practices. Based on the results, specific and necessary research topics and issues were identified for future studies.

KEYWORDS
Disabled People; Library Service; Disability Studies

INTRODUCTION
The issues of accessibility and disability have long been of interest to the diverse and information society (United Nations, 2018; World Health Organization, 2023). As understanding of disability grows, constructing an inclusive society becomes widely accepted in international societies. Important initiatives, including the Convention on the Rights of Persons with Disabilities, the Marrakesh Treaty, and the UN Sustainable Development Goals, called upon public attention to equal access. Library associations consider equal access to information a matter of value and human rights requirement (Khawaja, 2022). Several agencies, such as the International Federation of Library Associations and Institutions and the American Library Association, published guidelines to help the organizations and librarians achieve the mission (ALA, 2019; Day, 2004; IFLA, 2015; Irvall & Skat Nielsen, 2005; Mortensen & Skat Nielsen, 2007). Nevertheless, due to the highly contextual nature of the accessibility and service, previous studies have shown that understanding the guideline is not translated into field practices (Lin, Chang, & Yueh, 2018; Small, Myhill, & Herring-Harrington, 2015). Practical issues, such as librarians' attitudes and insufficient understanding of disability, were found to affect the effectiveness of library services (Kamarudin, Bakri, & Zaman, 2022; Pionke, 2018). Similarly, in the LIS research area, while a centralization on specific disability was also observed (Cheung, Ye, & Chiu, 2021; Chinnaraj & Kavitha, 2021; Davies, 2007; Janaarthanan & Nithyanandam, 2020; Kharbat, Alshawabkeh, & Woolsey, 2021; Xie, Wang & Saba, 2021), fewer discussing policy development and various types of disability (Small et al., 2015) in addition to the research endeavors in the design of physical environment (Bodaghi & Zainab, 2013) and adaptive materials (Adetoro, 2012; Conway, Oppegaard, & Hayes, 2020; Ry-Kottoh, Esseh, & Agbo, 2021). Hill (2013) has reviewed disability studies from 2000 to 2010 in Library and Information Science Abstract database and noted that previous research on disability has focused narrowly on specific types of disabilities, which frequently fails to capture their relevance and interaction with society as a whole. Following Hill's (2013) study, this study intends to investigate the current state of development of disability research, particularly in light of the impact of various automation and artificial intelligence technologies. Specifically, the research question focused on the overview of the disability issues distributed in the LIS research area from 2011 to 2021, hoping to capture the landscape and systematically identify important research topics and directions guiding library practices.

METHOD
This study adopted bibliographical and systematic content analysis (Chu, 2015; Hill, 2013) to explore the research trends and status of disability studies in the LIS research area. Regarding data collection and analysis, Library and Information Science Abstracts (LISA) was used to gather articles for analysis, searched by "disability*" and "disabled pe*," and limited to academic journals in English and published from 2011 to 2021. Duplicates, non-related, and non-full articles were removed, leaving 330 articles for evaluation. Open coding was used for content analysis with reference to the framework (Hill, 2013; Kajberg, 1996) that guided the categorization of disability issues. In an open coding process, two raters read the sections of abstracts and methods in 330 articles, then tagged one core disability issue in each article.

PRELIMINARY FINDINGS
Publications and types of disability
As shown in Figure 1, the number of disability studies increased yearly since 2011, except for the sudden drop in 2016. In addition to the general type (non-specific), visual impairment is the focus of research objects, echoing previous research (Cheung, Ye, & Chiu, 2021; Davies, 2007). And the number of other types, such as learning
disability (LD), hearing impairment (HI), Autism, and cognitive impairment (CI) also grew, suggesting an extending discussion of more types of disabilities.

**Distribution of research topics**

As shown in Table 1, 15 research topics in two different aspects were found from the 330 disability studies. Research topics #1 to #7 represented user-oriented studies that investigated more formal and popular issues such as "Accessibility," "Assistive Technology," "Information behavior," "Research Trends," and "Adaptive materials." On the other hand, less-discussed research topics, #9 to #15, were more related to the service framework in library practices. For example, topics regarding institutional management (Administration and Management), human resources (Attitude, Competence), and collection and service management (Technical Service, New Media).

Echoing Hill’s (2013) findings, disability studies in LIS research area kept focus on research topics of accessibility, adaptive materials, legislation, and introducing the disability service or program to libraries. It’s also worthy of notice that an emerging topic of “New Media,” which concentrates on expanding disabled patrons’ experiences beyond physical library surroundings, has obtained growing research attention. Based on the preliminary findings, our further studies intend to identify the subthemes associated with the research topics. And hierarchical analysis process will be used to understand the extent to which academic and practical library professionals consider and value these research topics when making decisions on library services.

<table>
<thead>
<tr>
<th>Rank</th>
<th>User-orientation</th>
<th>Rank</th>
<th>Service framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Accessibility</strong></td>
<td>9</td>
<td>Administration &amp; Management</td>
</tr>
<tr>
<td></td>
<td>67(20.3)</td>
<td>10</td>
<td>Attitude</td>
</tr>
<tr>
<td>2</td>
<td><strong>Comprehensiveness</strong></td>
<td>11</td>
<td>Competence</td>
</tr>
<tr>
<td></td>
<td>58(17.6)</td>
<td>12</td>
<td>Legislation</td>
</tr>
<tr>
<td>3</td>
<td>Assistive Technology</td>
<td>13</td>
<td>New Media</td>
</tr>
<tr>
<td></td>
<td>52(15.8)</td>
<td>14</td>
<td>System development</td>
</tr>
<tr>
<td>4</td>
<td>Information behavior</td>
<td>15</td>
<td>Technical Service</td>
</tr>
<tr>
<td></td>
<td>32(9.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Research Trends</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26(7.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>Adaptive materials</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17(5.2)</td>
<td></td>
<td></td>
</tr>
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<td>7</td>
<td>Introduction</td>
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<tr>
<td></td>
<td>15(5.2)</td>
<td></td>
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<tr>
<td>8</td>
<td>Instruction</td>
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<tr>
<td></td>
<td>12(3.6)</td>
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</tbody>
</table>

Table 1. Top 15 research topics found in 330 papers

**CONCLUSION**

This study investigated the research topics regarding disabled people in the library and information science research area. Through the systematic content analysis, the preliminary findings suggested 15 critical issues and the distribution in the 330 LIS papers in the past decade. Echoing previous studies (Hill, 2013), it was found that the number of disability studies related to service framework, although growing, is still insufficient to guide practical implementation in the fields. This study is a work in progress and will continue to complete content analysis to capture the landscape of accessibility studies in the LIS research area and to further develop decision criteria that link research and practices.
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Differences in Researcher Rankings in Multiple Authorship–Oriented Research Fields Determined by Full Counting and Harmonic Counting

Cheng, Tung-Wen  Tamkang University, Taiwan | twcheng@mail.tku.edu.tw
Chang, Yu-Wei  National Taiwan University, Taiwan | yuweichang2013@ntu.edu.tw

ABSTRACT
This study explored whether harmonic counting, which emphasizes the position and role of authors in the author byline, produces researcher rankings (based on the number of articles published) that differ from those produced through full counting in multiple authorship–oriented research fields. An analysis of articles published during a 10-year period (2012–2021) by 377 chemical engineering professors or associate professors revealed a significant and positive correlation between full counting rankings and harmonic counting rankings. This finding indicates that when multiple authorship is the predominant trend for researchers within a given field, full counting can be performed to quickly determine researcher productivity rankings because it is more straightforward than harmonic counting. Future research should explore other research fields with diverse publishing trends.

KEYWORDS
Researcher rankings; Multi-authorship; Full counting; Harmonic counting

INTRODUCTION
Multiple authorship has become a common publishing pattern for researchers in numerous disciplines, particularly in the scientific and technological fields, where author order is crucial because it serves as the basis for attributing author credit and responsibilities. Although no common practices and definitions for essential author positions have been established for coauthored publications, the first and corresponding authors are the two mostly widely discussed positions. In terms of research contribution, the first author is typically the individual who has contributed the most (Larivière et al., 2016). The corresponding author may share the same level of credit as the first author (Duff, 2017; Mattsson et al., 2011). Although a corresponding author can be in any position, they are usually also the first or last author (Bhandari, et al., 2014; Fox et al., 2018).

Given that author order reflects the research performance of researchers, it should be applied to productivity analyses. Although the authors of a study differ in terms of their research contribution, the full counting method, a widely used publication counting method, assigns equal credit to all authors, ignoring author positions and roles in the context of research contribution. Although harmonic counting addresses the unfairness of assigning equal credit to all authors of a coauthored paper (Hargen, 2008, 2010), a further investigation is required to determine whether researcher rankings differ when full counting or harmonic counting is employed in a field where multiple authorship is prevalent. Therefore, the present study explored whether a reduction in the total number of papers attributed to each researcher affects researcher rankings. Author ordering conventions vary across disciplines (Frandsen & Nicolaisen, 2010). In the present study, we focused on the field of chemical engineering, where multi-authorship is prevalent.

METHODOLOGY
We assessed the article productivity of 400 full-time professors or associate professors, who were affiliated with 25 departments of chemical engineering of universities in a specific country. The affiliations of these researchers were verified by checking their academic profiles and publication lists, as listed on the webpages of their departments. Because departmental webpages do not necessarily provide the latest updated versions of these researchers’ publication lists, we used data from the Scopus database as the basis for confirming each sample researcher’s publication list. The publication data available on departmental webpages were used to facilitate the collection of bibliographic records pertaining to articles published during the study period (2012–2021) from the Scopus database. Subsequently, 23 researchers were excluded because they did not publish any articles during the study period; 377 researchers and their article data were included in the analysis of the present study.

Although several counting methods other than harmonic counting also consider the positions and roles of authors, harmonic counting was selected because it is a widely recognized method for calculating the credit attribution for a coauthored article (Kim & Kim, 2015). A coauthor of the present study is a chemical engineering researcher, and to the best of his knowledge, the first and corresponding authors are emphasized in the field of chemical engineering. Thus, these two author roles were assigned the most credit and considered in the harmonic counting method used in the present study.

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The harmonic counting formula can be expressed as follows: \[ \frac{1}{\sum_{i=1}^{N} R_i}, \]
where \( N \) is the number of authors of an article and \( R \) is the sequence of authorship. For a given article written by four authors, the first, second, third, and fourth authors were assigned the credit values of 0.48, 0.24, 0.16, and 0.12, respectively. When a corresponding author was defined as having the same research contribution as the first author and if the fourth author was the corresponding author, both the first and corresponding authors were each assigned a credit value of 0.36 \(((0.48 + 0.24)/2)\), and the other authors were each moved to their next position in the sequence. The second author would be moved to the third position and assigned a credit value of 0.16, and the third author would be moved to the fourth position and assigned a credit value of 0.12. Two sets of researcher rankings were generated (one using harmonic counting and the other using full counting) and compared on the basis of Spearman’s rank correlation.

RESULTS
For the 15,477 articles analyzed in the present study, the number of authors for each article ranged between 1 and 58, and the average number of authors per article was 5.5. Only 67 articles had a single author (0.4%). Most of the articles were authored by four authors (17.1%), followed by five authors (16.5%), three authors (14.4%), and six authors (13.8%). This finding indicates that the multiple authorship format is preferred in chemical engineering research. In addition, the average number of articles per researcher based on the full counting method was 41.05. Among the studied researchers, the variation in the number of articles published was considerable, ranging between 1 and 721 articles. The average number of articles per researcher based on the harmonic method was 10.83, ranging between 0.07 and 226.69.

Figure 1 compares the two sets of rankings (one generated using harmonic counting and the other using full counting) of the 377 chemical engineering researchers based on the number of articles published by each researcher. The numbers along the horizontal axis represent the author identification numbers assigned to each of the 377 chemical engineering researchers; these numbers were assigned on the basis of their full counting rankings (indicated by the blue line) for the number of articles published. For example, author no. 1 published the largest number of articles and is ranked first, and different researchers who published the same number of articles are assigned the same rank. The orange points indicate the ranks determined based on harmonic counting. For example, on the basis of the full counting and harmonic counting methods, author no. 180 was ranked 180th and 28th. More than half of the researchers (203 researchers, 58%) were ranked lower when harmonic counting was applied in place of full counting. Only the ranks of nine researchers remained unchanged irrespective of the counting method applied (2.4%). Notably, the differences between the two sets of rankings were small for the researchers with the highest and lowest article counts. Spearman’s rank correlation was computed to assess the relationship between the ranks obtained through full counting and those obtained through harmonic counting, and a positive correlation between the two variables was identified \([r (375) = .922, p < .01]\).

CONCLUSIONS
The present study identified a positive correlation between the researcher rankings obtained through full counting and those obtained through harmonic counting. The total number of articles published by each researcher was smaller when harmonic counting was applied in place of full counting. However, the researcher rankings obtained using the two counting methods did not differ significantly, particularly for researchers with the highest and lowest article counts. This may be related to the prevalent trend of multiple authorship in chemical engineering research. Prolific researchers tend to be the first or corresponding author, thereby earning them more credit when harmonic counting is applied; by contrast, the ranks of researchers with low article counts cannot be improved because of the limited number of articles published by them. Given the positive correlation between the results obtained from the two counting methods and the more straightforward format of full counting relative to harmonic counting, full counting should be applied when the objective is to quickly obtain a set of rankings for a large number of researchers. However, for a small group of researchers with similar levels of productivity, harmonic counting can yield a set of rankings that accounts for the different contributions of authors. Finally, future studies should explore other research fields where the prevalence of multi-authorship is similar to that of chemical engineering, thereby allowing for the application of harmonic counting to be further explored.
ACKNOWLEDGMENTS
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REFERENCES
What Is the Process of Data Practitioners Utilizing Open Government Data?

Cheng, Wei-Chung  
Graduate Institute of Library and Information Studies, National Taiwan Normal University, Taiwan  
80415003e@ntnu.edu.tw

Chiu, Ming-Hsin Phoebe  
Graduate Institute of Library and Information Studies, National Taiwan Normal University, Taiwan  
phoebechiu@ntnu.edu.tw

ABSTRACT
Open Government Data (OGD) plays a crucial role in enhancing governance transparency, fostering civic engagement, and fostering collaboration between the public and private sectors. To effectively promote the development of the OGD Movement in Taiwan from a pragmatic perspective, this research employs a qualitative approach to investigate the behaviors of 35 data practitioners, drawing upon the principles of grounded theory. The findings reveal that OGD practitioners' behavioral patterns can be categorized into seven distinct phases, namely “Requirement Analysis,” “Functionality Design,” “OGD Awareness,” “OGD Access,” “Data Cleansing,” “Implementation,” and “Optimization and Maintenance.” Additionally, this study identifies “OGD quality” and “Interaction with the government” as critical factors influencing the data practitioners' developmental process. In conclusion, the research presents specific recommendations to enhance the OGD utilization environment and provides directions for further research endeavors.

KEYWORDS
Open Government Data; Data Practitioner; Behavior; Need; Qualitative Analysis

INTRODUCTION
The concept of Open Government has inspired governments worldwide to enhance governance transparency and improve civic services by opening their data, known as Open Government Data (OGD). According to the Organization for Economic Co-operation and Development (OECD), OGD promotes transparency, accountability, and value creation by making government data accessible to all, encouraging business innovation and citizen-centric services. Numerous studies have highlighted OGD's potential for driving data-driven economic development and improving public services (Herala et al., 2018; Kawashita et al., 2022; Magalhaes & Roseira, 2020; Pereira et al., 2017). In Taiwan, the government actively promotes OGD utilization, leading to various applications in different industries. Academics have employed OGD for disease prevention and public health improvement, while industries have used it to innovate products and services (He, 2020; Tu et al., 2018; Wu et al., 2018).

However, despite the value of OGD for both the government and the public, its benefits can only be realized through the efforts of data practitioners—individuals possessing coding skills or related expertise—who utilize the data to create specific products or services (Gurstein, 2011; Peixoto, 2012; Ponte, 2015). Therefore, data practitioners play a pivotal role in actualizing the philosophy of OGD. Nonetheless, few studies have explored the experiences of data practitioners while developing products with OGD. This study aims to gain insights into the behavioral characteristics of data practitioners using OGD in their products and provide valuable recommendations to the government for improving the OGD ecosystem. This research seeks to address two key research questions:

RQ1: What is the process followed by data practitioners in utilizing OGD for their products?
RQ2: What are the primary needs of data practitioners during the process of OGD utilization?

METHODS
This study employed a qualitative research design for acquiring OGD practitioners' contextual experiences through semi-structured interviews and analyzed the transcripts using a grounded theory approach (Creswell, 2013; Glaser & Strauss, 1967).

Research participation and data collection
The study's sampling criteria were intentionally restricted to data practitioners who had prior experiences utilizing OGD in specific products, regardless of their demographic characteristics, to maximize participant recruitment. We gathered contact information of potential participants via various channels, including OGD portal websites, OGD-related civic communities and Facebook groups, OGD hackathon websites, and online news and research papers addressing OGD utilization within the past five years. Invitations were extended to all potential participants, with an additional request for each interviewee to invite others who possessed similar OGD utilization experiences. Consequently, 35 participants (P01-P35) were recruited. All interviews were conducted during the latter part of 2022. Considering the COVID-19 pandemic, every participant could choose to interview remotely via Google Meet and telephone or face-to-face wearing a mask. The questions focused on what the interviewees had done while
utilizing OGD in their products, including how to know OGD, where to access OGD, and what to do after obtaining such data. Each session was recorded and transcribed for further analysis under the participants’ consent.

Qualitative analysis based on grounded theory
The study employed text analysis following the three stages of grounded theory: open coding, axial coding, and selective coding. During open coding, meaningful phrases were extracted from the transcripts and grouped into specific facets. Subsequently, the coding paradigm was employed in axial coding to reconstruct relationships among these facets comprehensively. Through an iterative and comparative analysis process, the final conceptual categories were aggregated in selective coding to address the research questions. To ensure the quality of the conceptual categories, this research enlisted two additional coders with qualitative analysis proficiency for triangulation.

PRELIMINARY FINDINGS
Using a qualitative research design, this study identified seven distinct behavioral phases exhibited by data practitioners while utilizing Open Government Data (OGD) in specific products. These phases encompass the decision-making processes and actions undertaken by data practitioners to fulfill specific requirements.

Behavioral phases of data practitioners utilizing OGD
The OGD utilization process demonstrates similarities with the general software development phases, indicating that OGD does not significantly influence data practitioners' behavior. However, it remains a valuable resource in product development. Figure 1 presents a macro perspective of the OGD utilization process, addressing RQ1. For instance, interviewee P10 aimed to create a service providing information on the distribution status of COVID-19 home-test kits for the public. Initially, P10 conducted a Requirements Analysis, considering possible shortages of home-test kits when the policy was first implemented. To ensure wide accessibility, P10 chose to develop the service as a webpage with simplified filters for Taiwan's counties (Functionality Design). Drawing from prior experiences, P10 was well aware of where to find the necessary OGD (OGD Awareness) and only required specific data for the service (OGD Access). After obtaining the relevant OGD, P10 refined the content through Data Cleansing and proceeded to develop the service using the processed OGD (Implementation). Eventually, the service was released to the public and subject to adjustments based on user feedback (Optimization and Maintenance).

Furthermore, this study identified the following observations: (1) Data practitioners may enhance product functionality by recognizing another suitable OGD (OGD Awareness); (2) Data practitioners may refine product functionality after accessing another potential OGD (OGD Access); (3) Data practitioners may integrate additional OGD to improve product quality based on user feedback (Optimization and Maintenance); (4) It is common for data practitioners to utilize both OGD and non-OGD to meet product functionality requirements.

DISCUSSION AND CONCLUSION
This study aims to investigate the processes and requirements of data practitioners during the utilization of OGD. The obtained insights will enhance the government's comprehension of actual OGD utilisers' behavior, facilitating targeted assistance at different phases. To encourage more practitioners to participate in the OGD Movement, the government must prioritize improving OGD quality. Access to usable data will streamline practitioners' tasks, expediting the development process. Meanwhile, enhancing the interaction quality is crucial. Providing frontliners in governmental agencies with a specific operating protocol and fostering their OGD literacy through educational programs will foster greater dedication to the OGD Movement. Moreover, this research further suggests that: (1) analyzing practitioners' needs in each behavioral phase in-depth will enable the government to offer tailored support effectively; (2) comprehensively understanding possible support requirements in each phase will facilitate the establishment of a more user-friendly OGD utilization culture and environment by the government.
ACKNOWLEDGMENTS
We thank all the interviewees and the two coders for participating and offering valuable experiences to help us finish this research.

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A Text Mining Approach to Uncover the Structure of Subject Metadata in the Biodiversity Heritage Library

Cheng, Yi-Yun
School of Communication and Information, Rutgers University, USA | yiyun.cheng@rutgers.edu
Parulian, Nikolaus Nova
School of Information Sciences, University of Illinois Urbana-Champaign, USA | mnp2@illinois.edu
Dinh, Ly
School of Information, University of South Florida, USA | lydinh@usf.edu

ABSTRACT
We propose a bottom-up, data-driven pipeline to uncover the structure of biodiversity subject metadata using a combination of text mining approaches. In this study, we analyze 721,035 subject terms in the Biodiversity Heritage Library (BHL). We utilize named entity recognition and word-embedding methods to systematically label and group terms based on their vector-space distances. The results show that the subject terms from BHL are clustered into several prominent themes relating to environmental regulations, geographic locations, organisms, and subject access points. We hope that our approach can serve as a first step to group similar subject terms together in large-scale, constant growing digital collections with aggregated metadata from multiple sources. Ultimately, we hope the next phases of this project can become a basis for biodiversity digital libraries to standardize their vocabularies.

KEYWORDS
Subject headings, text mining, Biodiversity Heritage Library

INTRODUCTION
Subjects are important metadata elements as they capture the main content of a scientific work (Hjørland, 2016). In a large-scale digital environment, metadata records are expected to be reliable access points for users to retrieve relevant online collections (Lu et al., 2010; Walsh, 2011). However, the involvement of multiple metadata providers for a large digital library may result in confusion in the practice of how subject headings are assigned (Tarver et al., 2015). For instance, the Digital Public Library of America (DPLA) contains metadata from 23 providers with differing practices for assigning subject headings. The HathiTrust Digital Library (HTDL) also recognizes the difficulty in aggregating metadata from over 150 sources (Jett et al., 2016; Fenlon et al., 2014).

The Biodiversity Heritage Library (BHL), a large-scale digital library that houses legacy biodiversity literature, also aggregates metadata from numerous natural history collections (Gwinn and Rinaldo, 2009). In conversations with BHL administrators, they mentioned that BHL used the Library of Congress Subject Headings (LCSH) initially to assign the subject headings to items. As BHL’s number of partnering institutions increased, the process of cataloging has been delegated to these partnering institutions. These institutional partners have their own heuristics to create and assign subject terms to their items. As a result, the subject terms have been growing organically into a large and flattened list of terms (BHL, 2022). We use the term “subject terms” instead of “subject headings” in this study, for the reason that not all subjects in BHL are from standardized, structured subject heading lists.

To provide better subject access, prior literature stressed the importance of assigning subjects from structured (mostly, hierarchical) subject heading lists (Hjørland and Nielsen, 2001; Hjørland, 2016). The goal of this study is thus to propose a pipeline to uncover the structure of BHL’s flattened subject term list. Currently, the biodiversity community has established several standards, such as Darwin Core, ABCD, or the Collection Descriptions. These standards emphasize on the metadata elements for describing biodiversity data and collections. There is still a pressing need to establish a standardized subject heading list. We hope the findings of this study can further be used as a basis for building such specialized biodiversity subject heading list in the next phases of this project.

METHOD
For data collection, we extracted 721,035 subject terms from the BHL subject dataset (BHL, 2022) dated Feb 21, 2022. Upon initial observations, the subject terms indicate mixed variations or subject types, such as subjects about a date, locations, species names, or publication types. To understand the variation of the subjects and the distribution of the subject types across these BHL collections, we perform exploratory analysis on the subject terms to capture prominent topics in the BHL dataset. Figure 1 shows the general data analysis workflow for this study. The analysis consists of two parts: (1) Entity Detection; (2) Clustering. For (1) Entity detection, we first conduct partial string matching between BHL subject terms with LCSH to determine the extent to which the two overlaps (w.1). We then perform standard Named Entity Recognition (NER) using SpaCy to infer common entities such as locations or names (w.2). For the unrecognized entity from NER, we use specialized species and organisms entity detector (Pafilis et al., 2013) to distinguish these subjects based on NCBI classification (w.3). Recognizing that geographic information is crucial for biodiversity data to understand the distribution of species, for the location entity, we

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further use external georeferencing databases to match finer-grained locations and perform analysis on these geographic entities (w.5, w.6). For (2) Clustering, we generate a word-embedding based on a pre-trained word2vec model for the rest of the non-identified subjects based on term co-occurrences (w.4).

Figure 1. Exploratory Analysis Workflow (Full size online visualization at: https://tinyurl.com/BHL-subjects)

FINDINGS

Part 1 Named Entity Recognition Results
Table 1 shows the number of subject terms and the percentage per entity type (1) before deduplication (needed for the examination of the distribution of subject terms on all BHL records); (2) unique subject terms overlapped with LCSH; (3) unique subject terms from other sources (created by institutions themselves). The majority of subjects are undefined by NER (45% of unique subject terms), suggesting NER alone is not sufficient to capture all possible biodiversity-related entities. For georeferencing matching, the United States is the most frequently mentioned (63,004 mentions, 73.5%), followed by Canada (3.9%) and the United Kingdom (3.6%). We observe a long-tail distribution in the number of mentions, where the top 5% of countries comprises almost 90% of all mentions, and the remaining 185 countries only comprise 10%. Lower right of Figure 1 shows the most mentioned continents (full figure available online), with North America at 73.66% (71,119), and South America at 9.63% (9,299).

<table>
<thead>
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<th>Entity Type</th>
<th>Number of Subject Terms</th>
<th>Number of Unique Subject Terms</th>
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</tr>
<tr>
<td>Total</td>
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</tbody>
</table>

Table 1. Named Entity Recognition (NER) results based on entity type

Part 2 Clustering Results
We further cluster the 552,292 undefined subjects based on word-vector co-occurrence between subjects on the same publication title. Top right of Figure 1 shows 30 distinct clusters from our analysis, with the top ten terms in each cluster. Two coders perform a three-stage coding process to label the clusters: the main theme across the clusters are about environmental-related issues such as environmental regulations, pests, and conservation; followed by place names, specifically cities, townships, counties, and islands. Other prominent themes include organisms, specifically plant life (i.e. flowers) and animal life (i.e. mammals); and subject access points (subject areas, publication types, and publication labels). Some clusters are closer to each other in the embedding space, signifying a high frequency of co-mentions. For instance, the flowers cluster is closer to the locations cluster (i.e., Sarcoxic, New Braunfels, Glastonbury), suggesting that these specific flowers may be present in the specific regions. In future iterations of this work, expert knowledge is necessary to interpret the meaningfulness of the clustering results.

DISCUSSION AND CONCLUSION
This study provides an analytic pipeline for examining Biodiversity Heritage Library (BHL) subject terms using text-mining approaches. Our study shows that a rapidly-growing digital library needs a system to reexamine existing metadata records from numerous partnering institutions. An ideal situation for such a system would be a guideline to suggest controlled vocabularies usage for subject metadata. In reality, it is challenging for these institutions to follow new metadata practices under the constraints of content management systems used for digital collections. The practical implication of our analytic pipeline can serve as a first step for grouping similar subject terms together. This can help ensure the quality on these constantly aggregated metadata records. In future work, we will refine this approach to ensure all relevant metadata elements are also examined. Ultimately, we hope that our pipeline can be used to construct a specialized biodiversity subject heading list using a bottom-up, data-driven approach.
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Preliminary Findings on Developing a Scale for Credibility Assessment on Interactive Web Platforms

Choi, Wonchan  
School of Information Studies, University of Wisconsin-Milwaukee, USA | wchoi@uwm.edu

Zhu, Liya  
School of Information Studies, University of Wisconsin-Milwaukee, USA | liyazhu@uwm.edu

ABSTRACT
This poster introduces an ongoing project to develop a scale for measuring information credibility on current and newly emerging interactive web platforms. The poster reports on preliminary findings from an initial phase in the project to generate an item pool based on an analysis of existing scales for credibility ($n = 3$) and empirical studies in the library and information science literature on web credibility assessments in the social media context ($n = 19$). Results show that in most papers analyzed (16 of 19; 84.2%), credibility was conceptualized as a one-dimensional construct and often measured with only one item (e.g., credible, believable), despite the common view among scholars that credibility is a high-level, multifaceted concept. The analysis also identified 59 semantically distinct items as an initial pool, which will be validated and tested with empirical data in subsequent project phases.

KEYWORDS
information credibility, web credibility, scale, social media, social platforms

INTRODUCTION
Web credibility assessment on social media platforms can be defined as an individual’s judgment of the likelihood of a web-based information object, such as a post or the online community, being a source of high-quality information. Adopting the widely accepted two-dimensional model of credibility by Hovland et al. (1953), web credibility is determined by the perceived goodness and morality (i.e., trustworthiness) and perceived knowledge, skill, and experience (i.e., expertise) of the information object as a source of online information (Fogg, 2003; Rieh, 2017). Web credibility assessment is a crucial aspect of online information behavior, particularly on social media platforms, where anonymous users create and circulate information on a wide range of topics (Choi et al., 2023).

Given the abstract and perceptual nature of credibility (Rieh & Danielson, 2007), a validated psychometric instrument is needed to measure credibility, which would improve knowledge on how web users judge the credibility of online information and how that judgment is associated with their information behaviors on the web, such as selecting an online source over alternatives, accepting advice on the web, and sharing online information with others (Choi et al., 2022). Although some credibility scales have been developed, mainly in the interpersonal communication context (e.g., Gaziano & McGrath, 1986; McCroskey & Teven, 1999; Meyer, 1988), there is lack of research on developing and validating a scale for measuring information web credibility on interactive social platforms, such as peer-knowledge production communities (e.g., Reddit, Wikipedia, Stack Exchange), microblogs (e.g., Twitter), and image- and video-sharing sites (e.g., Instagram, YouTube). Furthermore, measurements in the web credibility literature often mixed up reflective and formative indicators, blurring the conceptual relationship between the underlying dimensions of credibility (i.e., reflective indicators) and elements that contribute to the perception of credibility (i.e., formative indicators). As part of a larger project to develop a scale for measuring users’ perceptions of information credibility on web-based interactive platforms, this poster reports on preliminary findings from efforts to generate a pool of items that will be tested in subsequent phases. Specifically, results of an analysis of existing credibility scales and the literature on web credibility assessments in the social media context are discussed.

METHODS
We analyzed the literature to survey how web credibility in the social media context has been measured in prior studies in library and information science. We searched articles in Web of Science under the Information Science and Library Science category using two keywords—credibility and social media—in the author keyword and title fields. Our last search in May 2023 identified 31 articles. We reviewed the full text of each article to determine relevance for further analysis based on inclusion and exclusion criteria: original research papers in English measuring credibility either as the main concept or a component of a larger conceptual model were included; reviews, non-English papers, and studies that did not use any measurements of credibility were excluded. As a result, 19 articles remained.

To analyze each included article, we developed an initial coding scheme by mapping the indicators (items) used in validated scales (Gaziano & McGrath, 1986; McCroskey & Teven, 1999; Meyer, 1988) based on semantic similarity (Figure 1). Using the initial coding scheme, we coded the dimensions of credibility identified in included papers by either mapping the associated items to the relevant ones in the coding scheme or adding new items if none of the existing items in the coding scheme could be mapped.

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<table>
<thead>
<tr>
<th>Items</th>
<th>1-dimension scale (Gaziano &amp; McGrath, 1986)</th>
<th>2-dimension scale (Meyer, 1988)</th>
<th>3-dimension scale (McCroskey &amp; Teven, 1999)</th>
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<tr>
<td>Fair/fairness</td>
<td>Credibility</td>
<td>Believability</td>
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<tr>
<td>Unbiased</td>
<td>Credibility</td>
<td>Believability</td>
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<tr>
<td>Tells the whole story</td>
<td>Credibility</td>
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<td>Accurate</td>
<td>Credibility</td>
<td>Believability</td>
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<tr>
<td>Trustworthy/Can be trusted/trustful</td>
<td>Credibility</td>
<td>Believability</td>
<td>Trustworthiness</td>
</tr>
<tr>
<td>Respects people’s privacy</td>
<td>Credibility</td>
<td>Believability</td>
<td></td>
</tr>
<tr>
<td>Watches out after readers’ interests</td>
<td>Credibility</td>
<td>Affiliation</td>
<td></td>
</tr>
<tr>
<td>Concerned about the community’s well-being</td>
<td>Credibility</td>
<td>Affiliation</td>
<td>Goodwill</td>
</tr>
<tr>
<td>Concerned about the public interest</td>
<td>Credibility</td>
<td>Affiliation</td>
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</tr>
<tr>
<td>Separate fact and opinion</td>
<td>Credibility</td>
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<td>Credibility</td>
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<td>Competition</td>
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<tr>
<td>Cares about me</td>
<td>Credibility</td>
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<td>Goodwill</td>
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<tr>
<td>Concerned with me</td>
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<td>Goodwill</td>
</tr>
<tr>
<td>Has my interests at heart</td>
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<td>Goodwill</td>
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<td>Not self-centered</td>
<td>Credibility</td>
<td></td>
<td>Goodwill</td>
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<td>Sensitive</td>
<td>Credibility</td>
<td></td>
<td>Goodwill</td>
</tr>
<tr>
<td>Understanding</td>
<td>Credibility</td>
<td></td>
<td>Goodwill</td>
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**Figure 1. Initial Coding Scheme Developed by Mapping Items across Validated Credibility Scales**

**RESULTS**

Twelve of 19 included papers (63.2%) examined credibility issues on Twitter, Facebook, or both. Other types of social media studied included Instagram (3; 15.8%) and YouTube (2; 10.5%).

Sixteen papers (84.2%) measured credibility as a one-dimensional construct, two papers (10.5%) used a three-dimensional credibility measure, and one (5.3%) used a two-dimensional measure. In total, 59 semantically distinct items were identified, including those presented in Figure 1. The number of items used in individual studies ranged from one to 18, with a mode of three (7 papers; 36.8%), followed by one item (5; 26.3%) and eight items (2; 10.5%). Frequently used terms (adjectives) to phrase the items included trustworthy or trustful (11; 57.9%), followed by expert (6; 31.6%), knowledge or knowledgeable (5; 26.3%), reliable (5; 26.3%), and accurate (4; 21.1%).

**DISCUSSION AND FUTURE DIRECTIONS**

Despite the common view of credibility as a multifaceted concept among scholars from various fields (Choi & Stvilia, 2015; Rich & Danielson, 2007), most of the empirical studies we analyzed measured credibility as an unidimensional concept, with many using only one item phrased as the concept itself (i.e., “credible”) or a synonym (e.g., “believable”). These findings indicate the need to develop and test a scale that can effectively capture the multidimensional nature of credibility in the web context. The immediate next steps in the current project will involve expanding the item pool by further analyzing related literatures and evaluating the validity of items through expert and user reviews, as suggested by established guidelines for scale development and validation (DeVellis & Thorpe, 2022). The validated items will then be used to create a scale, which will be tested with empirical data on various types of interactive web platforms that serve as useful sources of online information, including current social media sites and newly emerging generative AI-based platforms.

**CONCLUSION**

Developing such a scale can provide researchers with a validated tool to quantify users’ perceptions of web credibility, thereby serving as a crucial component in their study models of statistical associations among variables of interest. Additionally, the indicators (items) included in the scale can be used to develop a coding scheme for analyzing qualitative data on users’ perceptions and behaviors associated with their assessments of web credibility.

**REFERENCES**


Digital Information Service to Combat Violence against Women: The Comunica Mulher Project

Costa, Michelli  
Universidade de Brasília (UnB), Brazil | michelli@unb.br

ABSTRACT
The present study discusses the methods and outcomes of a project conducted at the University of Brasília with the aim of providing information services to the community of the Federal District (Brazil) on COVID-19 prevention and vaccination, as well as addressing domestic violence. Employing social marketing strategies, such as content marketing and viral marketing, the project sought to disseminate pertinent information and engage the target audience through social media platforms, primarily Instagram. The content marketing approach entailed the creation and distribution of reliable information utilizing authoritative sources and visual resources, such as illustrations, graphs, infographics, and diagrams. Simultaneously, the viral marketing strategy endeavoured to identify emerging subtopics of interest by leveraging the Google Trends tool and relevant commemorative dates. These integrated strategies yielded a remarkable 700% surge in the project's Instagram account reach alongside heightened audience engagement. The study concludes that community information services should prioritize the dissemination of contextually relevant information for various population segments, particularly those that are historically marginalized.

KEYWORDS

INTRODUCTION
Access to information is a fundamental right and must be guaranteed to everyone. Libraries are social institutions that promote the organization, preservation, and distribution of registered information. Since the 20th century, information and referral services have been improved within libraries to promote access and use of information by the entire community, defined as the target audience (Grogan, 1992). In contemporary times, such services face other information issues, such as the availability of safe and useful information and the spread of fake news.

In response to current information problems, Souza Júnior et al. (2020) highlighted the need for measures to contain the proliferation of false information and the provision of quality information, which enables health education. In recent years, this topic has been widely discussed because of the COVID-19 pandemic. Other challenges highlighted by the pandemic, such as domestic violence, also gained importance. This form of violence increased the social isolation imposed by the pandemic, as shown by Vieira, Garcia and Maciel (2020).

Considering these demands, a project was created in 2020 at the University of Brasília (Brazil) in the Library Science course. The project aimed to offer information services to the community of the Federal District (DF, Brazil) regarding COVID-19 prevention and vaccination. It addressed domestic violence as well. To achieve this, informative materials were identified and produced targeting distinct audiences, especially women from DF. These materials were disseminated through the social media platform Comunica Mulher and on events promoted within the project. In this context, the target user is a woman who lives in DF, especially in the Estrutural City. In this region, a community library is a part of the same project. For communication on social media, the target user was defined as a woman aged 18–60 years. However, data from Instagram and Facebook show that 85% of the audience are women, and more than 50% are up to 34 years old. To reach older users, the project promotes events and direct communication through WhatsApp.

One of the interdisciplinary methodologies applied in the project, which was reflected in the field of Library Science, was social marketing. According to Lefebvre (2013), social marketing aims to introduce and disseminate new ideas. The author emphasizes its common use in promoting discussions around public health and its increasing use for other social changes. Lee and Kotler (2015) highlight that the application of social marketing aims to influence behaviours, promoting new standards and working to modify them. Based on this experience, this study aimed to answer the following question: What are the contributions of social marketing strategies to the execution of information services for communities in a digital environment?

METHODOLOGY
The social marketing techniques used in the project are within consumer-centered strategies and encompass content marketing and viral marketing. Both strategies fall within the scope of organic marketing, which aims to establish a long-term relationship with the target audience through engaging and providing high-quality content (Pullizi, 2012). The reported study covers the period from April 2021 to March 2023. The evaluation focused on Instagram posts (Source: https://www.instagram.com/comunicamulher_/). The monitoring data was collected using Meta Business Suite, a tool from Meta Platform.

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RESULTS AND DISCUSSION
The first strategy is content marketing. Khotib and Picchiai (2022) defined content marketing as a technique for creating and distributing relevant and consistent content. In this context, defining the target audience is essential, as relevance is determined by the community’s needs and interests. In the Comunica Mulher project, the content strategy was implemented from the beginning, based on two techniques presented by Khotib and Picchiai (2022): encoded resources and symbolic objects. Encoded resources refer to the distribution of information elaborated by reliable and reference sources on topics. Within the project, official sources from the Brazilian government and state agencies were considered for COVID-19 and gender-based violence. The informative materials produced by the project members fall under the category of symbolic objects, as defined by Khotib and Picchiai (2022). Such resources should present secure and pertinent information using graphical elements that convey the message. In Comunica Mulher, visual language was developed using illustrations, graphics, infographics, and diagrams in the production of cards published on social media.

The second marketing strategy was viral marketing. These methods are based on projecting increased interest in a specific topic from specific social contexts. In the context of the Comunica Mulher project, two tools were used to identify subtopics of growing social interest. The first tool was Google Trends, which allows the identification of frequently used terms for searches on specific topics, trends, and demographic data related to the searches. As for the second tool, commemorative dates related to the theme were mapped to establish the content to be promoted in the project. Commemorative dates tend to generate predictable peaks of interest on social media, making them a good strategy for anticipating informational demands.

The application of the techniques in the indicated periods resulted in a 700% increase in the reach metrics of the Instagram account, which was the focus of the content strategies (Figure 1). The same account also demonstrates the effectiveness of viral marketing techniques, achieving the highest levels of audience engagement during the observed period.

Figure 1. Instagram reach

CONCLUSION
Information services for the community should be committed to providing the necessary information for the activities of the population, especially historically excluded groups. The promotion of information in a digital environment should consider the dynamics and strategies that have the greatest potential to reach the target audience. Digital marketing strategies have proven to be relevant in this context.

In the case of the Comunica Mulher project, two strategies were selected to evaluate their impact over a two-year period. The results showed that the two selected strategies, content marketing and viral marketing, were relevant in achieving a wider reach of the project's target audience. Other metrics such as audience and engagement were also significantly expanded, which can be attributed to systematic actions based on the principles of Library Science and social digital marketing strategies.
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ChatGPT Media Coverage Metrics; Initial Examination

Delellis, Nicole S.  
University of Western Ontario, Canada | ndelelli@uwo.ca

Chen, Yimin  
Royal Roads University, Canada | yimin.25chen@royalroads.ca

Cornwell, Sarah, E.  
University of Western Ontario, Canada | scornwel@uwo.ca

Kelly, Dominique  
University of Western Ontario, Canada | dkelly48@uwo.ca

Mayhew, Alex  
University of Western Ontario, Canada | amayhew@uwo.ca

Onaolapo, Sodiq  
University of Western Ontario, Canada | sonaolap@uwo.ca

Rubin, Victoria, L.  
University of Western Ontario, Canada | vrubin@uwo.ca

ABSTRACT
This paper presents an overview of coverage of OpenAI’s ChatGPT in media outlets from November 2022-March 2023, a comparison to previous media coverage of the chatbot Tay across the same outlets, and a count of ChatGPT media articles pertaining to government legislation and regulation. The New York Times, Wired, Gizmodo, The Globe and Mail, and The Guardian were searched for coverage. Across all five outlets there is an uptick in media coverage surrounding ChatGPT, with total numbers of included articles per month being 0 in November, 39 in December, 68 in January, 104 in February, and 143 in March. Findings exemplify the trend of increased coverage of ChatGPT in media public discourse, which contrasts with previous smaller media coverage of Tay. Examination of headlines and subheadings of included articles reveals minimal coverage (5.7%) dedicated to government legislation of ChatGPT. Future research will evaluate what is being said about ChatGPT within these media outlets.

KEYWORDS
ChatGPT; Media Coverage; Tay; Legislation

INTRODUCTION
Library and Information Science (LIS) should be interested in chatbots, such as ChatGPT, because of the field’s long history of analyzing and critiquing information systems, including conversational agents or chatbots (e.g., Rubin et al., 2010). A chatbot is “a computer program that uses AI and natural language processing (NLP) to understand customer questions and automate responses to them, simulating human conversation” (IBM, (n.d)). Shum et al. (2018) note that “perhaps the very first chatbot known publicly” (p. 11) was Eliza, a chatbot created by a MIT researcher in 1966. Over 55 years since the creation of Eliza, on November 30th, 2022, OpenAI released its artificial intelligence (AI) chatbot ChatGPT which quickly gathered media interest. Previous studies have noted that the use of AI in “[…] both the private and public sectors has captured the interest of media and citizens” (Igartua et al., 2022, p. 2), and news coverage “makes trends visible, influences public discourses, contributes to the discursive construction of benefits and risks (Lupton, 2013), and shape technology perceptions (Pentzold et al., 2019)” (Nguyen & Hekman, 2022, p. 1). The media coverage surrounding ChatGPT seems to differ from previously released chatbots. This work seeks to examine coverage of ChatGPT in media discourse, assess if media coverage of ChatGPT differs from past coverage on a previously released chatbot (Tay) and provide a glimpse into the type of topic coverage surrounding ChatGPT. Tay was released on March 23rd, 2016 by Microsoft Corporation and was selected as a comparable chatbot that also created a splash in the media due to its promise in AI conversational technology innovation.

METHODS – DATA COLLECTION
The media outlets of The New York Times, Wired, Gizmodo, and The Guardian were selected for “their international scope and focus on technology […] and influential voices in global media discourses on technology” (Nguyen & Hekman, 2022, p. 2). This decision parallels Nguyen and Hekman’s (2022) study that examined media rhetoric of artificial intelligence across these same four media outlets. The Globe and Mail was also included to represent Canadian media coverage. Across all five media outlets the search string of ‘ChatGPT’ was used, and each media outlet was searched for articles from the period of November 1st, 2022 to March 31st, 2023. Exclusion criteria were set to omit articles that did not mention ChatGPT within the title, subheading, or first two paragraphs of the text. Additionally, the following retrieved items were excluded across media outlets: quizzes, briefing/summary articles, letters to the editors, applications/tools, quotes of the day, videos, podcasts, advisory weekly letters, investor newsletters, global advisory reports, cartoons, advertisement of products/courses, paid content, call for opinions, and duplicate articles. Apart from including any retrieved hits that mentioned Tay within the title, subheading, or text of the article, the same approach to searching was conducted for collection of media articles published in the year 2016 and pertaining to Tay. We also scanned the headings and subheadings of included articles pertaining to ChatGPT and counted how many of them mentioned government legislation or regulation, omitting mentions of school policies, and concerns about legality of ChatGPT output and its uses (e.g., pertaining to copyright law).
INCREASE IN MEDIA COVERAGE

Figure 1 depicts the number of media articles meeting inclusion criteria per month across all five media outlets (The New York Times, Wired, Gizmodo, The Globe and Mail, and The Guardian).

![Graph showing the number of included ChatGPT-related media articles per month across five media outlets from November to March 2023.]

As clearly visible in the graphic, all five media outlets had a sharp increase in the number of articles pertaining to ChatGPT from November 1st 2022 to March 31st 2023. The average numbers of articles collected from each organization per month were: 0 in November, 7.8 in December, 13.6 in January, 20.8 in February, and 28.6 in March. When combining the total number of included articles across media outlets per month, the total numbers of articles steadily increased from month to month: 0 in November, 39 in December, 68 in January, 104 in February, and 143 in March. In total, 354 articles had substantial coverage of ChatGPT and met our inclusion criteria.

Comparison to Tay Chatbot Media Coverage

A total of 354 included media articles were collected from all five media outlets pertaining to ChatGPT, while Tay’s media coverage was about 17 times smaller during the entire year of 2016. Only 21 Tay-related media articles were gathered from the same five outlets. In comparison to Tay, ChatGPT is clearly receiving more media attention akin of a hype. While AI may “capture the interest of media and citizens” (Igartua et al., 2022, p. 2), there appears to be a different level of media coverage dedicated to ChatGPT compared to past chatbots, such as Tay. While Tay didn’t sustain media attention due to its technology limitations, it appears that within the first four months since its release date ChatGPT has been able to not only retain media interest but has had increased media coverage month over month which may be in part attributed to ChatGPT’s more advanced technological state.

Example of Analysis of ChatGPT Coverage – Government Legislation and Regulation

This work is part of a larger study examining media rhetoric of ChatGPT and as such provides initial findings pertaining to media discourse covering government legislation and regulation in relation to ChatGPT. After scanning the headlines and subheadings of the 354 included media articles pertaining to ChatGPT across media outlets, a total of 20 articles (5.7%) were found to contain reference to government regulation or legislation of ChatGPT. Total number of articles pertaining to legislation and regulation (0 articles in November, 3 in December, 2 in January, 5 in February, and 10 in March) tended to follow the same increased trend in coverage as total included articles pertaining to ChatGPT.

CONCLUSION

Our data shows and provides evidence for a steady rise in media coverage of ChatGPT from late 2022 to early 2023 across our five selected media outlets. By comparison with another innovative leap in technology, Tay’s coverage in 2016 never reached a similar level of hype within the same media outlets. Alarmingly, only 5.7% of the articles in the dataset prominently profiled the issues of government regulation/legislative oversight of ChatGPT in their headlines. This paper calls for further investigations of legacy news and social media coverage of ChatGPT in LIS, highlighting its importance to understanding public perception of such innovative information systems and the need for further public oversight and regulation of AI technologies.
ACKNOWLEDGMENTS
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Tracing Information Use Over Time: A Comparative Study of Undergraduate Engineers

Dodson, Samuel University at Buffalo, USA | smdodson@buffalo.edu

ABSTRACT
This study investigated the patterns of undergraduate engineers’ information use as they transition from students to emerging professionals. We administered a questionnaire to 54 undergraduate engineers at a large research university, and compared the information use of 2nd and 4th year students. The results showed that 4th year students reported using more genres associated with professional contexts, such as technical reports, and fewer classroom-based genres, such as textbooks, than 2nd year students. However, a significant proportion of all students reported that they do not frequently use professional genres. These findings have implications for information literacy instruction by highlighting students’ need for further training on the relationship between genres and tasks.

KEYWORDS
Engineering Education, Genre, Information Literacy, Information Use, Task

INTRODUCTION
Knowing how to use and create discipline-specific information is a crucial information literacy in everyday life. For example, engineers must know how to interact with a number of genres, such as instruction manuals, technical specifications, and technical reports, in order to do their jobs. Better understanding how new and emerging professionals develop these skills and abilities can offer implications for the design of information literacy instruction. In this study, we were guided by the following research question: What are the trends of undergraduate engineers’ information use as they transition from students to emerging professionals?

The research literature has explored how undergraduate engineers engage in a number of information-intensive tasks, such as doing projects or writing reports. Mercer et al.’s (2019) scoping review found that students experience challenges finding, evaluating, and applying information to these tasks; however, there is also evidence that students’ information literacies develop throughout their programs of study. Previous work has found that, for example, undergraduate engineers cite journal articles more frequently as they progress in their studies (Yu et al., 2006). It is unclear whether the use of other genres also change over time. This led us to carry out a comparative study of 2nd and 4th year undergraduate engineers’ information interactions.

We employed a genre-theoretical approach, following Andersen (2008). In this framing, discourse communities, such as the discipline and profession of engineering, are responsible for the creation and enactment of genres (Miller, 1994; Swales, 1990). Genres embody norms for how, why, and to what effects members of a discourse community communicate among themselves (Orlikowski & Yates, 1994; Spinuzzi, 2003). As Russell (1997) argues, genres are specialized tools that mediate activities. This suggests that an individual’s ability to effectively use, manage, and create information requires an awareness of both genres and the tasks they are useful for. Similarly, Dodson (2021) and Freund et al. (2005) identified that a statistically significant relationship exists between genres and tasks performed in the context of engineering. This indicates that tasks often require the use of specific genres.

METHODS
We administered a questionnaire to undergraduate engineers at a large research university (see also Dodson, 2021; 2022). We compared the information use of respondents in their 2nd (N = 20) and 4th year (N = 34) of study. This preliminary work focuses on one of the 14 questions that comprised the questionnaire. We instructed respondents to complete the statement, “I frequently use ___ when writing reports”, by selecting all appropriate items from a list of 23 genres. No respondents reported using dissertations / theses or syllabi, so we removed these two genres from the data analysis. We compared the responses of 2nd and 4th year undergraduate engineers with Fisher’s exact test. We also calculated the relative frequency of each genre for both groups, which is the proportion of respondents in a group that used a specific genre. For example, 50% of 2nd year respondents (N = 10) and 41% of 4th year respondents (N = 14) reported frequently using textbooks. We used relative frequencies because the two groups are comprised of unequal numbers of respondents. We created a bump chart and bar chart to visualize the relative frequencies and ranks (i.e., most- to least-frequently used genre) of the 21 genres over time (see Figure 1).

RESULTS
While the Fisher’s exact test result was p = .69, we identified trends of information use across time that warranted further exploration. We found that the relative frequency of all but one genre associated with classroom-based learning, such as instructors’ handouts, notes, and slides, decreased between the 2nd and 4th year of study. Several classroom-based genres decreased considerably in use, including notes (~38%) and instructional videos (~24%). Other genres completely fell out of use. No 4th year respondents reported using practice exams (~10%) or
worksheets (~5%). Discussion forum posts was the only classroom-based genre that increased in use (+4%) from 2nd to 4th year.

We also examined the genres that are not primarily associated with classroom-based learning, such as journal articles, patents, and technical reports. We referred to these as “professional genres.” The relative frequency of all but two professional genres increased between the 2nd and 4th year of study. The most-frequently used genre by 4th year respondents was journal articles (N = 17; 50%) – its relative frequency of use increased by 10% and its rank moved up five spots, to #1. We also observed a double-digit increase in the use of technical reports (+12%). Magazine articles and patents were the only professional genres that decreased in use (~6% and ~1%, respectively).

**I frequently use ____ when writing reports.**

![Figure 1. A bump chart (“A”) visualizes the rank of each genre over time. The vertical axis represents rank, descending from the most-frequently used genre (#1), at the top, to the least (#21), at the bottom. The horizontal axis represents year of study, with 2nd year on the left and 4th on the right. For each genre, a line connects 2nd and 4th year responses. Positive slopes indicate an increase in rank from 2nd to 4th year. A bar chart (“B”) visualizes the difference in relative frequency of use between 2nd and 4th year for each genre (i.e., 4th – 2nd year). Positive percentages indicate an increase in relative frequency of use from 2nd to 4th year.](image)

**DISCUSSION**

We investigated undergraduate engineers’ transitions from students to emerging professionals by tracing the patterns of their information use across time. While previous studies have described undergraduate engineers’ information seeking and use behaviors (e.g., Mercer et al., 2019; Phillips et al., 2019; Saleh and Large, 2011), it was not clear whether changes in students’ use of one type of information coincide with changes in how they use other information types. We found that, overall, 4th year students reported interacting with fewer genres than students in their 2nd year of study. The findings also showed that 4th year students, as compared to 2nd year students, reported lower use rates of course-based genres and higher use rates of genres that are more strongly associated with professional contexts, such as journal articles, patents, and technical reports (cf. Freund et al., 2006). We also found that most undergraduate engineers are developing these competencies. Only 40% of 2nd year and 50% of 4th year respondents, for example, reported frequently using journal articles, the most-popular professional genre, when writing reports. This finding is aligned with previous studies of undergraduate engineers. Artemeva and Fox (2010), for example, found that genre awareness increases with experience, and Artemeva (2009) also found that learners continue to develop these skills and abilities into their careers.

**CONCLUSION & FUTURE WORK**

The questionnaire responses indicated that undergraduate engineers’ information use changes throughout their programs of study. Upper-year students used more professional genres and fewer classroom-based ones, relative to lower-year students. In a subsequent study, we plan to investigate whether information use changes for other tasks, such as doing labs or projects. The research question cannot be fully answered by questionnaires alone. In-depth interviews or observations could be carried out with undergraduate engineers to better understand why and how their information use changes. We argue that the findings have implications for the design of information literacy instruction. The questionnaire responses indicated that a large proportion of all students are not using professional genres. Consequently, students may benefit from further information literacy instruction – especially training that describes (1) the relationship between genres and tasks and (2) how to interact with professional genres.
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Comparing the Writing Styles of Multiple Disciplines: A Large-Scale Quantitative Analysis

Dong, Shuyi  School of Information Management, Nanjing University, China | sydong@smail.nju.edu.cn
Mao, Jin  Center for Studies of Information Resources, Wuhan University, China | maojin@whu.edu.cn
Pei, Lei  School of Information Management, Nanjing University, China | plei@nju.edu.cn

ABSTRACT
Investigating the writing styles of different disciplines is crucial for comprehending the scientific language in scholarly communication. This study examines the variations in scientific writing styles across disciplines using a large-scale analysis on 14 million abstracts from the Microsoft Academic Graph database. Writing styles are quantified in four aspects: symbolic, lexical, syntactic, and readability. The t-tests were employed to explore potential trends in the evolution of writing style and investigate linguistic differences across disciplines. Results indicate an overall trend towards increasing complexity and informativeness in writing, with significant changes observed in Biology, Chemistry, Computer Science, and Psychology. Disparities of linguistic features in writing styles were observed across disciplines. The findings shed light on the distinct language use in scholarly communication across disciplines.

KEYWORDS
writing style; scholarly communication; scientific community; linguistic features

INTRODUCTION
“Academics do not act in a social vacuum and knowledge is not constructed outside particular communities of practice.” (Hyland, 2006, p. 39) As an essential transmitter of scientific findings, scientific papers convey information, establish scholarly communities of shared knowledge (Harrison & Stephen, 1995), and lay the foundation for scientific communication and development (Abelson, 1980). The scientific writing style is of great significance to scientific communication (Song et al., 2023), as authors will choose appropriate discipline-sensitive linguistic resources and present their studies to intended readers and reviewers (Hyland, 2006). Furthermore, the scientific writing style can be seen as a reflection of science culture. At the discipline level, culture consists of knowledge traditions in which scholars from the same field share updated findings, hold similar cultural notions, and follow uniform codes of conduct (Argamon et al., 2008). Under disciplines’ consistent research goals, genres, and vocabularies, unified sets of communication symbols were formed, manifesting as similarities in writing (Lu et al., 2019; Swales, 1990).

To deeply understand discipline-oriented scholarly communication, it is essential to uncover the differences in writing styles across disciplines and further explore the reasons behind their formation (Teich et al., 2016). This study aims to provide a large-scale quantitative analysis of the writing styles of disciplines to provide a panoramic understanding of how the writing styles have evolved and how they differ according to the underlying disciplines’ cultures. By answering the following research questions, this study offers valuable insights into the distinctive language usage found in scholarly communication across various disciplines:
1. How do the writing styles of disciplines change over time?
2. Do the writing styles of disciplines significantly differ from each other?

METHOD
We selected a representative set of disciplines across the scientific landscape, guided by the hierarchy of science (Fanelli & Glänzel, 2013). The selected disciplines included Art, Philosophy, Sociology, Psychology, Biology, Chemistry, Computer Science, and Mathematics, with the first four falling under soft sciences and the last four under hard sciences. We collected journal abstracts from the Microsoft Academic Graph database from 1990 to 2019 for the selected disciplines. After conducting necessary data cleaning procedures, we obtained 14,285,952 abstracts for analysis. Quantitative linguistic features were measured from four perspectives: symbolic, lexical, syntactic, and readability (Juola, 2006). Symbolic features comprised digit frequency and punctuation frequency (Wu et al., 2021). Lexical features encompassed average word length, word count, number of unique words, and type-token ratio (Chen et al., 2020). Syntactic features consisted of average sentence length, sentence count, and sentence length dispersion (Jin et al., 2021). Readability features encompassed the Coleman Liau, Dale-Chall, and SMOG indexes (Ante, 2022).

The t-tests were conducted to investigate the extent of changes in linguistic features over time and across disciplines. Cohen’s d effect size was calculated to determine whether the observed significant differences are of practical concern. We followed Cohen’s (1992) guidelines for interpreting effect sizes, where a value of 0-0.2 indicates a very small effect, 0.2-0.5 a small effect, 0.5-0.8 a medium effect, 0.8-1.2 a large effect, and above 1.2 a very large effect size.
RESULTS
Diachronic Changes in Disciplinary Writing Styles
Analysis revealed a consistent trend in linguistic features across all disciplines, with most features gradually increasing over time, trending towards more complexity and informativeness. In Figure 1(a), symbolic features showed stable digit frequency but increased punctuation frequency, indicating a rise in the use of symbols in scientific papers over the past 30 years. For lexical features, average word length slightly increased, while word count and the number of unique words fluctuated with an overall increasing trend, indicating that scientific publications are conveying more information. The type-token ratio decreased due to a greater increase in word count compared to unique words. In syntactic features, average sentence length remained stable, and sentence count increased in the last decade. Sentence length dispersion remained stable, indicating no significant changes in narrative rhythm. Readability indexes, such as the Coleman Liau index, consistently increased, while the Dale-Chall index and SMOG index exhibited fluctuating trends, indicating that scientific texts become harder to read.

In Figure 1(b), we examined the effect sizes of diachronic variations in linguistic features and observed high effect sizes in Biology, Chemistry, Computer Science, and Psychology, indicating significant changes in their writing styles. While Art, Philosophy, Sociology, and Mathematics displayed small effect sizes, suggesting little changes. Overall, the writing styles in hard sciences underwent significant transformations, while those in soft sciences remained relatively stable.

Pairwise Comparison of Writing Styles Between Disciplines
T-tests were performed on pairs of disciplines using data from 2017 to 2019 to ascertain their discernible differences. Figure 2 presents the effect sizes for the 28 pairs. Noticeable distinctions are evident in most disciplines, with the Art-related and Philosophy-related pairs displaying particularly pronounced differences and demonstrating similar patterns. Linguistic features exhibited fewer variations among neighboring disciplines, except for the Sociology-Psychology pairs. Psychology displays greater dissimilarities compared to the soft sciences and fewer dissimilarities compared to the hard sciences.

Additionally, when comparing Mathematics to the hard sciences, consistent patterns of distinction emerge, manifesting in greater disparities in symbolic features (punctuation frequency), lexical features (average word length, number of unique words, and word count), syntactic level (sentence count), and readability (Coleman Liau, Dale-Chall, and SMOG indexes). These findings assure that writing styles in scientific publications vary across disciplines.

CONCLUSION
The results indicate a trend of increasing complexity and informativeness in scientific writing styles, with hard sciences experiencing greater changes. Disparities in writing styles were observed across disciplines, exhibiting varying degrees of differences in features. Our study shows the dynamic nature of scientific language and confirms that different disciplines use different features to establish their unique linguistic identity. These insights contribute to a better understanding of disciplinary writing and discipline-oriented communication. We will further explore the
disciplinary differences by employing explainable machine learning methods to classify and identify writing styles and analyzing the contribution of features to reveal how linguistic traits encode scientific writing across disciplines.

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REFERENCES
An Instructional Binary: Analyzing How Accessibility Is Taught in Graduate-Level Library and Information Science Programs

Dorman, Evan J.  Old Dominion University, USA  |  edorm001@odu.edu  
Mallary, Kevin J.  Old Dominion University, USA  |  kmallary@odu.edu  
Nikiema, Jackie  Old Dominion University, USA  |  jniki001@odu.edu

ABSTRACT
While accessibility is a core value of the American Library Association (ALA) and represents an important factor in striving for diversity, equity, inclusion, accessibility, and social justice (DEIASJ), coverage of accessibility varies widely in programs intended to equip future LIS professionals to serve patrons with disabilities. This poster presents preliminary findings from a larger research project examining library and information science curricula at 77 North American colleges and universities. Through thematic analysis of course descriptions and syllabi, the researchers found that digital topics in accessibility are addressed more frequently than physical ones. Further, LIS curricula largely overlook the needs of disabled patrons when covering accessibility. These factors present challenges for future LIS professionals serving patrons with disabilities.

KEYWORDS
LIS curricula; Accessibility; Disability; Usability; User-Centered Design

INTRODUCTION AND BACKGROUND
In recent years, efforts have been made in library and information science (LIS) academic programs to improve their coverage of diversity, equity, inclusion, and social justice (DEIASJ) issues. Despite this, accessibility and disability are infrequently covered in LIS courses (Alajmi & Alshammari, 2020; Ren et al., 2022). While accessibility is a core value for the field, its coverage in existing curricula is slim and often limited to specific electives (Coverdale et al., 2022). The authors present preliminary findings drawn from a larger research project examining library and information science curricula at 77 North American colleges and universities, with the goal of identifying current trends in accessibility instruction in LIS programs. The findings highlight successes in existing curricula and identify areas of shortcoming in hope of improving accessibility instruction for future LIS professionals.

DATA COLLECTION AND ANALYSIS
The authors identified 460 LIS courses across the considered curricula, of which 238 (51.7%) covered physical or digital accessibility topics. A total of 126 syllabi (53.0%) were made available to the authors. Courses with available syllabi were grouped according to the type of accessibility addressed and further sorted by primary topic. Course outcomes, modules, resources, and assessments were analyzed to draw out key themes and determine depth of coverage.

FINDINGS AND DISCUSSION
Based on the thematic analysis of 126 syllabi, the authors identified six accessibility topics covering physical and digital spaces (Table 1).

| Accessibility Types | AB  
|  
| CM  
| ELPO  
| PD  
| UE  
| UCD  
|  
| (n = 4)  
| (n = 8)  
| (n = 15)  
| (n = 10)  
| (n = 21)  
| (n = 45)  
|  
| Physical Accessibility  
| Digital Accessibility  
| X  
| X  
| X  
| X  
| X  


Table 1. Digital and Physical Accessibility Topics

Physical accessibility coverage
Collection Management courses covering accessibility bridge physical and digital spaces. For example, one course objective for LIBR 580: Collection Management requires students to “assess library collections using a variety of collection- and user-centered techniques.” Another objective for INFO 6840: Content Management Systems expects students to “... apply key aspects of user-centered design and accessibility as they relate to digital collections.”

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Relevant assessments and readings include a “Tough topic assignment: Physical Disability/Disabilities” (LIS 610: Library Materials and Literature for Children) and “Controlling the costs of long-term digital accessibility: A cost model for long-term digital accessibility” (LIS 585: Archival Appraisal & Management). Overall, Collection Management courses were scarce (6.3%) among the 126 syllabi reviewed.

Courses addressing physical accessibility emphasize Program Design and Access Barriers. For instance, the description of one course, LI 833: Resources and Services for Diverse Populations, states that students shall “[p]lan the design, provision, and evaluation of services, which will help reduce or eliminate barriers to information seeking, access, and use for people from diverse and underserved populations.” Another course’s learning objectives include: “(1) Identify four types of physical ability challenges; (2) Define concepts and classifications of ICT accessibility for persons with physical access challenges; and (3) Understand concepts and theories related to ICT use posed by aging and disability” (LS 581: Universal Design for Information Technologies/Universal Access). In total, physical accessibility topics are covered in less than 20% of the syllabi analyzed.

Digital accessibility coverage
Ethical, Legal, and Professional Obligations pertaining to accessibility are covered when teaching professional ethics more broadly. While legal standards were frequently addressed, only one course (LIS 690: Disability and Access in Libraries) required direct engagement with disabled patrons’ lived experiences through an assignment that involves comparing disability podcasts.

Usability Evaluation, User-Centered Design, and associated topics were covered in a plurality of examined courses. Several (e.g., INFO 681: Community Building and Engagement, MLIS 7180: Library Services for Users with Disabilities) focus on users with disabilities in the context of their communities and families. Several others (e.g., LIS 5622: Resources and Technologies for People with Disabilities) present user-centered design in the context of social justice and equity. Each category features courses explicitly covering accessible design. However, these courses reflect the minority of user-centered design offerings, which leaves future LIS professionals unprepared to meet disabled patrons’ accessibility needs (Gibson et al., 2021; Pionke, 2020). While previous work advocates for accessibility instruction beyond computer science and human-centered computing courses (Coverdale et al., 2022), digital accessibility is covered more than physical accessibility in LIS education.

Limitations and Future Work
A primary limitation of this study is the limited number of syllabi available for analysis: while a slim majority of courses identified as covering accessibility had syllabi that were either publicly accessible or were made available to the authors, a significant percentage (47.0%) did not. Additionally, even when syllabi were available, details were often sparse, such as the names of assessments included without accompanying description. Future curricula analyses could benefit from examining peripheral materials alongside syllabi to obtain a more comprehensive picture of the state of LIS instruction at particular institutions.

CONCLUSION
In examining 126 syllabi from North American LIS programs, this study provides preliminary analysis of the divide between coverage of physical and digital accessibility, and of ongoing shortcomings of instructional content centered on providing resources and services to people with disabilities. Improving coverage in this area is vital to ensure progress in equity and justice in the field.

REFERENCES


Vocational Education and Training Data in Twitter: Making German Twitter Data Interoperable

Dörpinghaus, Jens  
Federal Institute for Vocational Education and Training (BIBB), University of Koblenz, Germany  |  doerpinghaus@uni-koblenz.de

Tiemann, Michael  
Federal Institute for Vocational Education and Training (BIBB), Germany  |  Tiemann@bibb.de

ABSTRACT
There are many valuable insights on jobs and professions in different sectors of society based on their imminent and ascribed characteristics. Studying such characteristics traditionally was done by action research, surveys, questionnaires, etc. which typically take much time and resources to be concluded. In this study we examine vocational education and training data on Twitter. While we present a generic framework to retrieve, process and analyze tweets, we will discuss two research questions from computational social science: First, how can we make Twitter data interoperable to other available resources, e.g. classifications of occupations, tools and skills? Second, do we have enough data to process job collocational prestige analysis on a geographical basis? This presents a novel approach towards labor market research, making novel data interoperable which has not been considered in previous literature. Our approach and pipeline is generic and could be easily extended to other languages. It also contributes to prestige research by widening the question of ascribed prestige to the question how information on occupations is collocated and what these contextualisations tell us about how occupations are seen.

KEYWORDS
Labor market research, social media, Twitter, text mining, semantic analysis, social network analysis

INTRODUCTION
The German labor market is dynamic: technical innovations and changes in society lead to novel skill requirements for employees. Vocational education and training, re-training and continuous vocational qualification are key to respond to these novel requirements (Dobischat et al., 2019; Helmrich et al., 2016; Schneemann et al., 2021). Also, it was found that social networking sites can be used to build (semi)professionalism and gain social recognition (Golan & Babis, 2019).

In this paper, our primary research questions is: How can we manage and analyze information resources from Twitter with existing classifications. In other words: How can we make Twitter data interoperable to existing resources? Labour markets are complex fields with diverse data structures and multiple applications, for example, connecting jobseekers to the right training or job (Felsenstein & McQuaid, 2006). In Germany, the “Klassifikation der Berufe” (KldB) is the basic reference for the institute for employment research (Institut für Arbeitsmarkt- und Berufsforschung, IAB) and the German Federal Employment Agency (Bundesagentur für Arbeit, BA).

However, we also focus on skills and tools. Our first example is the European Classification for Skills, Competences, Qualifications and Occupations (ESCO). It provides a multi-language hierarchy of skills and competences (and in addition qualifications and occupations) containing a full text description, scope notes and comprising examples. Gonzalez et al. state, that only few works have described the analysis and use of ESCO (González et al., 2021). Some work has been carried out for semantic interoperability between skills and labor market documents, which was initially promised by ESCO (le Vrang et al., 2014). Other scholars tried to use data from ESCO and Wikidata for text mining on scientific literature or for curriculum analytics (Kitto et al., 2020). Recent research has provided a generic mining and mapping approach (Fareri et al., 2021) and automated ontology alignment for ESCO and the English O*NET (Neutel & de Boer, 2021). We limit our approach to ESCO and tools provided by a BIBB tool taxonomy (Güntürk-Kuhl, 2017).

First, we will present a literature review which indicates that a generic approach and analysis workflow towards interoperable labor market data on Twitter is currently missing. Afterwards, we will briefly describe our workflow and show some preliminary results to evaluate our approach. They answer two research questions from social science: First, how can we make Twitter data interoperable to other available resources, e.g. classifications of occupations, tools and skills? Second, do we have enough data to process job prestige analysis on a geographical basis? Our conclusions and outlook are drawn in the last section.

LITERATURE REVIEW
Over the last decades, there has been an increasing interest in mining data from educational databases, advertisements and information systems (Dutt et al., 2017; Mohamad & Tasir, 2013; Romero & Ventura, 2007). Here, supporting decision-making and process management within education is key. The generic challenges are usually the automated extraction of knowledge from data, usually interpreted passages from texts, and the mapping to existing data sets. However, there are still several challenges on data and data integration (Kovalev et al., 2020).
Twitter has also been used as a source for further analysis, but mostly limited to homophily (Pan et al., 2019), measuring demographic characteristics (Abitbol et al., 2018; Ferguson & Wheat, 2015; Sloan et al., 2015), happiness (Guo et al., 2016) or socioeconomic status (Abitbol et al., 2018). However, these studies are limited to English texts and no approach tries to generate interoperable data, e.g. link tweets to existing data schemes. Here, several approaches exist, but they are usually limited to English texts, e.g. resumes (Ben Abdessalem & Amdouni, 2011; Kopparapu, 2010). Contextualisations with social media have been looked into in connection to occupational differences (which could not be found, Tifferet & Vilnai-Yavetz, 2018).

Since we can only rely on very limited previous work, we will continue with a detailed discussion of the methods to encourage further research in this field.

**METHOD AND INTERIM RESULTS**

In Figure 1 we show the generic workflow to analyze twitter data. It comprises three parts: First, reading the data retrieved from Twitter API from the database, then transferring the data using a custom UIMA Typesystem to the second part which analyzes the sentiment of words within a Tweet and annotates entities from ESCO and tools, and ultimately passes the result to the writer for storing the output. Besides of UIMA, we use Python with several libraries like SpaCy and Tweepy.

![Figure 1. Workflow analyzing tweets retrieved from Twitter API](image)

In general, out of 2,440,626 non-duplicated tweets, 1,947,744 were neutral, 400,170 negative, and 92,712 positive. This gives a broad basis for testing colloccational prestige. And even though only very few tweets contain geographical information (ca. 3%), we can find regional clusters for particular occupations. When presenting the poster, we will not only show that our approach makes tweets interoperable with KldB and ESCO, but also present those cases where we have enough data to process job prestige analysis on a geographical basis.

**CONCLUSION AND OUTLOOK**

In this poster, we will present a generic workflow to retrieve and analyze tweets and make them interoperable with existing taxonomies and data. We could identify this as a gap in current research. While our work focuses on German tweets, the workflow itself could be adapted for other languages. We will show an evaluation based on two research questions from social sciences that proof our concept and show data limitations.

We can identify several challenges and shortcomings: For examples, scanning the non-duplicate occupations for scraping and analyzing the tweets has several challenges, even for performance. In fact, if we consider alternative occupation labels without duplicates, the file consists of about 3000 whereas this file is at least 7 times bigger. In addition, our approach is currently limited to occupations, skills and tools and we will need an extensive test environment for further development.

While our naive implementation is both working and generic, it is still very early work on an issue which needs more attention. We hope that it will also highlight the importance of more interdisciplinary research in this field.

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Comparing Crisis Communication on TikTok and YouTube: A Case Study of the 2023 California Floods

Duan, Yiran  
Syracuse University, USA | yduan12@syr.edu

Khoury, Christy  
Syracuse University, USA | cjkhoury@syr.edu

Smith, Alexander O.  
Syracuse University, USA | aosmith@syr.edu

Joh, Una  
Syracuse University, USA | sjoh01@syr.edu

Hemsley, Jeff  
Syracuse University, USA | jjhemsle@syr.edu

ABSTRACT
In January 2023, heavy California flooding prompted users to capture and share video footage of their impacted surroundings. This preliminary study uses this crisis event to compare commenting behavior across three video content formats: YouTube videos, YouTube shorts, and TikTok videos. Using network and regression analysis to study 45 videos across these three formats, we find that users commented and replied to others more on YouTube than TikTok despite TikTok videos having more views than YouTube videos. Additionally, we find the most vibrant comment behavior under YouTube shorts. This work provokes additional research to understand the exact ways in which platform design and affordances can influence crisis communication around a specific event.

KEYWORDS
Climate Change, Platform Studies, Network Analysis, Comparative Analysis, Crisis Events

INTRODUCTION
This study explores the relation between platform design and crisis communication by examining the comment sections of 45 TikTok and YouTube videos about the California floods, which took place in March, 2023 after years of drought. Infrastructure, private property, and farms critical to the United States’ food supply were all impacted. Crises such as these are increasingly contextualized, discovered, and interpreted through informative videos posted on different social media platforms such as TikTok and YouTube. In such cases, the distinction between traditional news journalist and citizen journalist are blurred as “hybrid media” and “traditional” news formats conform and are flattened to platform features and affordances (see, Chadwick, 2013, pp. 166–176).

Relatively new to the hybrid media space is TikTok, which was introduced in 2016. While a great deal of work has looked at YouTube, very little work has yet looked at TikTok. Academic comparisons of TikTok and YouTube are even rarer, and have primarily focus on “health knowledge acquisition” (e.g. Al-Marooof et al., 2021; Tam et al., 2022) or comparative “cultural discourse” (e.g. Izotova et al., 2021). In the context of climate crises, some literature has discussed how communication approaches can affect information flow and engagement (Nisbet, 2009; Zhou, 2016), but overall, the effects of the mediating platforms are underrepresented in these bodies of literature. None that we know of has compared crisis communication on TikTok and YouTube.

Our work addresses this gap by selecting the 15 most viewed videos from three different video formats: TikTok, traditional YouTube videos, and YouTube “shorts”. We also consider the metadata surrounding these 45 videos and their titles and captions. We find that users commented more on YouTube and with other users compared to TikTok despite that TikTok videos have more views than regular YouTube videos, which suggests that users may choose using regular YouTube videos to discuss climate crises while using YouTube shorts and TikTok to share content about climate crises. We make a contribution by seeking to close the gap between climate crises communication and comparative platform studies by providing early results of a comparative analysis of several formats of video media in the context of crisis communication.

Hypotheses/Question
RQ1: Does one platform (YouTube vs TikTok) have significantly more user comment interaction than the other?
RQ2: Does the format of the video (long vs short) create significantly more user comment interaction than the other?
RQ3: Do first personal experience videos tend to use one format or platform over the others?

METHODS
To answer our question, we found the 15 most watched videos that used #californiafloods from YouTube regular videos, shorts, and TikTok, providing 45 total videos. We also collected the comment data from each video, which we used to build a user network of those who commented on videos and any responses to comments. We then calculated simple network statistics to measure the interaction among the users, and manually classified videos as being news or a first person experience. To answer our questions we used simple regressions.
YouTube videos and comments were collected via YouTube’s API and an R package, and a publicly available javascript, SerapeTikTokComments.js, was used to collect the video comments from TikTok. Additional metadata collected manually included: URL (link of each video), Creator Name, Follower Count, Date Posted, Caption, Number of Likes, Number of Comments, Number of Views, and Hashtags used. For each comment network, we calculated the number of nodes (users), number of edges (the relation of one user commenting on another or the video), and density, which measures overall connection of the network. Finally, we construct an *engagement* measure for each network by dividing the total users count by the number of users who commented on other users’ comments.

**FINDINGS**

Our multiple regression results show how the hosting platform and the video format substantially influence the network density, indicating more active dialogues among users in the comment sections, rather than simple, one-sided expression of opinions. Regardless of control variables (e.g. total users and experience) a consistent pattern emerges: videos in the “shorts” format and those posted on YouTube tend to encourage more vibrant user interactions compared to “long” format videos and those posted on TikTok. The “shorts” format and YouTube have positive level effects on network density, 0.06353 and 0.05212 respectively at the 99% confidence level. These findings suggest discernible differences in user interaction patterns within the comment sections of videos, even among 45 videos covering identical topics.

A logistic regression with “long” format as the dependent variable reveals that videos featuring creators’ experiences are more frequently shared as short videos rather than long ones. When using a combination of total users, engagement, and YouTube as control variables, experience consistently exhibits a negative coefficient at a 99% confidence level. In the most comprehensive model incorporating all control variables, experience displays a coefficient of -3.1576, thus illustrating a level effect, given that experience is a dummy variable. This suggests that content creators posting videos of their own experience of the flood tend to choose shorter video formats over longer ones. The inclusion of YouTube as a control variable confirms that this choice is not about the platform per se, but rather the format of the video.

**CONCLUSION**

Social media platforms are increasingly generating hybrid media and, in some cases, replacing the role of traditional media as outlets for crisis communication. How these platforms inform the public should be emphasized as they are increasingly normalized as locations for learning “the news.” Here we suggested that crisis events offer a unique perspective for comparing how platforms inform and generate discussion. Future crises being inevitable, future studies could provide a space for researchers and practitioners to evaluate how citizen communication is shaped by platform features, and thus shapes cultural understandings of unplanned media events. While previous research has considered sociocultural implications sites have on communication, few have considered the impact of short versus long video formats. Additionally, only recently have such social media sites been compared to each other with data. To our knowledge this is the first study which does so for crisis events with the interest of understanding how social media platforms act within larger “news” ecology.

Future research would allow for richer, mixed-methods comparisons of more representative data across additional field sites and crises.

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Evaluating the Effectiveness of VR Training for Crisis Communication Skills Development Among LIS Graduate Students

Dumas, Catherine  
SUNY-Buffalo, USA | cdumas@albany.edu

Williams, Rachel D.  
University of South Carolina, USA | rwilliams@sc.edu

Ogden, Lydia P.  
Simmons University, USA | lydia.ogden@simmons.edu

Flanagan, Joanna  
College of the Holy Cross, USA | jflanaga@holycross.edu

Porwol, Luke  
University of Galway, Ireland | porwol@gmail.com

Tillinghast, Julia  
Simmons University, USA | julia.tillinghast@simmons.edu

ABSTRACT
This research analyzes the results of a study that is part of a larger, interdisciplinary, and multi-institutional project that examines the usability and effectiveness of virtual reality (VR) training for library and information science (LIS) graduate students and professionals in gaining skills for interacting effectively with patrons in crisis. This paper reports on key findings related to the effectiveness of VR training for teaching empathy, confidence, and de-escalation skills for LIS graduate students. The findings illustrate that VR has the potential to impact LIS graduate education by reaching a wider audience that introduces training in low-stakes, immersive environments and that does not pose harm to patrons in crisis. This study also contributes innovative approaches that support training in skills including empathy, confidence, and de-escalation.

KEYWORDS
Virtual reality; Patrons in crisis; Usability; LIS graduate education; Crisis communication and de-escalation

INTRODUCTION
Recent trends in library services have increasingly centered on addressing the needs of patrons in crisis. The emphasis on developing services for patrons experiencing trauma of some kind means that library staff, and future librarians who are in LIS graduate programs, need to develop crisis communication skills. Training and professional development are crucial for supporting current and future library workers so that they have the knowledge, skills, and confidence to support patrons in crisis successfully. This project considers that need in the context of VR training, which has gained popularity as an approach for higher education in the past few years:

1. How effective is VR for teaching LIS graduate students basic de-escalation skills? What crisis response skills do participants successfully implement when interacting with an avatar depicting a patron in crisis in a virtual library environment?
2. Does the VR training positively impact LIS graduate student perceptions of mental illness and confidence/empathy?

LITERATURE REVIEW
Using VR in higher education has become increasingly popular over the past several years, and some of those uses indicate the possibilities for implementing VR in LIS graduate education. VR training provides a safe place to learn where one can repeat scenarios as needed and receive immediate feedback in a low-stakes environment (McGarr, 2020). Implementing training early on in LIS programs can support emerging professionals in developing the skills necessary to help them mitigate crises and recall skills when needed. VR has great potential for LIS education. The use of role-play in virtual environments is an approach adopted in this study as it is effective in achieving the desired learning outcomes for students (Hadley et al., 2019; Levine & Adams, 2013; Rogers et al., 2022; Wilson et al., 2013). Students perceive the virtual environment to be a safe place to learn, repeat scenarios as needed, and receive immediate feedback in a low-stakes environment (McGarr, 2020). Thus in our study we leveraged roleplay, along with traditional instruction methods, in the virtual environment.

METHODOLOGY
Our analysis reports selected, emergent findings of a usability study of VR training approaches using Oculus Quest 2 head-mounted displays (HMDs) and the social VR platform, Mozilla Hubs, for training LIS students in de-escalation skills. The participants consisted of 10 students recruited from the LIS graduate program at the authors’ university (6 female, 2 male, 1 non-binary, 1 unsure between male and non-binary). Each training session was individual, with a participant completing training in a virtual environment created by the researchers. The session included pre-and post-session questionnaires on communication skills, usability and effectiveness of VR. The questionnaires address the following: demographic data; experience in crisis management and communication/de-escalation skills; and experience with different technologies, effectiveness of training, the usability of VR headsets.
and the SVR platform, and the potential of VR for education in library and information science. The exercises implemented in VR have been used by two of the authors during in-person and Zoom-based training workshops with staff at libraries throughout the Northeastern United States.

**STUDY PROCEDURES**

Participants sent a profile picture to the researchers one week before their session, which were used to create avatars for the participants using their pictures and ReadyPlayerMe (https://readyplayer.me/). One person participated in the study at a time in the researchers’ lab. Sessions took about one hour total. Prior to the session, participants completed an informed consent form and pre-session questionnaire. Next, participants were given instructions on how to use the headset and enter the virtual public library environment created by the researchers. In the session, the participant watched a video presentation of a training session on implementing a set of de-escalation skills in the virtual library environment. Participants then watched a roleplay enacted by the researchers which was recorded in VR. They finally participated in a roleplay as a library worker with a patron in crisis (played by the researchers). The poster will contain images of avatars participating in the training in the virtual environment, and headsets will be available for participants to join the virtual environment. The virtual public library environment is live and can be accessed at https://hubs.mozilla.com/YVHiK2W/simmons.

**FINDINGS AND DISCUSSION**

To evaluate effectiveness, we tested baseline knowledge on mental illness, confidence and empathy among participants. Our measures allowed insights into how the VR experience changed participants’ knowledge, confidence, and empathy. At baseline, all participants wanted to learn effective methods for addressing library patrons with mental illness. Comparisons between pre- and post-tests indicate that most participants had a better understanding of mental illness and increased confidence helping a patron in crisis. Pre- and post-test measures of knowledge of and misconceptions towards mental illness found important changes as well. On the pre-test, 3 of 10 participants disagreed that mental illness is “an appropriate topic to discuss directly with library patrons.” At post-test, only one disagreed with that statement, suggesting that the VR experience impacted perceptions about their role. In terms of empathy, prior to the VR experience participants were mixed in terms of whether they believed themselves to “often have tender, concerned feelings for people less fortunate.” Four agreed or strongly disagreed, 4 were “not sure but probably agreed” and the other 2 “probably disagreed” or disagreed. The average score for that item was 4.2, “not sure but probably agree” to “agree.” The VR experience helped improve participants’ confidence by showing them they could remain self-regulated and act skillfully in an emergency situation, by placing them in just such a situation.

In their interaction with the patron in crisis, participants successfully demonstrated a good number of de-escalation skills when helping Michael, a patron experiencing an undisclosed crisis. Findings suggest that participants were successful in demonstrating a host of positive skills related to communication, empathy, and de-escalation. Almost all participants identified options and let the patron choose for himself. When interacting with Michael, participants offered to call a family member, move to a different area, or suggested options such as sitting down and taking a moment, or taking a deep breath. Empathy was evaluated by considering whether the participant displayed an ability to listen non-judgmentally; offered to help; gave reassurance; and validated Michael’s feelings. All participants offered to help Michael during the interaction. Participants also verbally communicated their respect for Michael’s personal space by asking if they could approach him, or letting him know that they’re going to back up a little bit to give him more space. Some participants displayed negative skills related to body language and communication. One participant stared at Michael from behind the desk, and another participant expressed some sarcasm and perhaps impatience (which may also be the result of anxiety during the interaction). One participant loudly and repeatedly told Michael to calm down and sit down. Another participant appeared to almost agree with Michael’s delusional statements, and a third participant laughed a bit and seemed uncomfortable during the interaction. Although these three participants did display some negative skills, they also attempted to reassure the patron, offering to help, and respecting his autonomy and space.

**CONCLUSION**

Preliminary findings show that training LIS graduate students in crisis communication skills using VR has positive impacts on their ability to display increased knowledge of mental illness and de-escalation skills when interacting with a patron in crisis. Our study also shows that LIS graduate students display greater empathy and confidence in interacting with patrons in crisis after participating in the VR training.

**ACKNOWLEDGMENTS**

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Navigating Higher Education: Insights from First-Generation Doctoral Students

Ekmekcioglu, Cansu  
University of Toronto, Canada | cansu.ekmekcioglu@mail.utoronto.ca

ABSTRACT
Access to higher education is a form of capital that is not always equally distributed. First-generation doctoral students (FGDSs) face unique challenges and barriers which can make it difficult for them to navigate academic and institutional structures and access key resources and support. We present preliminary findings from interviews with 8 FGDS participants who pursue doctoral degrees in the field of information science in Canada. Interviews focused on identifying FGDSs’ information practices in their pursuit of higher education. An inductive thematic analysis revealed the diverse information needs and sources utilized by this understudied population. The results provide insights about affective dimensions of information seeking and the role of mentors as key information intermediaries in supporting more diverse, inclusive, and equitable space for FGDSs. The poster concludes with implications for practice to improve the interfaces between FGDSs and higher education institutions as well as the broader academic landscape.

KEYWORDS
Information Needs, Information Intermediaries, First-generation doctoral students (FGDSs), Hidden Curriculum

INTRODUCTION
Scholars in Library and Information Science (LIS) have increasingly called for researchers to attend to equity, diversity, and inclusion in pedagogy, research, and recruitment (Caidi & Dali, 2015; Dali & Caidi, 2016; Jaeger & Franklin, 2017). Higher education serves an undeniably important role in the inclusion of individuals with underrepresented backgrounds, such as students at-risk, into the scientific knowledge production. Among students at risk, first-generation students constitute a distinct yet heterogeneous cohort. First-gens are typically described as students who are the first in their immediate family to attend any institution of higher education (Gable, 2021). Comparing to continuing-generation students where university is already a part of life, they are more likely to come from disadvantaged and minority backgrounds who may have more limited access to financial and informational resources, less exposure to cultural/social capital, more prone to psychosocial and cultural stress, tend to rely on themselves and less likely to seek support from academic and administrative units in their institutions (Holley & Gardner, 2012; Jones & Schreier, 2023). Despite their prevalence, our knowledge about the information practices of first-generation doctoral students is limited. Therefore, this pilot study investigates the following research questions:

RQ1. What are the information needs and sources of first-generation doctoral students?
RQ2. How can higher education institutions alleviate information challenges for first-generation doctoral students?

RELATED WORK
In sociology of higher education scholarship, Hidden Curriculum is a concept used to define informal and implicit rules, processes, and language that students are expected to know and perform, yet, unlike formal curriculum one that they are not explicitly taught or explained (Orón Semper & Blasco, 2018). Knowledge or behaviors such as how to network, interact with or ask professors for help, or secure fellowships are consequential for students' wellbeing, sense of belonging, and academic success. However, this knowledge is not accessible for all. As Calarco (2020:2) indicates “hiddenness perpetuates inequalities in grad school and in academia” where grad students from more privileged backgrounds tend to gain more rewards in academia since they have friends or family members who have been to grad school and can guide and help them uncover hidden curriculum. Information thus plays a critical role in eliminating educational and professional inequalities by supporting doctoral students and early career researchers to access key resources (Moore & Singley, 2019; Sloan & McPhee, 2013; Willson et al., 2022). Prior research has assessed information practices by non-dominant groups, including students with underrepresented backgrounds, seeking information to (re)build social capital, support wellbeing, and improve positive learning experiences (Chang et al., 2022).

METHODS
Eight participants, who are first-generation doctoral students in information science from two Canadian research universities, were interviewed to gain insights into their experiences. Purposive sampling techniques were employed to ensure diversity, and the interviews were conducted online via the institutional Zoom account, lasting between 45 to 70 minutes. No compensation was provided to the participants. The sample represented a range of characteristics, including gender, race, ethnicity, birthplace, immigration status, cultural/regional upbringing, and previous university experiences. The average age of the participants was 29, with five identifying as women. The interviews were carried out between June and September 2022, using a semi-structured interview guide based on a literature review that covered demographics, life and academic journey, and information practices. Thematic analysis was
performed iteratively, generating codes, themes, and patterns without relying on a predetermined conceptual framework, until saturation was achieved.

PRELIMINARY RESULTS
Through an inductive analysis, the following emergent themes are found: (1) Affective dimensions of information seeking; (2) The role of mentors as key information intermediaries; (3) Intersecting paths in mentorship.

Emotions and information seeking in the lived experiences of FGDSs
The findings reveal that FGDSs’ information seeking practices are closely tied to their affective experiences. Participants expressed concerns about their lack of confidence and understanding in their chosen profession as well as feelings of emotional distress and being overwhelmed by future career prospects. Graduate school was described as a rollercoaster ride, characterized by constant stress from navigating academia, competition, job insecurity, and the challenging academic job market. Several participants shared their constant anxiety about dropping out of the program and struggling to stay motivated with their tasks. For example, one participant acknowledged the importance of job market preparation but intentionally avoided discussing it with their advisor to reduce stress. FGDSs described feeling like an “outsider” (P1, P4, P6), and dealing with “imposter syndrome” (P2, P3, P4, P8). Many participants expressed the difficulty of feeling like they belonged in academia. Due to this frustration, participants indicated a lack of active engagement in seeking career-related information, as they perceive very limited opportunities to remain in the profession. In addition to stress, some participants experience frustration due to lack of empathic support or validation from families and friends about their research. For example, P3 shared: “I think my parents still have no idea what I'm up to over here. [...] They don't understand why I am struggling, and I think I just stopped trying to get them to understand my work or empathize with me.” In line with previous research (Willson & Given, 2020), these responses illuminate the degree to which FGDSs experience isolation, decreased motivation and avoid seeking potentially valuable information.

Guiding the way: Mentors as key information intermediaries
Participants emphasized the importance of supportive and experienced mentors who can provide insights, advice, and encouragement. They highlighted that the relational aspects of graduate school and academia are crucial for success, with one participant stating, "Access to people is essential for success here." These include forming and maintaining relationships with advisors, dissertation committee members, cohort peers and lab members, administrators, as well as academics in their respective fields. For example, one participant described how they sought information about “what a PhD student-advisor meeting look like” and the dynamics and boundaries of such a relationship. Participants highlighted mentors as trusted people who can “demystify academia” (P4) for them, help create networking opportunities (P1, P5, P6, P8), and making themselves “resource aware” (P7). As P7 shared: “If you’re coming from a minority background like myself, you’d think you don’t feel entitled to ask for support. From a resource perspective, you had either scarce resources or you knew there were setbacks if you asked for it.” By actively sharing information, providing guidance, and connecting individuals to relevant resources, these responses about the mentors resonate the role of information intermediaries in building social capital within disadvantaged communities (Buchanan et al., 2019; Nicol et al., 2022).

Intersectionality in mentorship
Although mentorship emerged as an essential aspect of FGDSs’ academic and social experience, the participants noted challenges they encountered in accessing mentorship. A significant challenge that participant mentioned is that of finding a mentor who can understand the complexities of their lived experience. First-generation status is compounded by their low-economic background, as well as the gendered, racial, and religious dimensions of their identity. However, these aspects are not reflected in their mentorship matches. As P2 recounted: “Sometimes it feels like mentors are just ticking off boxes, filling their service hours, and don't really care about you as a person.” The participants also noted that the limited number of faculty of color and international faculty further limits their choices of mentors who share similar experiences. Consequently, finding a mentor becomes a lengthy process, leaving some FGDSs feeling isolated and unsupported.

DISCUSSION, LIMITATIONS, AND FUTURE RESEARCH
The pilot study's preliminary findings revealed the intersectional and complex information needs of FGDSs in academia, emphasizing the crucial role of mentors as information intermediaries. Mentors are highly valued for their understanding of the relational aspects of the academic landscape and their ability to help FGDSs navigate the complexities and uncertainties of graduate school and academia. Improving access to mentorship is suggested to better support FGDSs in higher education institutions by providing them with experiential knowledge, critical resources, and demystifying the Hidden Curriculum. It is important to design mentorship programs that consider the intersectionality of FGDSs, recognizing their multiple identities and experiences, as culturally mismatched mentor-mentee arrangements risk neglecting the lived realities of FGDSs. This pilot study has limitations, including a small sample size and a narrow focus on Canada. However, these initial findings will inform a larger-scale study in the future. The study highlights the significance of first-generation scholars sharing their experiences at platforms like...
ASIS&T Annual Meetings. This supports first-generation doctoral students in achieving career goals, building confidence, and fostering inclusivity and equity within the information science research community.

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Digital Humanistic Crowdsourcing of Gamification Based on Interactive Digital Narrative: Taking Henan Yuediao Opera as a Case

Fan, Zhenjia  Business School of Nankai University, Nankai University Library, China | fanzhenjia@nankai.edu.cn
Li, Han  China National Aero-Technology Import & Export Corporation, China | woodwater@163.com
Yang, Lijuan  Business School of Nankai University, China | ljjangzxc@qq.com

ABSTRACT
In the "intangible cultural heritage" digital humanities project, crowdsourcing plays a key role. Based on the related theories of gamification and narrative, it takes the traditional Chinese opera Henan Yuediao as a case, designs a humanistic contextualized crowdsourcing platform based on interactive digital narration, and tests its usability and feasibility. The research is conducive to promoting the in-depth mining and utilization of archives.

KEYWORDS
Digital Humanities; Crowd-sourcing; Interactive Digital Narrative; Gamification Design; Chinese Opera

INTRODUCTION
Digital humanities is an interdisciplinary research field emerging in recent years. Crowdsourcing (Massung, 2013; Surowiecki, 2005; Howe, 2006; Ridge, 2013; Alam, 2012) can help project managers interact with the outside world and obtain higher quality and more practical solutions with the help of group wisdom (Zhao, 2020). "Narrative" has become a new thing with the same idea as digital humanities. Interactive digital narrative (IDN) is more suitable for researching digital humanities crowdsourcing (Basaraba, 2018). Gamification is an effective way to enhance user motivation, stimulate user interest, improve the experience, and enhance loyalty (Sun, 2017; Deterding, 2011). The most commonly used game elements are PBL (Points, Badges, and Leaderboards) (Koivisto, 2019). This research builds a framework of gamification elements based on the octagonal behavior analysis framework (Table 1) (Zhou, 2017).

Based on the above background, this study takes Henan Yuediao (one of the traditional operas in Henan Province in China, which is rich in history and culture) as a case, using game elements and interactive digital narrative technology to explore scientific research crowdsourcing projects under the digital humanistic situation. The research revolves around three questions: (1) What are the fundamental game elements under the background of crowdsourcing? (2) How to form a situational crowdsourcing scheme for digital humanities? (3) How effective is the digital humanities situational crowdsourcing scheme?

THEORETICAL BASIS
Interactive digital narrative theory Interactive digital narrative (Brand, 2005; Koenitz, 2010/2015/2018; Murray, 2018; Sylla, 2020; Vrettakis, 2020) is a general concept used to describe academic work in intelligent narrative technology, interactive drama, interactive storytelling, and narrative games. The interactive digital narrative system comprises four parts: environment definition, assets, settings, and prototype stories. Self-determination theory The user's contact with a specific information system will be driven by motivation, often explained by the self-determined theory (Ryan, 2000; Ping, 2008). Flow theory Flow theory is also called immersion theory. It holds that when people concentrate or concentrate on something (Mihaly, 2000), they will forget their surroundings and, at the same time, produce excitement and a sense of accomplishment. Its core is flow experience or immersion experience.

METHODS
Questionnaire In this study, for different game elements, the Kano questionnaire (Kano, 1984; Berger, 1993) is designed with two questions, positive and negative, each including five options. After the questionnaire is collected, the user's answers are divided into five dimensions: attractive attribute (A), one-dimensional attribute (O), must-be attribute (M),
indifferent attribute (I), and reversal attribute (R). The critical game elements from the user's perspective are obtained through the questionnaire survey. At the same time, the questionnaire is also an essential tool in the follow-up experiment.

**Experimentation**

In order to test the effectiveness of game-based narrative design, the research designs two experiments based on the developed experimental platform. Experiment 1 is designed as a usability test of the game-based narrative design platform, recruiting Yuediao enthusiasts, that is, direct users of the platform, as subjects, and the answers can be summarized into data sets involving Yuediao photo metadata and detailed information of significant events. Experiment 2 is designed based on the game and non-game modules in the minor program. The potential users of the platform are invited to evaluate the game narrative more objectively, analyze the use effect of the platform, and put forward the improvement direction.

**RESEARCH PROCESS**

First, we clarify that the digital humanities crowdsourcing platform should pay attention to the characteristics of XVHUVDQGWKHGHVLJQRIWKHFURZGVRXUFLQJSODWIRUPVKRXOGVWDUWIURPWKHXVHUV¶SHUVSHFWLYHDQGIRFXVHVRQWKHSORW of the Yuediao opera. Gamification is essential to LPSURYHXVHUV¶HQJDJHPHQW in the past practice of short-term crowdsourcing projects. To ensure a high level of user engagement in contextual crowdsourcing, we use interactive digital narrative theory to allocate game elements and narratives rationally. Second, we collect data by questionnaire (260 valid questionnaires in total. Table 2) using the Kano model to determine the critical game elements suitable for Yuediao’s crowdsourcing. It makes the user’s preference explicit. We also extract eight key game elements for further design (Table 3) (Q, questionable results).

After that, we take Yuediao's classic play "Shou Jiang Wei" as a clue and embed the game elements (Table 4) into the interactive digital narrative framework to form a complete game narrative scheme. We use it to attract lovers of Yuediao to use their knowledge and memory to mark the theme, characters, time, and background of Yuediao events or photos (Figure 1). Finally, we form the specific scheme and develop a test question and answer platform based on the "WeChat Applet." The usability and effectiveness of the gamification narrative design are verified through user test experiments (Table 4). The user's willingness to use the app has increased from 3.2 points to 4.5 points.

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<tr>
<th>Table 5. User’s willingness to use game narrative design before and after use</th>
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<tr>
<td><strong>Non-gate narrative platform</strong></td>
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<td><strong>Gamification platform</strong></td>
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</table>

**CONCLUSION**

The research selected the Yuediao opera "Shou Jiang Wei" (Winning Over Jiang Wei by a Clever Stratagem) as an experimental case, collected data by questionnaire using the Kano model, obtained eight-game elements belonging to expected attributes, designed WeChat applet platform, completed user test and optimized the scheme. When users use the app, they are attracted by game elements and immersed in Yuediao opera’s stories. They respond to controversial issues in opera archives by answering questions and participating in crowdsourcing projects to verify Chinese opera archives, contributing to the inheritance and utilization of art archives. The reusable and transferable design process we designed can be used in other projects, such as paper-cutting, dance, or traditional musical instruments. It provides metadata or basic background information on intangible cultural heritage and promotes the in-depth mining and utilization of intangible culture. This research also has certain limitations. The design and operation of gamified crowdsourcing platforms require a certain amount of money; There are shortcomings in both interface design and gameplay design; This plan is currently only applicable to short-term projects and has yet to be tested for long-term crowdsourcing projects. The innovation of this study is reflected in two aspects: We theoretically expand the research on narrative and gamification in digital humanities crowdsourcing and verify the role of flow theory and self-determination theory in gamification and narrative design; The introduction of gamified elements enriches the research on crowdsourcing tasks for the protection of intangible cultural heritage, which is interesting.
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ABSTRACT

Information triangulation is a complex practice involving seeking and assessment. Although a newer model, it has begun to be tested and expanded in subsequent research. This poster presents early results of a study of the information triangulation of 23 pregnant and postpartum people in Massachusetts, USA, who were making decisions about cannabis use. Interview transcripts and notes were analyzed using reflexive thematic analysis, in an emic-etic approach, and findings were compared against the six previously identified types of information triangulation. All six types were evident, although specific source types and pathways differed among populations. Further, participants described both explicit weighing of sources against each other and heuristics they used to determine source credibility.

KEYWORDS

Information seeking, information assessment, information triangulation, health information, information marginalization

INTRODUCTION

The concept of lay information triangulation was developed when a study of young parents in Canada found that participants engaged in complex and agentic information behaviours to identify and compare multiple sources of information on the same topic, in order to assess credibility and relevance when facing questions about their children’s health. (Greyson, 2018) The original proposed model of information triangulation identified 4 distinct patterns of seeking, assessment, and sense-making: 1) seeking from sources with escalating authoritative ness until a need was satisfied, 2) seeking a “second opinion” to verify information from an authoritative source, 3) comparing expert and lay perspectives to aid sense-making, and 4) an inclusive approach of comparing a variety of sources with different types of expertise. (Greyson, 2018) This concept has gained traction in information behaviour studies, especially but not limited to studies of health information behaviours and practices, having been cited 59 times over the past 3 years. However, the model remains emergent, requiring testing with multiple populations and topics in order to validate, extend, and potentially refine this working model of lay information triangulation.

Recently, articles have begun to test and expand upon the original triangulation model; for example, Huttunen found that transgender individuals in Finland, who face a number of barriers to accessing appropriate health care, use “complex information triangulation practices” to assess and make sense of information about gender affirming medical care. (Huttunen, 2023) This work extended the original model of information triangulation, adding use of participants’ own reasoning, bodies, and experiences as a source of evidence, reaching beyond purely cognitive information assessment to include also a fifth and sixth form of triangulation: 5) embodied triangulation (in which medical expertise was compared against personal or community experience as well as scientific evidence) and 6) affective triangulation (in which medical expertise was compared against one’s own intuition). (Huttunen, 2023).

This poster reports on an analysis of the information seeking, assessment, and triangulation practices in a population subject to surveillance and potential criminalization: pregnant and postpartum individuals making cannabis use decisions in a setting where cannabis use is quasi-legal for them. This population resides in a different setting than the above referenced information triangulation studies, yet shares certain attributes (pregnancy/parenting or in need of information about a stigmatized topic on which medical experts may not be well informed), while also navigating the unique challenge of needing information about cannabis consumption during pregnancy or lactation, a behavior for which the scientific evidence is scant and the legal consequences unclear.

OBJECTIVES

1. To explore information triangulation and assessment practices related to decision-making by expectant and new parents about cannabis consumption during pregnancy and lactation.
2. To compare and contrast findings from this analysis with prior models of health-related information triangulation published to date.
METHODOLOGY
This poster describes a secondary analysis of transcripts and fieldnotes from interviews about parental decision-making regarding cannabis consumption during pregnancy and lactation in a US state that recently legalized adult “recreational” use (i.e., for any medicinal or non-medicinal purpose) in 2016, yet retained some laws criminalizing fetal exposure to substances. The overarching conceptual framework for this work is that of everyday information practices (Savolainen, 2008), which draws on Bourdieusian practice theory (Bourdieu, 1977, 1998) to theorize people’s regular and familiar information actions as practices within the context of their respective habitus.

Data collection
Data for this analysis consist of interview transcripts and fieldnotes from individual interviews of 23 pregnant or postpartum participants recruited in 2020 using a combination of posters and conversations with health care providers and paid Facebook advertising. Semi-structured interviews lasting approximately 45 minutes were conducted from May to August, 2020, by telephone due to COVID-19 related public health restrictions that had recently been imposed. Participants received $25 (USD) gift cards as a thank-you for their time and expertise.

Analysis
Our analytic approach is reflexive thematic analysis (RTA) (Braun & Clarke, 2021). We applied RTA as an emic-etic (Miles et al., 1994) method beginning with a theory-derived preliminary deductive codebook that was iteratively refined through deductive and inductive coding as analysis proceeded iteratively through stages of increasing familiarity with the data, building and reviewing themes based on codes, and reporting on the “story” identified by the researcher (Campbell et al., 2021). Sensitizing concepts (Bowen, 2006) in this analysis include: the six types of previously-identified information triangulation practices (Greyson, 2018; Huttunen, 2023), as well as the concepts of agency (Kelly, 2007) and the emerging concept in information science of information marginalization (Gibson & Martin III, 2019), which applies a strengths-based view to the concept of information poverty, or the way social “outsiders” may be excluded from or face barriers to accessing and using information (Chatman, 1996).

RESULTS
All six previously identified forms of triangulation were evident in these study data; however, the specific pathways through which these types of triangulation are enacted varied greatly in this study of adult mothers in the US engaging in quasi-legal activity compared with the health information practices of young parents in Canada and Finnish transgender people. In addition to cross-checking to validate information from one source against others, study participants described explicit weighting practices as well as less-explicit heuristics for resolving contradictions among information sources they consulted as part of triangulation.

The threat of reporting pregnant people or parents to child protective services for substance use during pregnancy loomed over many participants, sometimes making consultation with experts with medical expertise and cognitive authority impossible (since clinicians might feel compelled to make a report to child protective services), and pushing participants into greater reliance on social and lay sources than they would have preferred. Our poster will share exemplar quotes of the various types of triangulation evident in these data as well as instances of weighting of information and source credibility against each other. As of July 2023, analysis is still in process; more complete results will be presented in October at the ASIS&T Annual Meeting.

CONCLUSION
While the six identified categories of information triangulation are likely transferrable across many health topics, specific source types and consultation patterns may vary based on topic, setting, population, and underlying environment related to information access and topic stigmatization. A unique aspect to this analysis is the uncertain and shifting policy environment regarding cannabis use during pregnancy in the USA, which imposed constraints on decision making (English & Greyson, 2022), and appears to have also shaped information seeking, access, and triangulation practices.

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Funding or Policy?  
Which Promotes Open Access Publication?

Hadad, Shlomit  
Ramat Gan Academic College; Bar-Ilan University, Israel | shsh3345@gmail.com

Aharony, Noa  
Bar-Ilan University, Israel | Noa.Aharony@biu.ac.il

Raban, Daphne R.  
University of Haifa, Israel | draban@univ.haifa.ac.il

ABSTRACT
This study focused on analyzing funded scientific publications by Israeli researchers from 2010 to 2020 in open access (OA). Based on the bibliometric investigation using the Scopus database, it was observed that the proportion of funded publications in OA increased over the years. Moreover, the number of funded publications in OA was significantly higher than those published in closed access. However, it is noteworthy that the number of publications receiving funding from funders with an explicit OA policy and published in OA was higher than those funded by entities without such policies. These findings suggest that while funding positively impacts OA publishing, the presence of OA policies has a more decisive influence on researchers’ choices to publish in OA.

KEYWORDS
Open-Access (OA) publication, OA policy, Research funding organizations

INTRODUCTION
Open Access (OA) refers to the unrestricted online availability of scientific publications (Clayson et al., 2021). Countries and research institutions worldwide have made commitments to provide OA to their research output by developing clear OA policies (Moskovkin et al., 2021). Additionally, numerous grant-funding organizations require that research outputs be made available through repositories (green OA) or OA journals (gold OA). Several studies have found evidence of a positive impact of funding on OA publishing, with a higher proportion of OA articles acknowledging funding, particularly from international and EU sources, compared to closed-access articles (Morillo, 2020). Based on data from SCImago Journal and Country Rank (https://www.scimagojr.com/), which relies on the Scopus database, the proportion of Israeli OA publications has risen from 31.74% in 2010 to 50.41% in 2020. However, this increase is relatively modest when compared to European countries with similar levels of overall scientific publications. One plausible explanation for this disparity is the absence of a national and institutional OA policy in Israel, as outlined in the European Open Science Cloud (EOSC) Portal. Therefore, this study aimed to investigate potential differences between funded publications by Israeli researchers published in OA and closed-access, and whether the presence of OA policies among funders influenced the rate of OA publications.

METHOD
This bibliometric study focused on Israeli researchers’ publications in all academic disciplines published between the years 2010 and 2020, that received funding for the research according to the Scopus database (https://www.scopus.com). From 2010 to 2020, a total of 177,080 articles declared receiving funding. Among these, 127,346 articles (71.9%) were published in OA, while 49,734 articles (28.1%) were published in closed access. To assess the significance of the differences over the years, non-parametric tests were employed initially. Subsequently, the study delved deeper by examining the OA policies of the top ten funders in Israel, based on Sherpa Juliet database. The distribution of their publications in both open access and closed access formats was also analyzed to test the significance of the differences in OA publications among these funders. These ten funders accounted for 53.2% of all funded publications in Israel, encompassing both open and closed-access formats. Notably, 91% of all publications attributed to these funders were published in OA.

RESULTS
The Impact of Funding on Open Access Publishing
Table 1 presents the results obtained by employing a Mann-Whitney U test with the effect size to determine if there are significant differences between publications that received funding and were published in open access (OA) versus research that received funding and was published in closed-access journals.

According to Scopus data, there has been a consistent growth in both the overall publication rate and the proportion of funded publications published in open and close access over the years. Additionally, except for 2010, the number of funded publications published in OA was significantly higher than those published in closed-access journals, demonstrating a large effect size based on Cohen's (1988) criteria, particularly from 2012 onwards.
<table>
<thead>
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<th>Year</th>
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<th>OA funded publications</th>
<th>Closed funded publications</th>
<th>Mann-Whitney U test</th>
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<td>2010</td>
<td>5953</td>
<td>3567</td>
<td>2386</td>
<td>$U = 11762.50, z = -1.079, p = .281, r = .06$</td>
</tr>
<tr>
<td>2011</td>
<td>8017</td>
<td>5207</td>
<td>2810</td>
<td>$U = 6056.00, z = -8.044, p = .000, r = .45$</td>
</tr>
<tr>
<td>2012</td>
<td>11054</td>
<td>7962</td>
<td>3092</td>
<td>$U = 4868.00, z = -9.495, p = .000, r = .53$</td>
</tr>
<tr>
<td>2013</td>
<td>10723</td>
<td>7490</td>
<td>3233</td>
<td>$U = 4898.00, z = -9.403, p = .000, r = .52$</td>
</tr>
<tr>
<td>2014</td>
<td>10089</td>
<td>6990</td>
<td>3099</td>
<td>$U = 4915.50, z = -9.381, p = .000, r = .52$</td>
</tr>
<tr>
<td>2015</td>
<td>12296</td>
<td>9192</td>
<td>3104</td>
<td>$U = 3323.00, z = -11.287, p = .000, r = .63$</td>
</tr>
<tr>
<td>2016</td>
<td>19301</td>
<td>14628</td>
<td>4673</td>
<td>$U = 2701.00, z = -12.050, p = .000, r = .67$</td>
</tr>
<tr>
<td>2017</td>
<td>20742</td>
<td>15426</td>
<td>5316</td>
<td>$U = 3022.00, z = -11.654, p = .000, r = .65$</td>
</tr>
<tr>
<td>2018</td>
<td>27643</td>
<td>20656</td>
<td>6987</td>
<td>$U = 2654.50, z = -12.143, p = .000, r = .68$</td>
</tr>
<tr>
<td>2019</td>
<td>25806</td>
<td>18300</td>
<td>7506</td>
<td>$U = 3425.00, z = -11.243, p = .000, r = .63$</td>
</tr>
<tr>
<td>2020</td>
<td>25456</td>
<td>17928</td>
<td>7528</td>
<td>$U = 3368.50, z = -11.313, p = .000, r = .63$</td>
</tr>
</tbody>
</table>

Notes: 1) $Md = Median$; 2) effect size ($r = \sqrt{\frac{z^2}{N}}$); 3) significant results are presented in bold.

Table 1. Differences between funded publications published in OA and closed-access for the years 2010-2020

Open Access Policy by the Top Ten Leading Funding Organizations

Figure 1 displays the top ten funding organizations that supported Israeli research from 2010 to 2020, as retrieved from Scopus. The numbers in the graph represent the count of OA publications per funding organization, and the percentages indicate the proportion of OA publications out of the total publications (OA and closed) for each funder.

Within the top ten funding organizations, two organizations, namely the Israel Science Foundation (marked by a rectangle in Figure 1) and the U.S-Israel Binational Science Foundation, lack an Open Access (OA) policy. The Israel Science Foundation, being the largest funding agency in Israel, stands out significantly ($X^2(9) = 1732.61, p = .000$) in this regard. The rate of OA publications in these two organizations is notably lower compared to organizations with established OA policies ($X^2(9) = 23.490, p = .005$). In contrast, the remaining eight funders within the top ten have implemented OA policies, with a particular emphasis on archiving in green OA repositories.

CONCLUSION

Based on the findings of this study, it can be concluded that funding plays a positive role in promoting OA publishing. Publications that receive funding have a significantly higher likelihood of being published in OA channels such as journals and repositories. However, there is considerable variation observed among different funding organizations. The rate of OA publications is notably higher among publications funded by organizations with established OA policies, compared to those funded by organizations lacking such policies. Unfortunately, one of the organizations lacking an OA policy is the Israel Science Foundation, which happens to be the largest funding agency in Israel. The study indicates that without a declared OA policy by the ISF, the proportion of OA articles financed by this funder (52.9%) is similar to the overall rate of OA articles in the country (50.4%). The absence of an OA policy leads many researchers to opt for closed-access publishing. Therefore, the implementation of a national or, at the very least, a funded-research policy favoring OA would greatly benefit the scientific community.
REFERENCES


**The Role of Public Libraries in Facilitating College Literacy: A Preliminary Analysis**

**Hands, Africa S.**
University at Buffalo, SUNY, USA | africaha@buffalo.edu

**Candela, Rose**
East Carolina University, USA | candelar21@students.ecu.edu

**ABSTRACT**

The decision-making process for potential college students in the United States is overwhelming because of the volume of information available and the complexity of higher education systems. Prospective students must consider institutional rankings, academic programs, and financial aid opportunities in addition to completing the numerous forms. For some students, there exist personal and professional resources to assist with navigating the process. Others with less social and cultural capital must figure out the system with little or no assistance while facing other barriers. Public libraries can be a resource for the college-bound community; however, research shows that public libraries are not actively engaged in supporting this user group. To provide focused, quality information services to any demographic, it is important to understand the perspectives of frontline information workers. Thus, through an online survey, this study seeks to learn staff perspectives on the role of public libraries in serving prospective college students.

**KEYWORDS**
Public libraries; college literacy; postsecondary education; higher education; qualitative analysis

**INTRODUCTION**

This poster presents research from an ongoing multi-phase research study focused on the American region of Central Appalachia (population 1,850,418) (Pollard & Jacobsen, 2022), which comprises parts of Kentucky, Tennessee, Virginia, and West Virginia. Central Appalachia has been impacted by the rise and fall of the coal industry. Due to the growing emphasis in the United States on natural gas, coal production declined 45% from 2005 to 2015, primarily in West Virginia and Kentucky (Bowen et al., 2018). Consequently, this decline in coal production has led to high unemployment rates. In the past, economic turbulence has spurred an increase in college enrollment and the demand for workforce training among adults (Barshay, 2020). However, rates of postsecondary educational attainment have been and continue to be lower in central Appalachia’s mining communities compared to similar communities in other parts of Appalachia: 28% of people aged 25 and older in central Appalachia attained a bachelor’s degree, compared to 42-49% in southern and northern Appalachia (Bowen et al., 2018).

Researchers note a connection between participation in the labor force and educational attainment, observing that “in 24 of the 33 counties where labor force participation levels were at or above the national rate, 90 percent or more of working-age adults had attained at least a high school diploma” (Pollard & Jacobsen, 2022, p. 81). Because the Bureau of Labor Statistics projects a continued decline in jobs that do not require a college degree (Kolko, 2021), it is important for individuals in this region and others like it to consider educational training and to have information on college planning readily available.

Public libraries are a well-known and highly regarded source for educational and cultural enrichment for all ages making public libraries ideal spaces for boosting one’s college literacy or “the possession of knowledge that assists one in making informed decisions to navigate higher education systems” (Hands, 2021, p. 1). For better or worse, public libraries also contend with the expectation of serving as third spaces, community spaces, and catch-all sites that serve or facilitate meeting the varied needs of myriad communities. As witnessed during the height of the COVID-19 pandemic, public library staff were called on to work as contact tracers (Inklebarger, 2020). The high expectation to serve the educational, civic, recreational, health, social, and social safety net-related aspects of community life places a burden on library staff. Recognizing this pressure, the current research aims to understand what public library staff think is the role of the library in purposefully serving college-bound patrons.

**LITERATURE REVIEW**

This research concerns the user group of prospective college students in Appalachia. These individuals experience academic under-preparedness, lack of information about college and financial aid, and few family members who attended college and can serve as ad-hoc advisors (Hale et al., 2017). Further, because low-income and underrepresented youth face numerous information barriers related to college preparation (Vargas, 2004), as adults this demographic may not possess foundational knowledge about college planning to ask important questions and make informed decisions.

Many prospective students in Appalachia and rural areas fit the category of *first-generation college students*, which can present additional barriers. While there is no standardized definition of first-generation college students, these students are usually characterized as one whose parent or caregiver has not earned a postsecondary degree (Peralta 86° Annual Meeting of the Association for Information Science & Technology | Oct. 27 – 31, 2023 | London, United Kingdom. Author(s) retain copyright, but ASIS&T receives an exclusive publication license.
Without a parent or caregiver having earned a degree and few family members who attended college, first-generation students do not have, in their socio-familial circle, individuals who may serve as information sources on the process. That is, they lack the social and cultural capital that has proven to be important to success in higher education for continuing-generation students (Nelson, 2016; O’Neal, 2021).

Forty-two percent of the Appalachian region is rural (Knudson, n.d.). It is well-known that rural communities often lack technological infrastructure such as broadband access, which impacts one’s ability to attain information and pursue online education opportunities. Fortunately, rural libraries serve over 30 million people who live within 5 miles, on average, of a library (IMLS, 2020). Libraries located in the rural locales included in this study served 3.5 million in the fiscal year 2017 (IMLS, 2020). With this reach, public libraries have an opportunity to support educational equity, information access, and economic growth for millions in this region of the U.S.

Library and information science is a context-distinctive and user-group-focused field, thus it is important to examine library and information services from the viewpoint of specific providers in specific contexts and communities. Calls for public libraries and library staff to meet the myriad community needs, especially in small or rural communities, can be overwhelming and tantamount to scope creep into areas where other organizations are better suited to serve. Obtaining staff buy-in is necessary for translating research into practice and action (Casey, 2015). To generate buy-in for what may seem like additional services to another user group, it is essential to know the perspectives of frontline information service providers. As such, this study examines the research question:

- From the perspective of public library staff, what is the public library’s role in supporting college-bound patrons and community members?

**METHODS**

A Qualtrics survey was used to collect quantitative and qualitative data for this research. The structured questionnaire contained closed-ended questions regarding staff awareness of college planning resources (e.g., FAFSA, the College Board, and the Common Application, which are common in the U.S.) and the demand for information and services related to college planning from adult and teen patrons and community members. Open-ended questions concerned the respondents’ perception of the public library’s role in supporting college-bound patrons and community members. The call for survey participants with a link to the survey was distributed through the listservs of the library associations in Kentucky, Tennessee, Virginia, and West Virginia; the listserv of the Association of Small and Rural Libraries (ARSL); and the Public Library Association’s member listserv. The researcher gained access to the listserv through membership in each organization. The data collection occurred between April and June of 2023. Concurrent with data collection, qualitative data analysis through several rounds of inductive coding (Saldaña, 2021) is underway on the open-ended responses collected thus far.

**PROJECTED OUTCOMES**

The outcome of this research will be an enhanced understanding of the library’s role in serving the information needs of a specific patron group. With growing expectations placed upon public libraries and the ever-evolving role of public library staff, insights gained from the perspectives of library staff will inform the actions and practices of library managers. This research may also inform findings from the first phase of this project, which noted the lack of relevant college planning information in the online environments for this information institution (Hands & Candela, 2022).

**ACKNOWLEDGMENT**

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**REFERENCES**


From Research to Practice: Strengthening the Irish National Code of Professional and Ethical Frameworks for Librarianship

Havelka, Stefanie
University College Dublin, Ireland | stefanie.havelka@ucd.ie

Dumbleton, Odile
University College Dublin, Ireland | odile.dumbleton@ucd.ie

ABSTRACT
All over the world, libraries are facing fraught political and economically insecure times; books are being banned, marginalised communities are being protested, and Library and Information Professionals (LIPs) are struggling to narrow the digital divide to support a well-informed society. This poster explores the connection between the competencies required by two professional library organisations and the reality of Irish library and information professionals in their actual work context. Our initial data collection consisted of a quantitative survey with 897 Irish library-based participants. The preliminary analysis suggests the need for the strengthening of an Irish national code of professional and ethical framework, which would be of benefit to LIPs and Irish society. These ethics and values statements are the foundational pillars on which knowledge, skills, and professional abilities are built.

KEYWORDS
competencies, professional skills, Ireland, professional associations, library and information professionals

INTRODUCTION
The purpose of this original research is to examine the connection between the professional competency and skill frameworks developed by professional library organisations and the reality of Irish Library and Information Professionals (LIPs) in their actual work contexts. The aim of this poster is to highlight the actual applicability of professional competency frameworks to "real world" librarianship in Ireland. We investigated seven themes detailed in the methodology section below. For this poster, we focus on the theme: Professional Expertise. This theme includes the concepts of intellectual freedom, including freedom from censorship, the confidentiality of information, and the right of all individuals to privacy.

Our research-into-practice study is guided by two frameworks, first the new International Federation of Library Associations and Institutions (IFLA) Guidelines for Professional Library and Information Science (LIS) Education Programmes and second, the United Kingdom’s (UK’s) Chartered Institute of Library and Information Professionals (CILIP) Professional Knowledge and Skills Base. Based on these two frameworks, we explored LIP staff knowledge and experience in practice for Ireland in order to address a gap in the scholarly literature.

The Role of Professional Competency Frameworks
IFLA guidelines are “promoting the quality of library and information science/studies (LIS) education globally. The quality assurance of LIS professional education advances the quality of library and information services, and their value to their constituents” (Chu, et al., p. 1). In many countries, the Master of Library and Information Studies is a degree accredited by a national professional library association body. In Ireland, it is the Library Association of Ireland (LAI). The purpose of accreditation is to provide a consistent broad baseline of knowledge and skills to the LIPs workforce in a local, national, and international context. Moreover, library associations around the world support the profession by upholding professional core values, which include such concepts as human rights, equity, diversity, inclusion, and accessibility (EDIA); public benefit; social justice, information literacy, and preservation.

The Importance of Professional Competency Frameworks
In today’s global political and economic climate, librarians are on the front lines fighting against book banning, providing access to information for marginalized people, and narrowing the digital divide, making a difference in their local and national stakeholders' lives. Irish LIPs are faced with the same challenges, and the preliminary data of this research suggests that a revised and updated national code of professional and ethical framework would strengthen the core competencies of Irish librarianship. In addition, we call for renewed advocacy and outreach to promote this new national code of professional and ethical framework among Irish citizens.

METHODOLOGY
To explore LIP competencies and skills usage, we administered an online survey via Survey Monkey using convenience sampling. The survey questions were informed by the research questions, scholarly literature, and Irish librarianship practice. Our call for survey participation was emailed to various Irish LIS listservs and posted on Irish-librarian related Twitter, Facebook, and LinkedIn accounts. The survey was available for four weeks, with a reminder call sent out in week two. The survey consisted of six demographic questions and 34 questions parsed into seven themes: professional expertise, learning and literacy, technologies and communications, user services and...
information needs, information and knowledge management, organisational and institutional management, and research.

**PRELIMINARY FINDINGS: PROFESSIONAL EXPERTISE**

A total of 897 people responded to the Ireland-based survey, with a majority, 39% employed in academic institutions, followed by 21% in archives, and 17% in public libraries. The participant’s education was comprised of 35% Master's degree, 41% Graduate Diploma, which is a professional degree unique to Ireland, and 6% a Ph.D. Careers ranged from 4 to 15 years of service. Figure 1 shows the results of how LIPs in Ireland support intellectual freedom, including freedom from censorship. Even though the majority, 42% of Irish LIPs, do support intellectual freedoms as part of their job, nearly 30% are indifferent or undecided.

![Figure 1](image1.png)

The complementary finding in Figure 2 depicts Irish LIPs’ attitudes toward library patrons' right to privacy and confidentiality. While 42% of the respondents uphold these rights, 26% feel strongly about supporting these rights, and 27% of respondents were indecisive.

![Figure 2](image2.png)

**DISCUSSION**

The role and importance of professional competency frameworks cannot be overstated. These ethics and values statements are the foundational pillars on which knowledge, skills, and professional abilities are built.

The UK, United States, and Australia, for example, each have an established published national code of professional and ethical standards. Ireland does not have a current, published, independently developed national code of professional and ethical guidelines to inform professional practice and policies. The findings in Figures 1 and 2 clearly indicate the need for the strengthening of an Irish national code of professional and ethical framework, which would be of benefit to LIPs and Irish society. The high numbers in Figure 1 for the indecisive and in Figure 2 for the indifferent are of particular concern. This also strongly suggests the need for further research into this finding, as it is surprising to see that so many librarians are neutral on these issues. This newly developed framework will translate our research to influence not only current librarians but also future librarians through our education theories and practice, thus impacting all Irish librarianship.

**FUTURE WORK**

Our research is still ongoing, and so far, the outcomes are preliminary. We are in the process of analysing and publishing outcomes from all seven themes. Moreover, as a follow-up, we plan to conduct an in-depth qualitative study with Irish LIPs based on our findings.

**CONCLUSION**

Through this poster, we urge LIPs, LIS educators, and LIS professional association of Ireland to revive a national code of professional and ethical frameworks collaboratively.
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How Digital Events Promote Intangible Cultural Heritage? A User Experience Perspective

He, Yan  
Shanghai University, China  |  heyan@shu.edu.cn
Chen, Xiaoyu  
Shanghai University, China  |  xiaoyu-chen@shu.edu.cn
Wang, Lihua  
Shanghai University, China  |  wanglh@shu.edu.cn

ABSTRACT
This poster proposes a conceptual model to understand how digital events promote intangible cultural heritage (ICH) from a user experience perspective. The model is tested using survey data from 149 valid respondents. Our results indicate that two important attributes of digital events (event design and historical re-enactment) significantly contribute to users’ positive perception of ICH promotions. This positive perception further leads to increased attraction, user satisfaction, and engagement with ICH promotions. The value perception of ICH promotions includes three components: perceived utilitarian value, perceived hedonic value, and perceived symbolic value. We also discuss the theoretical and practical implications of our findings.

KEYWORDS
Digital events; Intangible cultural heritage (ICH); User experience; Value perception

INTRODUCTION
According to the definition proposed by Federico Lenzerini, intangible cultural heritage (ICH) represents immaterial manifestations of culture, including “the variety of living heritage of humanity as well as the most important vehicle of cultural diversity” (Lenzerini, 2011, p. 101). In other words, ICH can be anything cherished in people’s life. Users attention to ICH is fast growing in parallel with the increasing immersion of digital technologies in ICH promotions (Hou et al., 2022). Against this backdrop, a deep understanding of the role of digital technologies in promoting ICH has drawn substantial attention from academia and practitioners alike.

Digital events are interactive, staged and experience-oriented practices and activities held in an environment with a wide variety of digitized functions and attributes (Simons, 2019). A typical example is a digital exhibition for China’s Grand Canal that creates two distinctive spaces, including metaverse and mixed-reality areas. Users can either experience pottery skills through Augmented Reality (AR) and Virtual Reality (VR) in the metaverse area or match with digital virtual people for paper-cutting through somatosensory technology in the mixed-reality area. A pleasant experience with digital events is critical to users because it may help strengthen their immersion and the presence of ICH promotions (Konstantakis & Caridakis, 2020). Related work focuses on measuring and analyzing user experience in cultural heritage technologies (Hou et al., 2022; Konstantakis & Caridakis, 2020). Nonetheless, few studies have tried to integrate user experience (UX) in understanding the role of digital events in ICH promotions. UX is a key concept originating from the Human-Computer Interaction (HCI) field, frequently used to assess user perception of digital products and services (Konstantakis et al., 2017). Recently, the cultural heritage community has been encouraging scholars to consider improving the use of digital technologies in ICH promotions by drawing on the UX perspective (Konstantakis & Caridakis, 2020).

For the purpose of this research, we anchor the UX perspective to construct a theoretical model which helps explain why and how digital events may work in ICH promotions. From the UX perspective, attributes of a digital product/service are important to users’ perception of its apparent characters, which further leads to a series of positive consequences including attraction of the product/service, user satisfaction and engagement (Hassenzahl, 2018). In our research context, such concepts are contextualized to understand the role of digital events in promoting ICH. Accordingly, attributes of digital events are conceptualized into four dimensions: event design, physical facets, historical re-enactment, and social interaction (Fu et al., 2017). User value perception is used to capture apparent characters of digital events in ICH promotions. Informed by Wongkitrungruang and Assarut (2020), value perception includes three first-order constructs: perceived utilitarian value, perceived hedonic value and perceived symbolic value. The consequences in our research context involve three outcomes: attraction of ICH promotions, user satisfaction and engagement with ICH promotions. In sum, seven hypotheses are developed in the poster. H1: event design➔ (+) value perception. H2: physical facets ➔ (+) value perception. H3: historical re-enactment➔ (+) value perception. H4: social interaction➔ (+) value perception. H5: value perception➔ (+) attraction. H6: value perception➔ (+) satisfaction. H7: value perception➔ (+) engagement.

METHODS & RESULTS
All constructs were measured using items adapted from existing literature. Specifically, the items of the four dimensions of event attributes (i.e., event design, physical facets, historical re-enactment, and social interaction) were adapted from the historical re-enactment festival attributes scales (Fu et al., 2017). Perceived utilitarian value,
perceived hedonic value, perceived symbolic value and engagement were measured using the scales from Wongkitrungrueng and Assarut (2020), which previously studied the role of live streaming in social commerce promotions. Satisfaction was measured using the items from Yoon and Uysal (2005) and Yoon et al. (2010), which separately assessed visitors’ satisfaction with a destination and festival. Measures of attraction were adapted from Laugwitz et al. (2008). An online survey was conducted and implemented in a professional Chinese survey platform—Credamo (www.credamo.com). With the assistance of Credamo, a sample of 149 valid respondents was retained for the following data analysis. The partial least square-structural equation modeling (PLS-SEM) technique was used in SmartPLS 4.0 (Ringle et al., 2022). The reliability, convergent validity and discriminant validity of each construct were qualified. Figure 1 shows the results of the hypotheses testing. Specifically, event design ($\beta=0.209$, $p<0.05$) and historical re-enactment ($\beta=0.321$, $p<0.001$) positively influenced value perception. Value perception was positively related to the attraction ($\beta=0.685$, $p<0.001$), satisfaction ($\beta=0.725$, $p<0.001$) and engagement ($\beta=0.725$, $p<0.001$). However, physical facets ($\beta=0.245$, n.s.) and social interaction ($\beta=0.130$, n.s.) are not significantly related to value perception. Hence, H1, H3, H5, H6 and H7 were supported, while H2 and H4 were not supported.

![Figure 1. Research model with PLS results.](image)

**Notes:** *p<0.5, **p<0.01, ***p<0.001, n.s. means no significance.

**CONCLUSION**

Three important findings can be gleaned from the data analysis. First, event attributes such as event design and historical re-enactment are positively and significantly related to user value perception of ICH promotions with digital events. This is in line with the existing literature suggesting that event design and historical re-enactment could affect user value perception (Fu et al., 2017). In contrast, physical facets and social interactions seem insignificant to user value perception. A possible explanation could be that users intend to pursue immersive experiences when participating in ICH promotions (Lunardo & Ponsignon, 2019). In comparison, sudden social interaction and excessive physical facets could interrupt this immersive experience. Second, user value perception of ICH promotions was a three-dimensional construct consisting of perceived utilitarian value, perceived hedonic value and perceived symbolic value. This suggests that the use of digital technology can be manifested by users’ perceived utilitarian value, hedonic value and symbolic value of ICH promotions. Third, user value perception of ICH promotions could contribute to one’s positive feedback in three aspects, namely, attraction, satisfaction and engagement. In particular, it is pointed out in the UX model that value perception can lead to emotional and behavioral consequences, such as appeal and satisfaction (Hassenzahl, 2018). Prior studies also showed that perceived value could affect user satisfaction and behavioral intentions (Oriade & Schofield, 2019).

This poster holds implications for theory and practice. Theoretically, it provides a useful conceptual model for understanding the role of digital events in promoting ICH. It contributes to the literature on ICH promotion by investigating how digital events empower ICH promotions from the UX perspective. On the practical front, our research may inform designers in ICH promotions by highlighting the importance of event design and historical re-enactment in digital events. Additionally, digital events have to be improved to enhance users perceived utilitarian value, perceived hedonic value and perceived symbolic value, which may further strengthen the attraction of ICH promotions, user satisfaction with ICH promotions and engagement with ICH promotions.
ACKNOWLEDGEMENTS
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Document Conflation of a Large Scholarly Full-text Dataset

Hsiao, Tzu-Kun
School of Information Sciences, University of Illinois Urbana-Champaign, USA | tkhsiao2@illinois.edu

ABSTRACT
The availability of large scholarly full-text datasets with in-text citations annotated opens the opportunity to investigate how articles have been cited in scientific literature at scale. However, duplicate documents may exist in a dataset, and these duplicates may impact downstream analysis such as calculating citation counts. Document conflation is the task of identifying documents that are nearly identical to each other. This study evaluates document conflation in the Semantic Scholar Open Research Corpus (S2ORC), a dataset containing over 12 million scholarly articles. The evaluation was based on 6,099,232 full-text S2ORC documents with PubMed IDs (PMIDs) or PubMed Central IDs (PMCID). Our findings showed that a portion of S2ORC might contain duplicates. Of the 6,099,232 full-text documents, 1,280,196 (20.99%) had the same PMIDs or PMCID as at least one other document. Pairwise comparisons of their full text found that at least 9.44% of the documents in S2ORC had duplicates.

KEYWORDS
bibliometrics, data quality, document conflation, scholarly full-text dataset

INTRODUCTION
Along with the growth of open access articles, several large-scale full-text datasets with in-text citations annotated have been released, including the Semantic Scholar Open Research Corpus (S2ORC) (Lo et al., 2020) and unarXive (Saier & Färber, 2020). The quality of large scholarly datasets has attracted scientists’ attention since it may introduce uncertainties into future research (Wu et al., 2022). Previous research has investigated a variety of data quality issues, including in-text citation identification rate (Hsiao & Torvik, 2023) and metadata accuracy (Lo et al., 2020; Saier & Färber, 2020). Document duplication is another quality issue that may influence the accuracy of counting citations or document linking. For example, articles associated with distinct document identifiers (e.g., S2ORC paper IDs) may be duplicates in the dataset, causing the potential problem of splitting citations to one entity into two or more entities. Wu et al. (2022) used the titles and authors of 150,000 documents sampled from S2ORC and estimated that the document conflation rate (i.e., the rate of documents being near duplicates) of S2ORC was 2.6%. To gain a deeper understanding of the document conflation of S2ORC, we performed pairwise comparisons on the full text of the documents. The following sections describe the design of our method and showcase the preliminary results.

METHODOLOGY
Identify potential duplicates
The evaluation was based on a version of S2ORC collected on July 7, 2020. There were 12,533,614 full-text articles in the corpus. Given the time complexity of \(O(n^2)\) (n=12,533,614), it was infeasible to perform pairwise comparisons on the full text of all articles. To address this challenge, we started by identifying pairs of documents that might be duplicates using the PubMed IDs (PMIDs) and PubMed Central IDs (PMCID) provided in S2ORC. Note that sharing the same PMID/PMCID does not guarantee that documents are duplicates, as previous research has discovered incorrect PMID-document associations (Hsiao & Torvik, 2023). The goal of using PMIDs/PMCID was to narrow down the scope of pairwise comparisons under the assumption that if two documents shared the same identifier (e.g., a PMID), they were more likely to be duplicates.

Of the 12,533,614 full-text documents in S2ORC, 6,099,232 (48.66%) had PMIDs or PMCID. Of these 6,099,232 full-text documents, 1,280,196 (20.99%) had the same PMIDs/PMCID as at least one other document. To perform pairwise comparisons, we first grouped the 1,280,196 documents into sets of documents based on their PMIDs/PMCID. Each document set was composed of documents having the same PMID/PMCID. As shown in Table 1, the sizes of the document sets (i.e., the number of documents with the same PMID/PMCID) varied from two to five. The most prevalent cases were two documents with the same PMID/PMCID (1,279,246 documents in total).

<table>
<thead>
<tr>
<th>Number of potential duplicates</th>
<th>Number of document sets (%)</th>
<th>Number of documents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>639,623 (99.95)</td>
<td>1,279,246 (99.93)</td>
</tr>
<tr>
<td>3</td>
<td>312 (0.05)</td>
<td>936 (0.07)</td>
</tr>
<tr>
<td>4</td>
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<td>4 (0.00)</td>
</tr>
<tr>
<td>5</td>
<td>2 (0.00)</td>
<td>10 (0.00)</td>
</tr>
<tr>
<td>Total</td>
<td>639,938 (100.00)</td>
<td>1,280,196 (100.00)</td>
</tr>
</tbody>
</table>

Table 1. Distribution of the Potential Duplicates
Pairwise comparisons of the potential duplicates

After grouping the potential duplicates by their PMIDs/PMCID, pairwise comparisons were performed between documents having the same PMID/PMCID using Python's `difflib` module. For document sets containing more than two documents, pairwise comparisons were performed on all the possible combinations of pairs of documents in the set. Each pairwise comparison was conducted in two steps: First, the sentences in each pair of documents were compared to determine which sentences were identical or had differences between the two documents. Note that the sentences that differed could be nearly identical (Table 2). Therefore, the sentences that differed were re-compared at the character level to obtain a fine-grained result of their differences. Similar to the sentence-level comparison, the character-level comparison identified text fragments (i.e., consecutive characters) in the sentences that were either identical or different between the two documents. The design of first conducting the comparison at the sentence level and then at the character level was to save computational time.

<table>
<thead>
<tr>
<th>S2ORC Paper ID</th>
<th>PMID</th>
<th>Sentence in the S2ORC dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>214848898</td>
<td>2988750</td>
<td>Two non-overlapping sets of biotinylated TUC338 RNA-binding probes were used as affinity reagents for chromatin precipitation from HepG2 cells. (see Table S1)</td>
</tr>
<tr>
<td>46992481</td>
<td>2988750</td>
<td>Two nonoverlapping sets of biotinylated TUC338 RNA-binding probes were used as affinity reagents for chromatin precipitation from HepG2 cells. (see Table S1)</td>
</tr>
</tbody>
</table>

Table 2. Examples of Near-identical Sentences in Two S2ORC Documents

After obtaining the comparison results, the similarity between each pair of potentially duplicate documents was calculated as follows:

\[
\text{similarity score} = \frac{L_{\text{identical sentences}} + L_{\text{identical text fragments}}}{L_{\text{identical sentences}} + L_{\text{identical text fragments}} + L_{\text{different text fragments}}} \times 100
\]

where \(L_{\text{identical sentences}}\) is the number of characters in the identical sentences; \(L_{\text{identical text fragments}}\) is the number of characters in the identical text fragments; and \(L_{\text{different text fragments}}\) is the number of characters in the text fragments that differed in the documents. The similarity score is 100 for a pair of documents that are identical.

RESULTS

The pairwise comparison is still in progress. We had completed pairwise comparisons of 629,204 pairs of potentially duplicate documents (1,258,408 of the 1,280,196 documents that could have duplicates). Figure 1 presents the distribution of the similarity scores. Of the 629,204 pairs of potentially duplicate documents, 591,624 (94.03%; 1,183,248 documents) were identical pairs (similarity score = 100), and 3,688 (0.59%) were near-identical pairs (100 > similarity score ≥ 99). The results showed that when two documents in S2ORC had the same PMID/PMCID, they were likely duplicates. It was worth noticing that 2.20% (13,820 out of 629,204) of the potentially duplicate document pairs had similarity scores below fifty. This implied that a small portion of documents associated with the same PMID/PMCID in S2ORC might be different articles.

![Figure 1. Distribution of the Similarity Scores](image)

CONCLUSION

This study examined the document conflation of S2ORC. The results showed that at least 9.44% (1,183,248/12,533,614) of the documents had identical duplicates, which was higher than the 4.79% (7,191/150,000) reported by Wu et al. (2022). Different from Wu et al.’s (2022) evaluation, which was based on the titles and authors of the 150,000 sampled documents, we evaluated the full texts of 1,258,408 documents. Our findings provided evidence on whether documents having the same PMID/PMCID in S2ORC were truly duplicates, and the scale of evaluation covered a larger portion of S2ORC. It should be noted that our evaluation was based on documents with PMIDs/PMCID, and the results could be influenced by the preferred mode of diffusing research in the biomedical field. Previous research showed that 67.6% and 14% of preprints deposited to bioRxiv and medRxiv (biomedical-related preprint servers) were later published in scientific journals (Fraser et al., 2020; Krumholz et al., 2020). Our goal for future work is to finish the pairwise comparison of all potentially duplicated document pairs and to extend the identification of potentially duplicated documents using other document identifiers provided in S2ORC (e.g., DOI). The extended result may provide a more comprehensive understanding of the data quality of S2ORC.
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A Generative Drug-Drug Interaction Triplets Extraction Framework Based on Large Language Models

Hu, Haotian  
Nanjing University, China | hhtdlam@126.com

Yang, Alex Jie  
Nanjing University, China | alexjieyang@outlook.com

Deng, Sanhong  
Nanjing University, China | sanhong@nju.edu.cn

Wang, Dongbo  
Nanjing Agricultural University, China | db.wang@njau.edu.cn

Song, Min  
Yonsei University, Republic of Korea | min.song@yonsei.ac.kr

Shen, Si  
Nanjing University of Science and Technology, China | shensi@njust.edu.cn

ABSTRACT
Drug-Drug Interaction (DDI) may affect the activity and efficacy of drugs, potentially leading to diminished therapeutic effect or even serious side effects. Therefore, automatic recognition of drug entities and relations involved in DDI is of great significance for pharmaceutical and medical care. In this paper, we propose a generative DDI triplets extraction framework based on Large Language Models (LLMs). We comprehensively apply various training methods, such as In-context learning, Instruction-tuning, and Task-tuning, to investigate the biomedical information extraction capabilities of GPT-3, OPT, and LLaMA. We also introduce Low-Rank Adaptation (LoRA) technology to significantly reduce trainable parameters. The proposed method achieves satisfactory results in DDI triplet extraction, and demonstrates strong generalization ability on similar corpus.

KEYWORDS
Drug-drug interaction; Large language model; Biomedical triplet extraction; Entity recognition; Relation extraction

INTRODUCTION
When patients take two or more drugs at the same time, there is a potential for Drug-Drug Interaction (DDI). This interaction may pose life-threatening risks to patients in severe cases (Zhang et al., 2020). The rapid growth of biomedical literature makes it increasingly challenging to manually update the DDI databases. Therefore, automatic DDI extraction is important for both pharmacological research (Asada et al., 2023) and clinical treatment.

Currently, most DDI triplets joint recognition research is based on BERT-like models, which usually shares a single set of parameters (Li et al., 2023). However, the decoding of entities and relations still relies on independent linear layers, and tends to use self-defined rules (Luo et al., 2020; Sun et al., 2022). The GPT-like Large Language Models (LLMs) can simultaneously complete sequence labeling and text classification tasks (Luo et al., 2022), which is precisely what is needed for DDI triplets joint extraction. Therefore, we proposed a generative DDI triplets extraction architecture (Figure 1) based on the current state-of-the-art LLMs, which transforms traditional entity recognition and relation extraction tasks into a unified seq2seq DDI triplets generation task.

METHODS
For LLMs, the GPT-3 (Brown et al., 2020) is an autoregressive model and performs well in text generation tasks. ChatGPT (GPT-3.5 and GPT-4) is a general-purpose dialogue model built on GPT-3. OPT (Zhang et al., 2022) and LLaMA (Touvron et al., 2023) are open source models adopt similar architecture and pre-training method as GPT.
For learning methods, the In-context Learning is applied to ChatGPT group, we compared the DDI triplets extraction performance of them in the 5-shots and 20-shots scenarios. We conducted Task-tuning (fine-tuning) for GPT-3, OPT, and LLaMA models with different parameter sizes. The Instruction tuning (Wei et al., 2021) is applied to OPT and LLaMA, improving the model’s understanding of user instructions and provide accurate feedback.

For Training methods, in addition to Supervised Fine-Tuning (SFT), which trains all parameters of LLMs, we also adopted the Parameter-Efficient Tuning method: Low-Rank Adaptation (LoRA). It freezes model parameters during training, only trains low-rank matrix, thus significantly reducing trainable parameters (Hu et al., 2021). Since the weights of GPT-3 are not publicly available, we adopted the LoRA method on OPT and LLaMA.

RESULTS AND DISCUSSION

Data and Model Setup
The Drug-Drug Interaction (DDI) dataset (Herrero-Zazo et al., 2013) is a widely-used benchmark containing 1,017 documents, 18,502 entities and 5,028 DDI relations selected from DrugBank and MedLine. We trained the models on DrugBank training set and validated performance on the test set. We further validated the best model on MedLine’s test set to verify the model’s generalization ability on similar data.

The hyperparameters for each model are as follows: the LLaMA trained for 10 epochs, with a learning rate of 3e-4, and a LoRA rank of 8. The OPT trained for 15 epochs, with a learning rate of 2e-4, and a LoRA rank of 16. The GPT-3 trained for 2 epochs with a learning rate of 0.1.

DDI Triplets Extraction Performance
Due to space constraints, we only reported the F1-score for two ChatGPT models in the In-context learning scenario. GPT-3.5 achieved F1-scores of 58.33% and 68.09% in the case of 5-shots and 20-shots, respectively, and the corresponding F1-scores for GPT-4 were 64.00% and 65.22%. We used ChatGPT’s F1-score of 68.09% as the baseline for subsequent experiments.

Table 1 lists the performance of LLMs with different parameter sizes and different training methods on DDI triplets extraction. The F1-score of all models exceeded the score of in-context learning, especially GPT-3 (175B) achieved an absolute improvement of 14.11%. In addition, most of the models have billions of parameters, while ChatGPT has a parameter size of more than 100 billion, which shows that using biomedical domain text for model fine-tuning can significantly enhance the information extraction ability of small models.

<table>
<thead>
<tr>
<th>Models</th>
<th>LLaMA 7B</th>
<th>LLaMA 13B</th>
<th>LLaMA 7B</th>
<th>OPT 6.7B</th>
<th>OPT 6.7B</th>
<th>GPT-3 6.7B</th>
<th>GPT-3 13B</th>
<th>GPT-3 175B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction</td>
<td>√</td>
<td>√</td>
<td>×</td>
<td>√</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Precision</td>
<td>78.98%</td>
<td>80.75%</td>
<td>76.54%</td>
<td>75.25%</td>
<td>79.88%</td>
<td>79.39%</td>
<td>82.40%</td>
<td>84.78%</td>
</tr>
<tr>
<td>Recall</td>
<td>66.67%</td>
<td>71.10%</td>
<td>67.92%</td>
<td>69.85%</td>
<td>73.15%</td>
<td>73.61%</td>
<td>77.25%</td>
<td>79.86%</td>
</tr>
<tr>
<td>F1-score</td>
<td>72.30%</td>
<td>75.62%</td>
<td>71.97%</td>
<td>72.45%</td>
<td>76.37%</td>
<td>76.39%</td>
<td>79.74%</td>
<td>82.20%</td>
</tr>
</tbody>
</table>

Table 1. DDI Triples extraction performance

For the GPT-3 and LLaMA group, performance was positively correlated with parameter size. The extraction performance of LLaMA was improved after introducing instruction-tuning technology. However, the fine-tuning approach yielded better results for the OPT model, indicating that instruction-tuning is not applicable to all LLMs. We also found that the performance of OPT (6.7B) and GPT-3 (6.7B) with the same parameters was comparable, and the former reduced the amount of training parameters by introducing LoRA during the fine-tuning process. This provided insight into training low-resource biomedical information extraction models. Admittedly, training only on the DDI corpus without external features may not provide enough information for capturing entities and relations.

In order to explore the automatic labeling and generalization capabilities of the model, we used the best-performing GPT-3 (175B) to automatically extract DDI triplets from a similar source, the MedLine test dataset. After calculation, the Precision, Recall, and F1-score reached 82.00%, 86.32%, and 84.1%, respectively, showing strong knowledge transfer and generalization capabilities.

CONCLUSION AND FUTURE WORK
We proposed a generative DDI triplets extraction framework based on LLMs for the joint extraction of entities and relations in the biomedical field. We introduced various technologies such as instructing-tuning, task-tuning, LoRA, etc., and validate the superior performance of LLaMA, OPT, and GPT-3. Next, we will expand the scope of the task and introduce expert knowledge to further improve performance. Also, the human evaluation will be considered.
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Patterns of Community-Based Data in the US State-Level COVID-19 Dashboards: Groupings, Inconsistencies and Gaps

Hu, Zhan  
Simmons University, USA | zhan.hu@simmons.edu
Zhang, Yishan  
Simmons University, USA | yishan.zhang@simmons.edu
Tang, Rong  
Simmons University, USA | rong.tang@simmons.edu

ABSTRACT
In this poster, we report the results of a research study examining the presence of demographic data and other community-based data and their grouping in visualization on the COVID-19 dashboards developed by the 50 state governments across the USA and the government of District of Columbia. It was found that while all dashboards included some level of demographic data, there is notable inconsistency in the groupings, and a very limited number of the state-level dashboards included visualization filtering beyond the basic demographic attributes. Several dashboards included additional data grouping capabilities such as underlying health conditions, residence/business clusters, employment status, or social vulnerability index. Both the inconsistency/gaps in demographic grouping and the fact that only a handful dashboards contained further community-based information shows the lack of awareness of state government on the importance of incorporating detailed grouping in demographic data as well as other community-based datasets. Public health dashboards, including those reflecting emergency or crisis situations such as COVID-19 dashboards, are in serious need to accurately, comprehensively, and inclusively represent and display the data patterns of all members of the community, especially the often overlooked and marginalized communities.

KEYWORDS
COVID-19 dashboards, demographic data grouping, community-based information, inclusive data report.

INTRODUCTION
During the COVID-19 pandemic, within the US, various states had produced dashboards tracking COVID-19 development and vaccination progress. As indicated by Shah (2020), "Covid-19 has shown the importance of dashboards and visualization for everyone. Various countries and even states/regions have created their own COVID-19 dashboards to educate people on the pandemic." Over the past two years, a number of research studies investigated usage habits (e.g., Röddiger et al., 2020) and user experience with map-based interaction with the COVID-19 dashboard visualizations (e.g., Cay et al., 2020). However, seldom has any study focused on the characteristics of demographic data or other community-oriented information on dashboards, whether the grouping of demographics is consistent across all dashboards, and the extent to which community-based data grouping is available on dashboards. Specifically related to data visualization and demographic data, Atherton (2021) warns that “Incomplete demographic data obscures the virus’s full impact on marginalized communities. Without more information about who the virus is affecting and how we cannot protect our most vulnerable” (p. 80). Atherton (2021) found that CDC’s early data listed race as “missing/unspecified” at 78% of the cases. The author further points out that the “disconnects between reported datasets and data visualizations in public-facing COVID health and science communication” are seriously problematic (p. 80).

STUDY OBJECTIVES AND RESEARCH QUESTIONS
The objective of this study is to examine the presence of demographic data and other community-based data and their grouping in dashboard visualization. The second goal of the study is to identify and reveal potential gaps in state-level dashboards when presenting the COVID-19-related datasets.

Specifically, our research questions are:

RQ1. What demographic data are present in state-level COVID-19 dashboards?
RQ2. What additional community-based data are present in state-level COVID-19 dashboards?
RQ3. What are the groupings of demographic and community-based data available in state-level COVID-19 dashboards?
RQ4. What are the notable gaps in presenting demographic and community-based data in state-level COVID-19 dashboards?

METHODS
For our data collection, we first identified the state-level COVID-19 data dashboard/portal of the 50 states in the US, plus the District of Columbia. The three researchers reviewed and documented the dashboards regarding patterns of data, focusing on demographic data such as age groups, sex/gender, race/ethnicity, as well as other kinds of data.
available on dashboards including medical conditions, high risk, or residence/clusters. The research team started collecting and coding data from February 2022 to May 2022.

RESULTS

Results showed that all 51 dashboards featured data analysis and presentation by different age groups, though specifics of groupings vary. The age groups structure differed from having a regular year period such as a ten-year period (n=39, 76.47%) to irregular grouping (n=12, 23.53%). In terms of Sex/Gender groups, 47 (92.16%) dashboards had breakdowns of data by Sex/Gender, with binary (n=45) (Male; Female; Nonbinary). Specifically, the predominant grouping method is the binary “female/male,” with only one dashboard (Massachusetts) included a “transgender” category and another (Oregon) included a “non-binary” category. Of 51 dashboards, 49 (96.08%) had Race/Ethnicity groupings, whereas New Jersey and New York had the grouping of “Black, White, Asian, Hispanic, Other.” There were almost equal number of dashboards that separated race categories and ethnicity categories (n=25) and remaining dashboards combined race and ethnicity categories (n=24). For race grouping, most of the dashboards used conventional grouping such as Black, White, Asian/Pacific Islander, American Indian/Alaskan Native; A good number provided categories such as “multiple race” or “two or more races.” For ethnicity grouping, most dashboards distinguished Hispanic/Latino from Non-Hispanic/Latino.

Ten (19.61%) dashboards had additional community/population grouping. Four states -- Arizona, Arkansas, and Louisiana, and Wyoming included the grouping of people with chronic medical conditions or underlying health concerns, and the grouping included Diabetes, Hypertension, Asthma, and more. Another four dashboards: Kansas, Massachusetts, Minnesota, and Wisconsin featured the clusters grouping of the facilities or residential areas such as “Bar or Restaurant,” “College or University,” “Corrections,” “Daycare,” “Government,” “Group Living,” “Long term care facility,” and more. In addition, Minnesota’s COVID-19 data dashboard also looked at how unemployment, worker characteristics, and group setting influence the case numbers. Ohio’s dashboard featured COVID-19 equity analysis by incorporating the calculation of the Ohio Opportunity Index. Oregon’s dashboard adopted CDC’s Social Vulnerability Index in their data visualization and also grouped data by types of disability and language.

Notable gaps

As shown in Table 1, we identify notable gaps found through inconsistent or conservative grouping, as well as inadequate depth of grouping. While the basic demographic attributes such as age groups, sex/gender, race ethnicity were grouped on dashboards, their groupings were inconsistent and mostly conservative or conventional, and did not reflect the multiplexity of the citizens’ demographics. Furthermore, with only a limited number of dashboards providing additional population grouping, there remains an alarming gap in COVID-19 dashboards facilitating an accurate, in-depth representation of the community’s situation during public health crisis.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Groups</td>
<td>Highly inconsistent</td>
</tr>
<tr>
<td>Sex/Gender</td>
<td>Conservative, only two (3.92%) had grouping that is not binary</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>Inconsistent and mostly conventional</td>
</tr>
<tr>
<td>Grouping beyond basic demographics</td>
<td>Insufficient dashboards (19.61%) included other population groupings</td>
</tr>
</tbody>
</table>

Table 1. Gaps in COVID-19 Dashboard Community Data Grouping

CONCLUSION

Both the inconsistency/gaps in demographic grouping and the fact that only a handful of the dashboards contained further community-based information shows the lack of awareness of state government on the importance of incorporating detailed grouping in demographic data as well as other community-based datasets. Public health dashboards, including those reflecting emergency or crisis situations such as COVID-19 dashboards, are in serious need to accurately, comprehensively, and inclusively represent and display the data patterns of all members of the community, especially the often overlooked and marginalized communities.

REFERENCES


Data Paper’s Functions in Scholarly Communication Ecosystem as Perceived by Natural Scientists

Huang, Pao-Pei | National Taiwan University, Taiwan | paopeihuang@ntu.edu.tw
Jeng, Wei | National Taiwan University, National Institute of Cyber Security, Taiwan | wjeng@ntu.edu.tw | corresponding author

ABSTRACT
Data papers, a new class of scholarly publication emerging from the open-science movement, foster data discovery and reuse by offering comprehensive descriptions of research data. Yet, despite their promising growth, the role of data papers in scholarly communication remains underexplored. This work therefore investigates the perceived contributions and functions of data papers to scholarly communication by interviewing 14 data-paper authors operating in the field of natural science. Using conceptual frameworks adopted from Borgman (2007) and Van de Sompel et al. (2004), we identify four general functions of scholarly communication (i.e., legitimization; dissemination; access, preservation, and curation; and rewarding). Additionally, our data lead us to propose that verification is a distinct scholarly communication, underscoring the importance of data papers in validating research findings in the context of ensuring research transparency. By elucidating the crucial role that data papers now play within the scholarly communication ecosystem, this study seeks to raise the academic community’s awareness of their fundamental position, as well as their co-existence with other forms of data publication, in advancing scientific research.

KEYWORDS
Data paper, Data journal, Data publication, Scholarly communication, Scholarly publication

INTRODUCTION
The landscape of scientific research is increasingly shaped by vast quantities of data, making research data a cornerstone of scholarly communication. While the current and potential importance of research data within the academic communication ecosystem are undeniable, incorporating data into the publication framework marks progress in integrating it into the current scholarly communication system (Mooney, 2016). Data papers could be seen as a meaningful evolution of that framework beyond prior forms of data publications, such as data repositories, as they prioritize data while adopting the form of articles. Being the products of the data-driven open-science ecosystem aimed at promoting data discovery and reuse, however, “Data papers are a young species of academic publishing” and are incompletely defined (Schöpfel et al., 2019, p. 623).

This work aims to enhance understanding of data papers as a rising means of scholarly publication by exploring their perceived fulfillment of scholarly communication functions. Our research question is: What functions do data papers serve in scholarly communication, as perceived by their authors working in the natural sciences?

METHODOLOGY
This study is a subset of an unpublished master’s thesis (Huang, 2022) that explores data papers’ incentive mechanisms and traits. Employing a semi-structured interview approach, our prior work (Huang & Jeng, 2022) was a first step toward identifying researchers’ motivation for submitting data papers. In the current study, we introduce a new research question and particularly seek to elicit the author’s perspectives on the scholarly communication functions of data papers. 14 participants were selected based on their experiences of publishing data papers within the previous eight years, 2015-2022. More specifically, to be included, they had to have published at least one data paper in Data in Brief or Scientific Data, either as the first author or corresponding author. Additionally, to facilitate more focused analysis, only those from the field of natural sciences were included.

Our data analyses were guided by the conceptual framework devised by Borgman (2007) and Van de Sompel et al. (2004), which collectively include four scholarly communication functions (i.e., legitimization; dissemination; access, preservation, and curation; and rewarding). The interview transcripts were screened to identify what the participants perceived to be the scholarly communication functions of data papers via mapping of keywords related to each function. Concurrently, however, we remained open to the existence of other functions. Our research materials, including the list of participants, the interview protocol, and the data-analysis framework, are available on the Open Science Framework (OSF) platform (https://osf.io/smq2y/).

FINDINGS
The results are summarized in Table 1 on OSF platform. To facilitate comparison across subgroups, their disciplines were subdivided into 1) biology and earth science and 2) medical science.
Legitimization
Following Van de Sompel et al. (2004), our analysis divided the legitimization function of data papers into two aspects: certification and registration. Certification, relating to data papers' quality-control, was recognized by roughly a third of our 14 experienced researchers. They praised the standardized format and peer-review procedures of data papers, suggesting these increase the credibility, quality, and value of the associated data (P01, P04, P05, P13). However, another participant expressed doubt that peer-review procedures could fully verify such data’s reliability (P14). Registration, meanwhile, was said by some participants to qualify data papers as independent, formal academic records and/or to facilitate data subjectivity in academic publications (P04, P10, P14). However, some considered them to be merely “by-products” of research, or supplementary information, rather than demonstrations of achievements (P02, P09, P13).

Dissemination
Dissemination involves data papers’ suitability as a medium for raising awareness of research data and the research that gave rise to it (Borgman, 2007). Through being cross-referenced with research papers and indexed in citation databases, data papers can provide additional showcases for their authors’ research (P07, P15, P16). However, similar data-dissemination channels, such as data repositories and data-centered publications, are already prevalent across many disciplines: e.g., the National Center for Biotechnology Information (NCBI) in the case of medical science, and genome announcements in genomics. Consequently, more than a third of the researchers we interviewed questioned the necessity of data papers (P02, P03, P07, P10, P16).

Access, preservation, and curation
In the aspect of access, data papers were praised for facilitating data linkage through keyword searches, as well as for enabling data attributions and reuse via formal citations, without any need to obtain permission from the data’s originators (P05). However, the limited scope of the datasets in data papers, which are often obtained from single research groups, was thought to restrict their practical usefulness, as compared to more extensive data repositories (P06, P10). When it comes to preservation function, only one participant (P13) mentioned that they could help ensure datasets’ ongoing existence. However, whether this is true is dependent on the diligence of data-journal publishers. Lastly, as curation implies data description and management, data papers offer a comprehensive, detailed variant of it, providing valuable resources for future researchers, practitioners, and interdisciplinary researchers by illustrating research procedures and revealing implicit knowledge (P03, P05, P08, P11, P13). Nevertheless, this implies a considerable investment of time, which may compromise the speed of data dissemination (P09).

Rewarding
In academia, rewards such as consolidating one’s current position or obtaining promotion opportunities tend to be based upon the quantitative accumulation of academic achievements (Van de Sompel et al., 2004). In some places, publishing data papers can assist researchers with such accumulation, especially insofar as their publishing process tends to be less onerous than that of research papers (P13). However, many institutions do not rate data papers highly as performance-evaluation indicators, and some ignore them altogether, meaning that publishing them may not be of much practical benefit to their authors (P05, P06, P15).

An unheralded scholarly communication function of data papers: Verification
A core aim of scholarly communication is to disseminate academic information and facilitate its use. Increased transparency and openness in the research process can enhance understanding, provide assurance, and allow for verification of information’s authenticity. Based on our qualitative data, we propose an additional function, verification: the indirect assessment of research credibility. Because data papers present data in a more detailed and complete manner than other types of data publications, they enhance verification’s efficacy and arguably do more to dispel doubts about the integrity of research. This, in turn, can address the crisis of research reproducibility and lead to solid academic achievements (P04, P09, P11).

IMPLICATIONS
Although persistent gaps still existed in data paper’s ability to meet researchers’ needs, researchers in the natural sciences perceive that data papers can fulfill multiple scholarly communication functions, including serving as authoritative academic records, data-dissemination channels, and means for data preservation and access. Such papers are seen by some as having the potential to recognized by institutions as academic performance records, and to serve as verifications of the integrity of research, in line with the aims of open science and research transparency. Furthermore, subtle differences could also be discerned in the participants’ views according to their sub-disciplines. We suggest that this could be due to cross-disciplinary differences in data-sharing culture, inter-researcher competitiveness, and expectations about data publications.

In short, data papers should not be conceived of as standing alone, but as part of the wider scholarly communication ecosystem. While the emergence of other forms of data publication may challenge data paper’s position, some might enhance their value. Future research could analyze the advantages and drawbacks of various data-publication
approaches, as well as their potential to complement or compete with one another: a collaborative approach among various data publication formats may contribute to the advancement of scientific research.

ACKNOWLEDGEMENT
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If Cybersecurity Was... Pizza? A Visual and Rhetorical Approach to Exploring the Concept of Cybersecurity

Huang, Yu-Wen  National Taiwan University, Taiwan | r11126004@ntu.edu.tw
Chen, Wen-Ning  National Taiwan University, Taiwan | b08106002@ntu.edu.tw
Lin, Yu-Jie  National Taiwan University, Taiwan | b09106039@ntu.edu.tw
Huang, Pao-Pei  National Taiwan University, Taiwan | paopeihuang@ntu.edu.tw
Hu, Hsin-Yuan  National Institute of Cyber Security, Taiwan | hsinyuanhu@nics.nat.gov.tw
Jeng, Wei*  National Taiwan University, National Institute of Cyber Security, Taiwan | wjeng@ntu.edu.tw

ABSTRACT
Understanding and defining cybersecurity-related concepts for the general public can often prove challenging due to their inherent complexity; consequently, visual imagery emerges as an effective device for articulating and elucidating these abstract ideas. In this study, we leveraged an adapted version of the existing iSquare approach to explore people’s understanding of cybersecurity. We collected 499 iSquares from a broad-spectrum backgrounds of participants attending a prominent international cybersecurity exhibition in Taiwan. Our preliminary findings revealed that metaphors of physical security and warfare were the most frequently employed in participants’ work roles were also observed to influence their respective attitudes and perspectives as expressed in their pictorial representations of cybersecurity.

KEYWORDS
cybersecurity, visual method, metaphor, information design, communication

INTRODUCTION
Cybersecurity, with the rapid development and changes in technology, lacks a universally accepted conceptualization, which leads to potential risks stemming from public misunderstanding and bias. In recent years, the cybersecurity field has begun to recognize an appreciation for visual imagery’s role in communicating the cybersecurity concepts, with initiatives such as IEEE VizSec encouraging the exploration of visualizing cybersecurity and the development of visual methods in terms of security. Many studies have also demonstrated that visual methods, such as sketching, can serve as a starting point for understanding people's perception of abstract concepts (Mckenna et al., 2015; Sturdee et al., 2021).

Metaphorical rhetoric has been identified as an effective bridge for communicating abstract concepts. Previous research has proposed five main metaphorical mental models for cybersecurity: the Physical Security, Medical, Criminal, Warfare, and Market Model (Camp, 2009). This study utilizes a visual rhetoric approach and develops a novel framework for visual analysis, examining patterns in how individuals employ visual objects as a means of communication. By leveraging existing visual research methods in the information science field, this study delves into the concept of cybersecurity, leading us to the following research questions:

RQ1: How do individuals from diverse backgrounds visually express their perception of the notion of cybersecurity?
RQ2: How can visual rhetoric perspectives be applied to analyze visual images?

METHODOLOGY
Given the multidimensional and emotive potency of visual imagery in comparison to text (Zarefsky, 1992; Foss, 2004), we employed the iSquare approach for data collection. iSquare is a visual method in the field of information science, initially proposed by scholar Jenna Hartel in 2010. It applied the draw-and-write technique to explore people's perceptions of the concept of "information"(Hartel, 2014a). We modified the standard iSquare cards by prompting participants to draw down “what is cybersecurity to you?”. On the back side, participants were asked to provide a brief text description of their artwork and assign a keyword to the concept of cybersecurity.

Data was conveniently sampled from onsite attendees at the CYBERSEC 2023 exhibition in Taiwan. We had a booth there and collected data for two days. To address our first research question, we used a board to guide and collect data from three overarching cybersecurity work role groups, i.e., technical, management, strategy officers, based on the definitions of Cyber Security Management Act enforced in Taiwan. The board was also displayed rooms for non-cybersecurity professionals (students and non-students). To assure anonymity in the data, no personally identifying information was collected. Our data sample eventually collected 499 responses; however, we excluded 8 iSquare cards that could possibly be provided by the minors: participants self-identified themselves as high school students or younger. Our final data sample included 491 iSquare cards, and the detailed data profile are accessible for review at https://osf.io/q2wbz .
PRIMARY RESEARCH FINDING
In this poster, we mainly report on the visual representations of cybersecurity found on the front side of the iSquare cards, but leaving out the textual information on the back. Our preliminary findings reveal both the commonly adopted metaphors for cybersecurity, and the differences in visual narrative among participants from different backgrounds. Figure 1 shows some of the iSquare samples from participants of diverse backgrounds.

![Figure 1. iSquare samples from participants of different backgrounds](https://osf.io/3vhxe/)

**Metaphor in Cybersecurity Visuals**
We found that physical security and warfare were the most prevalent pictorial metaphors for cybersecurity, which corresponded to previous research (Camp, 2009). We observed that participants brought in physical security—representing cybersecurity with architectures such as castles, doors, and walls symbolizing the notion of penetration preventing (E016, A166). For them, building up defensive barriers is the key way to maintain computer security. On the other side, representation of cybersecurity as warfare brings attention to both the attack and defense. Many participants drew weapons (arrows, swords or bombs), armors (shields or bucklers) or images of two sides of people fighting against each other (A136, D032). These metaphors assigned cybersecurity with a sense of high arousal and dominance, underscoring combative behaviors and the existence of a determined implacable enemy.

We also observed several repeating symbolic representations that could not be categorized into the five major metaphorical systems: money (B015); natural elements such as sunlight, clouds, iceberg, and the universe (C025, C026); food e.g., pizza and cheese (B005); part of a human’s body, e.g., eyes (B010). These objects will allow further exploration into participants’ diverse and unconventional perception of cybersecurity.

**Differences in Visual Narrative among Participants from Different Backgrounds**
According to our preliminary analysis, the images drawn by participants from different backgrounds appear to exhibit subtle variations in narrative perspective, emotions, and information framing. Cybersecurity professionals, particularly technical-related, often portrayed a sense of "self," typically as one of the parties involved in the attack or defense, and contained more personal expressions of emotions (e.g., with a cry face) (A153, A059). On the other hand, images created by management- and strategy officers tended to adopt a neutral, third-person perspective with few emotional elements. Nuanced differences were observed: management-related work roles tend to presented a comprehensive yet chaotic view (B002, B104), whereas images from strategy officers tended to be calm and macroscopic in nature, “cybersecurity is the universe (C026).”

Finally, we also observed that non-cybersecurity professionals, especially students, exhibited a surface-level and tangible aspects of ICT, such as computer devices and networks (E057, D054). Additionally, there was also a higher prevalence of emotions characterized by confusion and uncertainty towards the notion of cybersecurity (E037).

**FUTURE RESEARCH PLAN**
Our study explored the public understanding of emerging, abstract technological concepts, yielding a diverse array of cybersecurity imagery. However, the current iSquare approach lacks a comprehensive analytical framework: previous studies using the same approach typically focused on thematic clustering without delving into finer-grained semiotic analysis. To address this, our future effort aims to create a coding scheme to execute a more detailed analysis of visual rhetoric. Drawing on the rhetorical triangle model by Hesford and Brueggemann (2006), we aim to devise a three-dimensional encoding framework covering visual items, creators, and audience. This will facilitate systematical content analysis of user-created images, encompassing aspects such as metaphorical rhetoric, symbolism, compositional structure, narrative perspective, emotional tones, and local elements recognition. Each of the iSquare cards and the diverse metaphors they obtain will facilitate the development of multifaceted cybersecurity thinking and its application in well-rounded areas such as cybersecurity awareness promotion, educational training, and the product design. As one of our participants suggested that “like pizza, cybersecurity holds value whether viewed as a whole or in individual pieces (B005).”
ACKNOWLEDGEMENT
This work was financially supported by the National Science and Technology Council (NSTC) in Taiwan, under NSTC 112-2621-M-002-021- and 112-2813-C-002-061-H, and the NTU112L900202 & 112L9A001 from The Featured Areas Research Center Program by the Ministry of Education (MOE) in Taiwan, and the National Institute of Cyber Security in Taiwan.

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How China Governs Data: Evidence Mined from the Central Government Policy Documents

Huo, Fanfan
School of Information Resource Management, Renmin University of China, China | huo_ff@163.com
Huo, Chaoguang
School of Information Resource Management, Renmin University of China, China | huochaoguang@126.com

ABSTRACT
Data governance policy is of great importance for the development of digital economy. This paper proposes a four-dimensional policy mining framework to analyze the 1097 central data governance policies. We depict the development trajectory, analyze the policy subjects involved into the policy-making, trace the sources of policy, and characterize the policy tool structure based on the policy coding. We find that the core departments of data governance policy making need to strengthen the awareness of data governance; Policy-making should source enough convincing and authoritative policies to strengthen the long-term effectiveness and impact policies; There are imbalances and deficiencies of policy tool structure. It provides reference for other countries in data governance.

KEYWORDS
Data Governance; Data Governance Policy; Policy Analysis; Policy Informatics

INTRODUCTION
The role of data in economic and social development has become increasingly prominent. However, issues such as data leaks, privacy infringements, improper data collection, and data monopolistic practices have emerged in both China and worldwide (Jiang et al., 2021; Gregory et al., 2020). Data can be regarded as "oil" or "ammunition". Consequently, how to govern data has become a top priority for the development of the digital economy (Abraham et al., 2019). Policies are the objective manifestations and behavioral trajectories of political institutions (Yang and Huang, 2022). In China, how data is governed is predominantly reflected in data governance-related policies.

RESEARCH FRAMEWORK
By integrating the external structural elements and content elements of policies, this paper integrates policy external structural elements and policy content elements, and proposes a four-dimensional policy mining framework constituted of development trajectory, policy subjects, sources of policy, and policy tools. As illustrated in Figure 1:
Based on the Peking University Law Information Database (PKULaw), the most authoritative policy databases in China, 1,097 data governance policies from central government are collected and divided into four phases. The statistics about data governance policies, are shown in Appendix A.

DEVELOPMENT TRAJECTORY ANALYSIS
The development trajectory is an important dimension for studying the historical development and future growth of policies, including their origins, turning points, reforms, and innovations. Looking at the data governance policies since the reform and opening-up, data governance in China has experienced a gradual and rapid development process, the details are shown in Fig 2.

POLICY SUBJECTS MINING
Policy subjects refer to individuals, groups, or organizations that directly or indirectly participate in policy formulation, implementation, evaluation, and monitoring (Chen, 1998). In China, they are generally the entities that hold power in the process of policy-making and implementation, namely the policy executive subjects (Huo et al., 2021). Here, we develop a program to extract policy subjects and their co-issuance relationships. As shown in Appendix A and Fig 3, a total of 161 departments are involved, highlighting the significance of data governance across various sectors. Particularly, the results indicate that the data awareness of certain government agencies still needs to be further enhanced. Data differs from traditional information. Although the establishment of the National Data Bureau, it does not imply a straightforward merger, immediate transformation, or simple functional division for all policy subjects.

SOURCES OF POLICY MINING
Drawing on the concept of "Sources of Law," this study proposes the concept of "Sources of Policy" to emphasize that policy sources refer to the legal basis, value foundation, ideological basis, and spiritual basis for policy formulation, although some call them policy citation (Ba et al., 2023). Here, we develop a program to extract policy source relationships, construct a network of sources. This allows us to verify the primary foundations of data governance policies in different periods. As shown in Fig 4, the results reflect the formulation and elaboration of any policy must be based on the general principles or relevant basic laws, and the elucidation or interpretation of policy sources helps enhance their authority and persuasiveness. Conversely, the "Data Security Law" has not yet become a core reference, indirectly indicating that the corresponding governance system has not been updated in a timely manner. It also reflects the governance deviation that may occur when various central or local departments formulate policies in this area without higher-level laws and regulations as a basis.

POLICY TOOLS MINING
Based on the policy tool framework proposed by Rothwell and Zegveld, the most popular framework, here we code the policy from tool and content dimensions (Huang et al., 2021). The details are shown in Table 2. The analysis of data governance policy tools reveals that China has established a favorable environment for the implementation of data governance work. However, there remains a relative deficiency in awareness regarding aspects such as financial support, policy support, and data property protection. Furthermore, the utilization of supply-side policy tools, such as funding, talent cultivation, and technology investment, as well as demand-side policy tools, including government procurement and public-private partnerships, is insufficient. This limitation significantly impedes the development of data governance in China. Extensive practice has demonstrated that a single policy tool is inadequate to address the complexities, diversities, and even conflicts associated with practical needs. As a long-term and systematic undertaking, data governance necessitates the judicious combination and application of multiple policy tools to effectively tackle intricate challenges.

ACKNOWLEDGMENTS
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**APPENDIX A**

<table>
<thead>
<tr>
<th>Effectiveness level</th>
<th>Number</th>
<th>Involved Ministry/Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law</td>
<td>3</td>
<td>Standing Committee of the National People’s Congress</td>
</tr>
<tr>
<td>Normative documents of The State Council</td>
<td>6</td>
<td>State Council, General Office of the State Council</td>
</tr>
<tr>
<td>Documents of Judicial Interpretation</td>
<td>2</td>
<td>Supreme People’s Court, Supreme People’s Procurator, Ministry of Public Security, Ministry of Justice, and so on.</td>
</tr>
<tr>
<td>Work documents of the Supreme People’s Court and the Supreme People’s Procurator</td>
<td>1</td>
<td>Supreme People’s Procurator, Ministry of Public Security, Ministry of Justice, China Banking and Insurance Regulatory Commission</td>
</tr>
<tr>
<td>Departmental Regulations</td>
<td>13</td>
<td>Ministry of Finance, General Administration of Customs, Ministry of Ecology and Environment, Ministry of Industry and Information Technology, and others.</td>
</tr>
<tr>
<td>Administrative Licensing Approval</td>
<td>44</td>
<td>China Securities Regulatory Commission, National Cultural Heritage Administration, National Health and Family Planning Commission (now National Health Commission), and others.</td>
</tr>
<tr>
<td>Party Regulations</td>
<td>1</td>
<td>Office of the Central Cyberspace Affairs Commission.</td>
</tr>
<tr>
<td>Industry Regulations</td>
<td>95</td>
<td>People’s Insurance Company of China, Shenzhen Stock Exchange, China Futures Association, Shenzhen Stock Exchange, and others.</td>
</tr>
<tr>
<td>In total</td>
<td>1097</td>
<td>161 departments.</td>
</tr>
</tbody>
</table>


**Table 1. Statistics of Data Governance Policies of Central Government**
College Students’ Perceived Credibility of Health Information on YouTube

Hwang, Barun
Sungkyunkwan University, Korea | qkfms123@g.skku.edu
Oh, Sanghee
Sungkyunkwan University, Korea | sangheeoh@skku.edu | Corresponding author

ABSTRACT
This work-in-progress study explores users' perceived credibility of health-related YouTube videos and proposes a credibility evaluation framework consisting of twelve criteria across four levels: source, content, creator, and interaction. College students who use YouTube for health information were invited to participate in an online survey. A pilot study was carried out with a small sample size. The findings from the pilot study showed that participants frequently accessed health videos, mainly for specific diseases, treatments, mental health, nutrition, and fitness. There were statistically significant associations between source and interaction, as well as source and creator. Further analyses with a larger sample size will be performed and reported at the 2023 ASIS&T annual meeting. We believe the findings from this study could enhance the understanding of users' attitudes and behaviors of seeking and sharing health information on YouTube.

KEYWORDS
Credibility; Health Information; Social Media; YouTube; College Students

INTRODUCTION
People use social media to enhance their physical well-being, manage their diet and nutrition, or seek solutions for health issues (Goodyear et al., 2018; Prybutok & Ryan, 2015). Social media allows users to generate and distribute health information, connect with others, and obtain support from them (Li et al., 2018). As of Feb 2023, the global number of social media users stands at 3.96 billion, with YouTube ranking as the second most popular platform (Dixon, 2023). 40.8% of YouTube users watch health-related videos (Lee et al., 2022). Healthcare organizations and professionals offer public health information via YouTube (Cheong et al., 2021) but users often prefer videos featuring personal experiences or advertisements (Ferhatoglu et al., 2019). Such videos may convey misinformation that can have adverse effects on an individual's health (Szmuda et al., 2020). Therefore, it is crucial for users to have the ability to assess the quality of health information from YouTube properly. The purpose of this study is to explore users' perceptions of the credibility of health videos from YouTube using a proposed framework that incorporates four dimensions of credibility assessment: source, content, creator, and interaction. YouTube has been the most watched platform among users in their 20s (Korea Press Foundation, 2021), so we invited college students with experience in using health videos on YouTube to participate in an online survey.

CREDIBILITY ASSESSMENT OF HEALTH INFORMATION ON SOCIAL MEDIA
The quality of health information on social media play a vital role in influencing healthcare decisions and results (Wijayanti et al., 2022). A significant number of individuals have watched YouTube into their daily routines as a means to obtain information, engage in leisure activities, and connect with others (Byeon et al., 2022). YouTube videos are widely enjoyed, captivating, and perceived as a reliable source of information (Lim, 2021). YouTube has become an influential platform for health-related content, empowering individuals to educate themselves, share experiences and support, and make positive changes in their lives (Gimenez-Perez et al., 2020; Madathil et al, 2015; Niu et al., 2022). Users should remain vigilant, however, in assessing the credibility of the information they obtain from YouTube (Shabfi & Rowley, 2017).

People obtain information from diverse sources and such information may exhibit varying degrees of credibility. Hilligoss and Rieh (2008) evaluated the credibility of websites with a proposed model which encompasses three levels. First, the construct level refers to how people judge information with criteria such as truthfulness, believability, trustworthiness, objectivity, and reliability. Second, the heuristics level focuses on finding information quickly with media-related, source-related, endorsement-based, and aesthetics-based criteria. Finally, the interaction level pertains to credibility judgement specific to the sources of information, considering cues from the content itself, peripheral source cues, and peripheral cues related to the information object. Zha et al. (2018) measured the credibility of social media based on the trustworthiness, knowledgeability, and overall credibility of the individuals who generated information. Xiao et al. (2018) used the heuristic-systematic model to examine factors affecting consumer perception of information credibility on YouTube, including trustworthiness, social influence, argument quality, and information involvement. These studies presented various criteria for judging credibility across diverse dimensions and highlighted the credibility can vary depending on the medium of the sources (Lee et al., 2020).
PROPOSED FRAMEWORK OF CREDIBILITY ASSESSMENT OF YOUTUBE VIDEOS
From the literature review, we found that social media allows users to interact with others, and interactions can have a significant effect on perceived credibility (Choi & Lee, 2021; Yuksel & Cakmak, 2020). Thus, we proposed a framework for evaluating health videos which encompasses criteria at the source, content, creator, and interaction levels. Definitions and criteria of each level are as follows.

- **Source credibility** refers to a user's perceived level of trust in the YouTube platform, and of the criteria include trustworthiness, dependency, and familiarity (Hilligoss & Rieh, 2008; Oh & Choi, 2022; Xiao et al., 2018).
- **Content credibility** refers to users' perceived level of confidence and trust in the message being delivered and the quality and nature of the information within the message (Choi & Lee, 2021; Li & Suh, 2015). The criteria include objectivity, accuracy, and currency of information in the YouTube videos.
- **Creator credibility** refers to users' perceived level of trust in the YouTube content creator's characteristics (Kim et al., 2021). The criteria include expertise, truthfulness, and likeability of creators (Choi, 2020).
- **Interaction credibility** refers to the communication between creators and users or among users that occurs on YouTube, and the criteria include subscribers, comments, and likes on YouTube channels or videos (Yuksel & Cakmak, 2020).

METHODS
This study carried out an online survey among college students who watched or used health videos on YouTube within a month. The survey questionnaire was designed to obtain responses related to participants' background information, experiences of using YouTube for health, and their perceptions of credibility. A total of twelve criteria across the four levels of perceptions were tested with 44 statements using a five-point Likert scale. Participants have been recruited to take part in the online survey from various online communities of college students in Korea. In this poster, the findings from a pilot test were reported. The pilot test was performed with nine college students and the measurements showed excellent internal consistency (Cronbach's α = .94). The data collection will be completed within two months. Statistical analyses of examining the relationships between the background and experiences and perceived factors with the twelve criteria at the four levels will be carried out. The preliminary findings as well as the credibility framework will be presented at the 2023 ASIS&T annual meeting.

RESULTS
Participants spent an average of 1.89 days per week on health-related YouTube about specific diseases, treatments, mental health, nutrition, and fitness. Four participants subscribed at least one health channel on YouTube. Eight participants expressed that the health videos from YouTube helped them recover from certain health conditions. The health topics that they have sought and shared on YouTube were diverse, covering symptoms or treatments for insomnia or gastroesophageal reflux disease (GERD), the consequences of excessive nutritional supplement use, and information regarding prescribed medications.

The average rating for the twelve criteria was 3.38, indicating a moderate level of importance. At the four levels of the credibility, the source credibility received the highest rating (M = 3.61, SD = .49), followed by creator credibility (M = 3.56, SD = .79), interaction credibility (M = 3.49, SD = .92), and content credibility (M = 2.86, SD = .57). Pearson’s correlation analysis revealed strong and statistically significant coefficients for the relationship between source credibility and interaction credibility (r = .850, p = .008), as well as the relationship between source credibility and creator credibility (r = .868, p = .005). There was a statistically significant relationship between the perceived credibility of creators and the channel subscription (F=8.344, p<0.05), while no significant effects were observed for gender, age, and frequency of use.

DISCUSSION & CONCLUSION
The pilot test had a limitation to run the statistical tests with the small sample size. Nevertheless, the majority of users believed health videos were valuable in addressing their diverse and specific health problems. Most importantly, user perceptions on the credibility of YouTube as a source of health information were strongly associated with the perceived credibility of creators and interaction. This could be attributed to the dynamic and interactive nature of YouTube which facilitates direct communication and engagement between users and creators. Our proposed model specified the criteria at the source, content, creator, and interaction levels. We will conduct a more extensive analysis examining the relationship between these criteria and other factors using a larger sample size. Additionally, we expect that the analyses will reveal a diverse range of health topics and behaviors related to the use of YouTube for health purposes.

This study could provide valuable insights, both theoretical and practical, that enhance the understanding of users’ attitudes and behaviors in YouTube for health information. Findings could inform the importance of evaluating the quality of videos critically and information literacy to empower users to make informed health decisions. Findings could also provide valuable feedback to YouTube and creators on how to improve the quality of their services by considering user perceptions on the credibility.
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Ikeuchi, Ui  Bunkyo University, Japan | ikeuchi@bunkyo.ac.jp

ABSTRACT
Journal policies play a crucial role in facilitating the sharing of research data. This study examined the Data Sharing Policies (DSP) and Supplemental Materials Policies (SMP) of ten journals from 22 disciplines in 2023, comparing the findings to those of previous surveys conducted in 2014 and 2019. Among the 220 journals analyzed, 91.4% implemented DSP, whereas 95.0% adopted SMP. Compared with the surveys conducted in 2014 and 2019, a greater number of journals exhibited more stringent requirements for DSP, particularly in the fields of Engineering, Economics & Business, and Computer Science. Although the percentage of journals that accepted supplemental materials increased, only 12.7% strongly required their submission. Furthermore, this study compared the changes in Journal Impact Factors (JIF) between journals that adopted DSP (either requiring or recommending it) and those that did not have DSP in 2019. These findings suggest that DSP has a significant effect on JIF in the Economics & Business and Psychiatry/Psychology fields.

KEYWORDS
Research data sharing; Journal policy; Scholarly publishing; Journal Impact Factor (JIF); Open Science

INTRODUCTION
The promotion of research data sharing is essential to maximize the benefits of scientific research. Journal data policies serve as key motivators for researchers to share their data (Fecher et al., 2015), and previous studies have suggested that journals with stronger policies may experience higher rates of article citations (Christensen et al., 2019). The standardization of data policies is currently underway (Hrynaszkiewicz et al., 2020). This study builds upon previous surveys conducted in 2014 (Ikeuchi & Itsumura, 2016) and 2019 (Ikeuchi et al., 2019), focusing on examining Data Sharing Policies (DSP) and Supplemental Materials Policies (SMP). It aims to identify discipline-specific trends by comparing the rankings of the DSP and SMP. Additionally, it investigates the adoption of DSP to determine its impact on Journal Impact Factor (JIF).

METHODOLOGY
In the 2014 survey, ten journals with high impact factors (JIF 2012) were selected from each of the 22 disciplines listed on the Essential Science Indicators (ESI) journal list (Ikeuchi, 2018). For this study, the DSP and SMP of 220 journals surveyed in 2014 and 2019 were reviewed and ranked based on the following scale: (1) require (3 points), (2) recommend (2 points), (3) accept (1 point), or (4) have no mention (0 points). To ascertain the effects of changes in data policies, the JIFs of (a) journals without DSP in 2014/2019/2023 and (b) journals without DSP in 2014 that adopted DSP in 2019 were compared. Given that the range of JIFs varies across disciplines, the Difference-in-Differences (DID) approach was employed to measure the impact of DSP on journals in the same field.

RESULTS
Data Sharing and Supplemental Materials Policies across 22 Disciplines
The percentage of journals implementing DSP increased to 91.4% compared to 59.5% (2014) and 85.0% (2019), whereas SMP adoption reached 95.0% compared to 89.5% (2014) and 90.9% (2019). Policy rankings varied across disciplines, with all ten journals in the fields of Molecular Biology & Genetics requiring data sharing, whereas only one journal in Psychiatry & Psychology had this requirement (Figure 1). A weak positive correlation was observed between DSP and SMP within each discipline ($r = .484, p < .05$).
Changes in DSP and SMP
To elucidate the changes in DSP and SMP over time within each discipline, the average ranking points of the policies were calculated (Figure 3). DSP have shown an increase in both adoption rates and rankings, with significant changes occurring in Engineering, Economics & Business, and Computer Science. While the number of journals accepting supplemental materials has increased, those mandating their submission has not. Some journals impose restrictions on the types and quantity of supplemental materials, whereas others recommend their submission to data repositories.

Effects on Journal Impact Factor
In 2019, the eight disciplines included both (a) journal(s) that had not adopted a DSP and (b) journal(s) that had adopted a new DSP (require or recommend). However, the Social Sciences and Multidisciplinary fields were excluded because of the inclusion of journals that were not assigned JIFs for reasons such as journal name changes. As shown in Figure 4, these five fields experienced a higher rate of increase in JIF for journals that adopted DSP. The DID analysis revealed an effect of 5.922 for Economics & Business, 4.801 for Psychiatry/Psychology, 2.285 for Agricultural Sciences, 0.831 for Engineering, and 0.141 for Mathematics. Physics could not be tested because of the differing trends in the JIF between the 2014 survey (JIF 2012) and the 2019 survey (JIF 2017).

CONCLUSION
This discipline-specific survey of journal DSP and SMP highlighted the increasing adoption rates and rankings of DSP over time. Furthermore, the findings suggest that DSP adoption may have a notable impact on the increase in JIF. The adoption of DSP by journals may be associated with the increased attention and credibility of the articles. Future research endeavors should examine a larger and ongoing sample to further explore the influence of journal policies on scholarly communication in the era of Open Science.

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Positive Ageing: How Can Public Libraries Help?

Islam, Md. Anwarul  
University of Dhaka, Bangladesh | anwar@du.ac.bd

Ikeda, Mitsuru  
Japan Advanced Institute of Science & Technology, Japan | ikeda@jaist.ac.jp

ABSTRACT
The growth rate of older adult produces demographic shift in Bangladesh. The objectives of this study is to explore how public libraries in Bangladesh can work or support for positive ageing. This study is a small part of larger survey study of the public libraries in Bangladesh. Data were collected from two open-ended questions which were used in the larger quantitative survey. Out of 59 responses received from the public librarians, only 15 librarians responded to open-ended questions. The answers of these two open-ended questions were coded and analyzed. Public libraries do not offer exclusive services for the older adults but many of the general services are used by the older adults. However, public librarians have come up with significant ideas to support older people for promoting the positive ageing. Findings also focused how this helps to achieve some of the UNSDGs in the context of Bangladesh.

KEYWORDS
Positive ageing, ageing population, public library, library services, community engagement.

INTRODUCTION
Bangladesh is undergoing a significant demographic transition. The number of older population aged 60 or above in Bangladesh was 13 million (8.3%) in 2019 and expected to become 36 million (21.9%) in 2050 (Help age international, 2022). Social supports, pension system, health care facilities and social safety scheme to the elderly people are very limited and in some cases absent in Bangladesh (Sarker, 2021). If we want to turn the older people into ‘positive ageing’ population, we have to offer social participation which is the first stage of ‘positive ageing’ proposed by WHO (WHO, 2002). Keeping a positive approach about life throughout the older age and maintaining in physical and emotional wellbeing are often considered as positive ageing. Many countries in North America, Europe and Australia have used ‘public libraries’ as social engagement platform for the older people. Country like Japan has extensive programs for the elderly people (part of services for the disabled) like memory sharing group, mobile library services, fireplace room and health information service areas under the public libraries (Donkai & Mizoue, 2014). Public libraries in the USA offer lifelong learning opportunities for the older adults, access to computer and assistive technologies for the ageing people (Bennett-Kapusniak, 2013). In a large-scale study, Lenstra, et al. (2020) presented how the public libraries in the USA serve the ageing communities in multiple ways including offering specialized programs for the ageing people. At present public libraries in Bangladesh neither offer special services for the elderly people nor do they involve the elderly people in the service design process. Public libraries in Bangladesh as research topic are less focused and studied by the researchers. Recently very few studies e.g., public libraries response to global pandemic (Begum, Roknuzzaman and Shobhanee, 2022); UNSDGs and public libraries in Bangladesh (Islam, Sultana and Widen, 2022) and libraries unlimited project for impact assessment of public libraries in Bangladesh (Crawford, 2018) are some of the relevant studies which have been conducted in the context of public libraries in Bangladesh.

Aging brings several challenges and this can be transformed into ‘active aging’ by engaging them in social activities. Public libraries can play a social participation platform for the older people and can work as third place. Out of the three pillars of active aging ‘Participation’ ‘Health’ and ‘Security’ of WHO (2022), public libraries can offer its position under the first pillar. Engaging the ageing population in service design e.g., inviting them to conduct story telling session, recreational reading and offering health contents in local language or health infographic can help the elderly people to think public library as social engagement platform. This will also increase the older peoples’ sense of worth, connectedness and satisfaction within the local community. While the UNSDGs motto is ‘leaving no one behind’, public libraries can help the ageing populations of the society by inviting them in various social activities (UNDP, 2022). Ageing populations and public libraries in the context of Bangladesh is new and none of the existing studies covered this research area. This is the first time an attempt has been taken to explore this research area.

OBJECTIVES OF THE STUDY
Inviting older adults in the service design process requires assessment of that specific community’s needs. Due to the country-wide network, public libraries in Bangladesh have the potentials of becoming community engagement center for the elderly people by offering community information what they need, various digital services, and other services that might improve their mental and physical well-being. The objectives of this study are:

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RQ1. How do public libraries support older adults?
RQ2: How can public libraries help for positive ageing?

METHODLOGY
In a larger quantitative survey study with 59 public librarians, Islam, Sultana and Widen (2022) found that public libraries in Bangladesh ranked well to achieve some goals like SDGs#1: poverty end, SDG#2: end hunger, SDG #3: good health and well-being, SDG#4: quality education and SDG #17: partnerships for the goals. Authors have come up with some findings which suggested increasing the engagement of public libraries by observing national days, organizing various awareness programs of social issues with the community people. A few recommendations are provided to design the services and service plan in line with the UNSDGs.

The present study is an extension of the Islam, Sultana and Widen (2022)’s study. The used data for this study were collected as part of a larger quantitative survey of public librarians across Bangladesh investigating the likelihood of public libraries supporting UNSDGs. The focus of the present study is the qualitative analysis of the open-ended responses to two questions relating to supporting older populations. Questions on services for the older people have not been adequately investigated in the earlier study.

DATA ANALYSIS
Out of 59 public librarians, only 15 public librarians responded to these two open-ended questions. For analyzing the open-ended responses, all data were imported in an Excel spreadsheet. Three kinds of coding were used (open, axial and selective coding) for analyzing the responses (Corbin and Strauss, 1990). Initial responses are treated as open coding which led to create candidate concepts for categories, then categories were grouped into major categories (axial coding) and finally this shifted to selective coding. For the present study, only few selected responses are presented. There were 15 responses for each question. Public librarians’ responses have mapped with RQ1 and RQ2. RQ1#1, the numbers within brackets indicate the sum total for all responses in that category. ICT services- ‘adequate free computer and internet access for the older adult’ ‘provide mobile-based health related contents’ ‘helping to use SNT tools’ ‘guiding them to use communication apps like WhatsApp’ ‘Online news contents and portals’ ‘COVID-19 online information sources’ ‘non-communicative disease prevention information’ (15); Social services- ‘Public gathering space’ ‘newspaper services’ ‘outreach services for the older adults’ ‘designated spaces for them to enjoy reading’ ‘offering information services required by them’ ‘story telling sessions organized and invite elderly people to share their experiences’ ‘inviting them as jury for the book reading competition’ (15)

FINDINGS AND DISCUSSION
While the growth rate of older adult produces demographic shift, reshaping public library services can be an effective ways for caring the ageing population. Even though the numbers of responses for the two open-ended questions are few, the initial findings of this study can draw some significant findings to discuss. Current services and supports offered by the public libraries for the older adults are not exclusively design for them; it is under the general services that they provide to the community. Setting up an appointment to share information about services to older adults is a first step toward forming partnerships. Public libraries can design more services for the older adults. In case of positive ageing, public librarians in Bangladesh have positive approach. Their responses brought a wide set of findings and this can be addressed in the service design process.

Department of Public Libraries (DPL) in Bangladesh can come up with some plans and projects to nurturing this positive aging concept in the service domain. Memory sharing groups among the senior citizens, materials to inspire (mental health building book) and designated senior areas are some of the concepts that public libraries can take into consideration. Though public libraries in Bangladesh have not yet developed a support program to lead elderly participation in social activities, libraries need to pay more attention to supporting elderly citizens. Public libraries in Bangladesh exist in urban, suburban, and rural neighborhoods, and typically they have a long history in their community. This country-wide network of public libraries can help Bangladesh achieve UNSDGs like ‘SDG 3: Ensure healthy lives and promote wellbeing for all at all ages’ and ‘SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable’. There needs a wakeup call among the policy makers, public librarians and government to work for the well-being of the older adults, supporting mental health and designing library programs in combating ageism. A future study will focus why the elderly people are not involved in the service design process, and some targeted users (elderly people) will be invited to examine their real needs and then to provide more specific suggestions to improve the quality of the service of the public libraries in Bangladesh.
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AI or Authors?: A Comparative Analysis of BERT and ChatGPT’s Keyword Selection in Digital Divide Studies

Kang, Woojin  
Kyungpook National University, Republic of Korea  |  rkddnwls1234@knu.ac.kr

Lee, Myeong  
George Mason University, USA  |  mlee89@gmu.edu

Lee, Jongwook  
Kyungpook National University, Republic of Korea  |  jongwook@knu.ac.kr

Oh, Sanghee  
Sungkyunkwan University, Republic of Korea  |  sangheeoh@skku.edu

ABSTRACT
Author keywords attached to academic papers are often used in intellectual structure analysis. However, the length and selection criteria for keywords vary across publications and, even some publishers do not require keywords for their articles. To explore the opportunity to overcome such keyword inconsistency issues, this study compared author keywords from papers focused on the digital divide with those extracted using the language models, BERT and ChatGPT. Preliminary findings reveal structural variations across the keyword networks and suggest a potential need to revisit keyword-based research. Future research will expand the scope of the dataset and conduct an in-depth analysis of keyword patterns across the language models.

KEYWORDS
Author Keyword, Large Language Model, BERT, ChatGPT, Keyword Analysis

INTRODUCTION
The author keywords assigned to academic papers are widely used for indexing, searching, and bibliometric analysis, as they convey the core concepts of the papers (Lu et al., 2019). In bibliometric studies, it is common to create keyword networks by utilizing the co-occurrence frequency of keywords to understand the intellectual structure of a specific subject area. However, there are limitations in utilizing author keywords in the field. Previous studies acknowledged that the criteria for selecting keywords are ambiguous, the subjectivity of indexers may be involved, and the semantic relationships between keywords may be ignored (Chen & Xiao, 2016; He, 1999; Wang et al., 2012). Furthermore, many papers or bibliographic records do not contain author keywords (Lee et al., 2023). To explore the possibility to address these issues using large language models (LLMs), we compared the author keywords of academic papers about the "digital divide" with those generated by advanced LLMs, BERT and ChatGPT. Based on the keywords generated from them, we compared the topological characteristics of their networks.

METHOD

Data Collection and Keyword Extraction
Using the citation database Web of Science, we collected 2,180 articles published between 2017 and 2022 that contained "digital divide" or "digital inequality" in the title, abstract, or author keyword fields. Of the 2,180 articles, 142 (6.51%) had empty author keyword fields, while 19 articles (0.87%) were missing their abstracts. First, we found that there were 11,680 author keywords from 2,038 articles, with an average of 5.7 keywords per article (min=1, max=25, SD=2.02). Next, we used KeyBERT and ChatGPT to extract five keywords per article from the abstracts (Grootendorst, 2020). GPT-3.5 was used for ChatGPT as their APIs yielded a better scalability for extracting keywords, compared to those of GPT-4. The query we used for ChatGPT was "Extract five keywords from the text and separate them with semicolons." Also, we tuned the LLM parameters based on the face validity of the results. This method yielded 10,805 keywords extracted from 2,161 abstracts. The extracted keywords were standardized by converting all letters to lowercase and singularizing plural forms. Additionally, fuzzy matching based on the Levenshtein distance was applied to unify or disambiguate similar keywords.

Data Analysis
We first descriptively examined the distribution of author keywords and the keywords extracted using BERT and ChatGPT and investigated the proportion of duplicate and unique keywords. Next, we created three keyword networks using the sets of keywords based on the co-occurrences of keywords within the same paper using the Ochiai coefficient (Ochiai, 1957). As "digital divide" and "digital inequality" were used as search terms, they were excluded from the keyword networks. For the keyword networks, we calculated degree centralities, betweenness centralities, the number of components, and network density. Also, the degree centralities were fitted to the power-law distribution to better examine the networks’ topological characteristics.
PRELIMINARY FINDINGS

Keyword Distributions
Overall, 11,680 author keywords, 10,805 BERT-based keywords, and 10,805 ChatGPT-based keywords were extracted from the 2,180 articles. The number of unique keywords across all three models was 11,571, while the number of keywords that appeared in all models was 1,034 (8.9%). Upon examining the number of unique keywords in each model, 2,549 (22.0%) were identified as unique to author keywords, 3,689 (31.9%) to BERT, and 2,218 (19.2%) to ChatGPT. The number of common keywords between author keywords and BERT was 428 (3.7%), between author keywords and ChatGPT was 811 (7.0%), and between BERT and ChatGPT was 842 (7.3%). The top 10 most frequent keywords across the models exhibited similarities, with 7 out of 10 keywords (i.e., digital divide, COVID-19, digital inequality, Internet, ICT, social medium, older adult) being the same between author keywords and ChatGPT, and five keywords (i.e., digital divide, digital inequality, digital inclusion, Internet use, older adult) being the same between author keywords and BERT. We further examined the correlation between the rankings of keyword frequencies among the 1,034 keywords that appeared in all three models using Spearman's rank correlation. The results showed a correlation of .549 (p < .05) between author keywords and BERT, .686 (p < .05) between author keywords, and ChatGPT, and .594 (p < .05) between BERT and ChatGPT. This shows that the correlation between author keywords and ChatGPT is higher than that between author keywords and BERT.

Keyword Networks
Keyword networks are based on the co-occurrence frequencies (at least two times) of keywords for each model. The author keyword network had 531 nodes, 1138 edges, 16 components, and a density of 0.008. The BERT keyword network had 176 nodes, 216 edges, 20 components, and a density of 0.014. The ChatGPT keyword network had 328 nodes, 647 edges, 11 components, and a density of 0.012. Analysis of the degree centrality (dc) and betweenness centrality (bc) of keywords in each network revealed differences depending on the model as shown in Table 1. While the power-law fitting results show different topological structures across the three networks, the disparity in topology between author and ChatGPT-based keywords is smaller compared to that with BERT-based ones.

<table>
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</table>

Power-law distribution parameters for degree centralities

\[\alpha = 2.377 \ (x_{\text{min}} = 0.007, \sigma = 0.113)\]
\[D = 0.064\]
\[\alpha = 3.169 \ (x_{\text{min}} = 0.011, \sigma = 0.256)\]
\[D = 0.085\]
\[\alpha = 2.459 \ (x_{\text{min}} = 0.012, \sigma = 0.162)\]
\[D = 0.074\]

Note. The last row shows power-law distribution parameters when fitting the degree centralities. \(\alpha\) denotes the power-law coefficient, \(x_{\text{min}}\) is the point where the fitting started, \(\sigma\) is the standard error, and \(D\) is the Kolmogorov–Smirnov distance (Massey, 1951).

Table 1. Degree and betweenness centrality of top 10 keywords

DISCUSSION AND FUTURE WORK
Can AI replace authors in selecting keywords? While answering this question requires further analyses, the differences between three networks indicate that author keyword-based analyses could be revisited using LLMs’ keyword extraction capabilities. Because prior work that used author keywords could lead to topological and structural biases that stem from ambiguous criteria to select keywords and a lack of keywords in some publications, we hope our preliminary analysis opens up discussions for the potential use of LLMs in extracting keywords. Future work will expand the scope of the data and examine the differences before and after applying language models to supplement author keywords in papers with missing data. Examining the relationship between LLM parameters and the distribution of keyword networks is also crucial in assessing the robustness of the approach. Finally, future work needs to examine the quality of AI-generated keywords qualitatively to understand their consistency, accuracy, and reliability.
REFERENCES


**ABSTRACT**

Introduced by Microsoft in February 2023, Bing Chat is a feature of the Bing search engine that integrates an OpenAI large language model (LLM) customised for search (Mehdi, 2023a). This poster compares the outputs of Bing Chat and a standard existing search engine (DuckDuckGo) in response to identical keyword queries and corresponding natural language (NL) questions. Specifically, we examined: (1) the length of Bing Chat’s responses and DuckDuckGo’s first page of search results, by number of website links; and, (2) the length of Bing Chat’s textual summaries, by number of website links. We found that, on average, significantly fewer websites were linked in Bing Chat’s responses compared to DuckDuckGo’s search results. Our findings have important implications for website operators, who may receive less traffic and ad revenue if LLM-enabled search engines are widely adopted in the future. Human-Computer Interaction (HCI) will inevitably face the need for more research on human information behaviours adaptations in response to the changing search paradigm.

**KEYWORDS**

Search Engines; Bing Chat; DuckDuckGo; Large Language Models; ChatGPT

**INTRODUCTION**

In February 2023, Microsoft released a new AI-enhanced version of its search engine, Bing, to the public in a limited preview. A February 7th promotion from Microsoft announced that the new Bing contained a Chat feature and ran on “a new, next-generation OpenAI large language model that is more powerful than ChatGPT and customized specifically for search” (Mehdi, 2023a). Bing Chat’s launch garnered significant media hype (e.g., Roose, 2023), with both journalists and Microsoft stating that the service had the potential to reinvent search engines and fundamentally alter the way that users interact with the web (Mehdi, 2023a; Stokel-Walker, 2023). In the same month, Google provided a public demonstration of Bard, its conversational AI service (Pichai, 2023), prompting some to suggest that a new “AI arms race” (Chow & Perrigo, 2023; Stokel-Walker, 2023) or “war of the chatbots” (Rudolph et al., 2023) was underway.

A May 4th, 2023 Microsoft blog post announced that Bing had “grown to exceed 100 million daily active users”; in 90 days, customers had “engaged in over a half a billion chats” (Mehdi, 2023b). Bing Chat’s emergence and immediate popularity, along with Google’s stated plans to make Bard more widely available (Pichai, 2023), fulfill prior predictions that LLMs will be incorporated into search engines (van Dis et al., 2023).

**OBJECTIVES AND RESEARCH QUESTION**

Research has begun to investigate how LLMs compare to standard search engines. For example, Aljanabi et al. (2023) discuss the advantages of using ChatGPT-3 as a search engine, noting its ability to “understand the intent behind a query and provide information that is directly related to the question being asked” (p. 62). Another study replicated a user’s Google web searches on ChatGPT to compare how the services responded to queries related to health information (Dubin et al., 2023). To our knowledge, however, no study has assessed how a search engine with LLM integration, like Bing Chat, and a standard search engine respond to the same search tasks. Our work directly compares the outputs of Bing Chat and DuckDuckGo in response to identical keyword queries and NL questions, with a specific focus on: (1) the length of Bing Chat’s responses and DuckDuckGo’s first page of search results, by number of website links; and, (2) the length of Bing Chat’s textual summaries, by number of website links. Our research question (RQ) is: is there a significant difference between a standard search engine and an LLM-enabled search engine’s output, in their resulting number of website links initially presented to the user?

**METHODS: DATA COLLECTION AND ANALYSIS**

In March-April 2023, we performed internet searches on DuckDuckGo and Bing Chat, using an Edge Browser with cleared history and default settings. We obtained the top 10 keyword queries from the list of Google Search Trends’ “Rising search queries” (for Canada in March 2023). Top search queries are “[the] most popular search queries” for a given time period, while Rising search queries are those with “the biggest increase in search frequency since the last time period” (Google, 2023). Several of the Top search queries (e.g., “YouTube,” “Facebook,” etc.) appeared to have a navigational intent, with users aiming to visit a specific known website (Rose & Levinson, 2004). The Rising
search queries better represented informational intent, where the user’s goal is “to learn something by reading or viewing web pages” (Rose & Levinson, 2004, p. 15). Compared to navigational search tasks, informational search tasks are more appropriate for our study because they are more complex and better suited to the capabilities of chatbots. This study used Rising search queries (representing informational intent) instead of the Top search queries. The list of 10 frequently-searched keywords (for March 2023 in Canada) was as follows: 1. Miami Open; 2. Indian Wells; 3. Filipino adobo; 4. Nowruz; 5. March Madness; 6. Lance Reddick; 7. Euro qualifiers; 8. Scream 6; 9. Ramadan 2023; 10. Temu.

NL question search was deemed important for this study. “Search engines are observing an increase in the fraction of Web search queries that take the form of natural language” (White et al., 2015, p. 135), and the incorporation of LLMs like ChatGPT-3 – which has the “ability to understand and respond to natural language queries” (Aljanabi et al., 2023, p. 62) – into search engines may accelerate this trend. We generated 10 NL questions by recording the first NL query that was presented in Google’s “People also ask” panel for each corresponding keyword (in italics): e.g., 1. What is the prize for winning the *Miami Open*?; or, 9. What are the *Ramadan* dates for 2023?

The total number of website links were counted for each keyword query and NL question in DuckDuckGo’s first page of search results and in Bing Chat’s responses for a paired between-group comparison test (a two-tailed distribution t-test). The number of website links specifically cited in Bing Chat’s textual summaries were also counted. Repeats and links to images and videos were excluded; multiple webpages from a single website were only counted once. Figure 1 shows an example screenshot of a Bing Chat response from our dataset: we analyzed the content within the light grey box, namely the textual summary, footnotes linking to websites within the textual summary, and website links listed at the bottom next to “Learn more.”

**Figure 1. Example of a Bing Chat response from our dataset**

**RESULTS AND DISCUSSION**

We found a significant difference in the number of website links returned by the Bing Chat search (M=4.2, SD=1.2) versus by the DuckDuckGo search (M=9.6, SD=2.7); t(19)=8.46, p<0.001. On average, Bing Chat returned significantly fewer website links (4.2) compared to DuckDuckGo (9.6 links), across a combined total of keyword queries and NL questions. The discrepancy grows when considering only the number of websites cited within Bing Chat’s textual summaries (2.35 links, on average). Bing Chat cited a slightly larger number of websites (2.7 links) within these summaries for NL questions versus 2.0 links for keyword queries, on average.

Since its inception, some have speculated that Bing Chat will drive less traffic to websites, thereby reducing the ad revenue that these sites receive and often rely on to operate (e.g., Vincent, 2023). Our results suggest that these concerns are warranted. We found that Bing Chat exposes users to a narrower range of website links than a standard search engine like DuckDuckGo, with Bing Chat’s textual summaries, in particular, citing a highly limited number of websites. Furthermore, for over half (11/20) of all searches, some “Learn more” website links could only be accessed by clicking an additional button (see Figure 1). There is also no guarantee that users will want or need to click the website links that Bing Chat presents; indeed, Microsoft’s February 7th blog post explicitly highlights the capability of the new Bing to provide “[c]omplete answers” (Mehdi, 2023a). Since the new Bing “reviews results from across the web to find and summarize the answer you’re looking for,” users can obtain detailed answers “without scrolling through multiple results” (Mehdi, 2023a). The possibility of LLM-enabled search engines, like Bing Chat, gaining rapid adoption in the future raises the question of how website operators will be compensated for their content – and whether they will have sufficient incentives and/or resources to continue operating.

**CONCLUSION**

Our work provides empirical evidence that a search engine with LLM integration returns significantly fewer website links – particularly in its textual summaries – compared to a standard search engine. We intend to build on this work by expanding the number of search tasks that are completed and analyzed and classifying the returned linked websites by their type: legacy publisher, community-edited, social media, and commercial.
ACKNOWLEDGMENTS
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Retaining LIS Professionals of Color: Examining Job Survival through Survival Analysis

Kim, Sunha  University at Buffalo, USA | sunhakim@buffalo.edu
VanScoy, Amy  University at Buffalo, USA | van scoy@buffalo.edu
Crabtree, Ayiana  University at Buffalo, USA | ayianacr@buffalo.edu

ABSTRACT
Examining the factors influencing the decision of Library and Information Science (LIS) professionals to leave their positions, we conducted a survival analysis using the WILIS2 dataset, with a specific focus on professionals of color. In our study, we investigated the impact of the comfort level with newer technology and the perceived effectiveness of online courses during their graduate program on professionals' retention decisions, while also examining potential differential effects across racial groups. The results revealed that both the comfort level with newer technology and the perceived effectiveness of online courses were significantly positively associated with professionals' decision to stay in their positions. Importantly, we found no significant differential effects of these factors across different racial groups. These findings provide empirical support for promoting a comfortable level of technological proficiency and recognizing the value of online education as effective strategies to improve retention rates among LIS professionals, particularly those from minoritized backgrounds. Additionally, we discussed the implications of our study for Equity, Diversity, Justice, and Inclusion (EDJI) in the field, and offered suggestions for fostering an inclusive and supportive environment based on our findings.

KEYWORDS
retention, LIS professionals of color, technology, online education, survival analysis

INTRODUCTION
The retention of professionals of color in the field of Library and Information Science (LIS) is a matter of utmost significance, particularly given the persistently high turnover rates (Jaeger et al., 2011; Jones & Murphy, 2019; Rosa & Henke, 2017). To address this issue, it is crucial to explore various factors that contribute to retention, with a particular focus on ensuring a comfortable level with newer technology and a perceived effectiveness of online courses during their graduate program. Proficiency in digital tools and platforms is indispensable for professionals to meet the evolving needs of the LIS field (Binici, 2021). This study aims to delve into the significance of retaining professionals of color in LIS and highlight how equipping them with technological skills and promoting online education can significantly improve retention rates (Krtalic & Mandl, 2019; Maceli, 2018). To achieve this, we utilized survival analysis techniques on data from the Workforce Issues in Library and Information Science 2 project (WILIS 2), a comprehensive and representative dataset from North America. Survival analysis is an appropriate method for examining attrition and retention outcomes in a longitudinal framework (Allison, 2010; Singer & Willett, 2003). This study specifically focuses on the comfort level with newer technology and the perceived effectiveness of online courses during their graduate program as important predictors of retention in the digital age. The research questions guiding this study are: What is the pattern of job departure trajectory among LIS professionals of color? Does comfort with newer technology and effective online courses successfully predict retention probability? And if so, do these factors have differential effects across different racial groups?

METHODS
The database utilized for our analysis is the Workforce Issues in Library and Information Science 2 (WILIS 2) dataset. This comprehensive dataset collected information from graduates of 39 LIS programs in North America. The survey items covered various aspects such as program assessment, employment status, career progression, career satisfaction, and continuing education (Marshall et al., 2010). WILIS 2 is the most recently completed longitudinal dataset in North America. Our study focused on a subsample of 302 LIS professionals of color who started their first job between 1988 and 2010 and either remained in or left their positions within the study timeframe. The dependent variable of our study was job departure status, coded as 0 for still working and 1 for leaving the job. We also measured the duration from the start of their first job (captured by the "start_time" item) after obtaining their LIS graduate degrees until attrition or retention (captured by the "end_time" item). To explore variables influencing retention, we analyzed the effects of respondents' comfort with newer software (referred to as "software"), perceived effectiveness of online courses in their graduate program (referred to as "online"), and job satisfaction (referred to as "satis"). Additionally, we investigated potential differences in the effects of software and online variables between Latino and non-Latino professionals among LIS professionals of color, by including a Latino variable (referred to as "latino") and two interaction terms, namely "lat_soft" and "lat_online." The software variable used the item "I dread new versions of software." The online variable was measured by the item "Thinking about your courses delivered online, how effective did you find this delivery format?" with responses ranging from 1 to 5.
(strongly agree) to 4 (strongly disagree). Job satisfaction was assessed with the item "Overall, I am satisfied with what I do in my job," using a scale from 1 (strongly disagree) to 4 (strongly agree). Lastly, we included the item "Are you Spanish/Hispanic/Latino?" (coded as 0 = No; 1 = Yes) to create two interaction terms: lat_soft, which multiplied the latino variable with the software variable, and lat_online, which combined the latino and online variables. These interaction terms were used to examine the differential effects of software and online variables between Hispanic and non-Hispanic groups.

The primary analytical method employed in this study was survival analysis, a suitable method to examine the occurrence and timing of job departure events using longitudinal data (Allison, 2010; Singer & Willett, 2003). At the initial stage, we created graphical plots to illustrate the hazard probabilities of job departures to visually demonstrate the departure probability patterns. Subsequently, we developed a survival analysis model that incorporated the aforementioned variables to forecast the probability of job departure specifically for professionals of color in the LIS field.

RESULTS

The hazard probabilities demonstrated a pronounced elevation within the first three years, with the peak occurring in the first year (refer to Figure 1).

![Figure 1. Estimated hazard probabilities](image)

Table 1 presents the results of our analysis, indicating that a higher comfort level with newer software significantly reduced the likelihood of job departure \( (e^{\text{coefficient}} = 0.424, p < 0.05) \). Similarly, LIS professionals of color who perceived online courses during their graduate program as more effective were significantly less likely to leave their job \( (e^{\text{coefficient}} = 0.563, p < 0.05) \). Importantly, we found no differential effects of these variables between Latino and non-Latino groups \( (\text{lat_soft}: e^{\text{coefficient}} = 1.257, p > 0.05; \text{lat_online}: e^{\text{coefficient}} = 0.782, p > 0.05) \). The results indicate that both the comfort level with newer technology and the perceived effectiveness of online courses were significantly positively associated with professionals' decision to stay in their positions, regardless of their ethnic background.

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Table 1. Analysis Results from a Survival Analysis Model

CONCLUSION

In conclusion, the retention of professionals of color in the LIS field plays a critical role in fostering an inclusive and diverse profession (Harper, 2020; Vinopaul, 2016). To effectively address the high turnover rates, a comprehensive approach is necessary (e.g., Caragher & Bryant, 2023, Senteio et al., 2021). Ensuring a comfortable level with newer technology and a perceived effectiveness of online courses during their graduate program emerges as a significant factor based on our findings (Read & Cox, 2020; Tattersall, 2019). Proficiency in digital tools and platforms is indispensable for LIS professionals to serve diverse stakeholders and contribute to the transformation and innovation of the LIS field. By prioritizing technological literacy and recognizing the value of online education, graduate programs and the LIS community can create an environment that supports the career development, satisfaction, and retention of professionals of color. Our study's unique contribution, utilizing survival analysis with interaction terms in the longitudinal analysis framework, expands upon existing studies and offers insights specifically focused on minority LIS professionals using the WILIS2 data (e.g., Marshall et al., 2009; 2010; Rathbun-Grubb, 2016).
ACKNOWLEDGMENTS
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Reading Comprehension in Information Retrieval (RCIR) for Personalized Results

Kim, Yumi  Kyungpook National University, South Korea | yumikim@knu.ac.kr
Kim, Heesop  Kyungpook National University, South Korea | heesop@knu.ac.kr

ABSTRACT
Recent research on personalized retrieval technology has been actively conducted to meet the needs of users for seeking adequate information. To refine the retrieval, researchers are considering user behavior patterns in a variety of ways. In this study, we use eye-tracking metadata to predict users' levels of comprehension as textual evidence for IR processes. Furthermore, we incorporated eye-tracking metadata on the Automated Readability Index (ARI), a readability assessment tool of an English text. Our research is largely divided into two tasks: i) comprehension evaluation task (CET) and ii) comprehension-based retrieval task (CRT). In the CET task, for predicting the comprehension level, we applied various regression models. Among them, the Voting regressor demonstrated the highest performance with a Spearman's \( \rho \) of 0.68. In the CRT task, we incorporated the level of comprehension predicted in the CET task and ARI score into the ranking results. We derived a sentenceBERT to find the relevant text for a query and the Normalized Discounted Cumulative Gain (nDCG) for evaluating the CRT task. The nDCG score for Comprehension Level only and that with ARI together were 0.65 and 0.78, respectively. Thus, applying ARI resulted in a higher nDCG score compared to comprehension level only.

KEYWORDS
Reading comprehension; Information Retrieval; Personalization; Eye-tracking; Automated Readability Index

INTRODUCTION
In order to provide personalized information retrieval to users, recent research tried to apply user behavior patterns, such as facial expression data (Arapakis et al., 2010). Although many studies have been done on machine learning approach for information retrieval, little work has focused on reading comprehension in personalized information retrieval. One such research effort has been done in Reading Comprehension in Information Retrieval (RCIR) (Healy et al., 2022) pilot task in NTCIR which is a series of evaluation workshops designed to enhance research in Information Access (IA) technologies (Kando et al., 1999). In this pilot task, they integrated reading comprehension measures from eye tracking as a source of evidence when ranking text content. In this paper, we adopted the Automated Readability Index (ARI), a readability assessment tool of an English text to enhance the performance of the task. Our study focuses on two sub-tasks: the Comprehension Evaluation Task (CET) and the Comprehension-based Retrieval Task (CRT). In the CET task, we compare the predictive performance of four regression models. Additionally, our proposed CRT task explores the integration of comprehension prediction models from the CET task into an information retrieval system that ranks results based on comprehension scores and ARI of texts. The findings from our research provide insights into human reading and information seeking processes, and offer potential improvements for machine systems in meeting users’ information needs.

METHODS
Dataset
The dataset obtained in the NTCIR-16 RCIR Task is structured into 9 directories (from 0000 to 0008). Each directory contains one volunteer’s reading data and other associating metadata for model training. Each volunteer has 72 records in the form of a csv file, accordingly (Healy et al., 2022). The reading data consists of comprehension score, topic and text ids, the duration of reading, and the number of total words. The comprehension score, denoted as \( c_{\text{score}} \), is defined by the number of correct answers by a volunteer to three multiple choice questions per paragraph.

Eye-tracking Feature Extraction and Adding ARI for Improved Performance
During the experiment, eye-movement measurements were collected using an eye-tracker system as participants read the text. The raw eye-tracking data for each record has been processed to extract meaningful features, such as fixations, saccades, blinks, and pupil size. More detailed presentation of the eye-tracking feature can be found in (Healy, 2022).

Automated Readability Index (ARI) is a readability measurement tool for evaluating the difficulty level of an English text based on its words (Readable, 2021). The ARI estimates the grade level needed to understand a text, similar to other readability formulas such as Flesch-Kincaid Grade Level and SMOG index. It considers the average words per sentence and average characters per word to calculate a score, which is then mapped to a grade level category. Lower scores indicate easier readability and lower grade levels for comprehension. We employed textstat 0.7.3, a user-friendly Python library, to calculate statistics from the text.
CET Task
In this paper, we predict the comprehension score (c_score) of volunteers. Other associated metadata includes the pre-computed 302 features from the volunteer’s eye-tracking data and ARI scores. To compare with previous research (Kim et al., 2022) results where ARI was not included in the dataset, we utilized the same four regression models (Linear Regression, Random Forest, Gradient Boosting, and Voting Regressor) used in the previous study.

CRT Task
In order to find relevant texts for a query, we adopted S-BERT (Reimers & Gurevych, 2019). Texts were preprocessed through tokenization, cleaning, and normalization using re Python package for processing regular expressions. We apply embedding to convert out text into a vector using the S-BERT model, followed by searching texts and query. Finally, we rank searched texts by computing the cosine-similarity between the query and texts.

We employed the Normalized Discounted Cumulative Gain (nDCG) proposed by Järvelin and Kekäläinen (2002) for evaluating the CRT task. DCG (RL) for nDCG is defined by
$$\text{DCG} = \sum_{i=1}^{n} \frac{\text{text_score}(R_L)}{\log_2(i+1)},$$
where RL is the ranked list.

The text score of a text $T$ is calculated as follows:
$$\text{text_score}(T) = (c_{score}(T) + 1) \times \frac{1}{\text{ARI_score}} \times \text{rel_score}(T),$$
where $c_{score}(T)$ is the true comprehension score of text $T$ (c_score $\in \{0, 1, 2, 3\}$), and rel_score ($T$) is the text relevancy to the query which is either 0 (not relevant) or 1 (relevant). The ARI score indicates the text difficulty and readability ranging from 1 to 15.

FINDINGS

Findings of CET Task
Training data divided into training data and test data at a ratio of 3:1. We utilized the test data to evaluate the performance of each model, and compared the performance of each model with Spearman’s rank correlation coefficient (Spearman’s $\rho$) and prediction values. Table 1 presents the previous work, which was submitted to NTCIR-16 and the proposed method in this study. When comparing the results of the regression models applied to the newly augmented dataset with ARI scores, we can observe an improvement in performance across all models. These results demonstrate a higher performance compared to the CET results (0.60(Nguyen et al., 2022), 0.51(Liu et al., 2022)) of the other two teams in the NCTIR-16 in 2022.

<table>
<thead>
<tr>
<th>Model</th>
<th>Kim et al. (2022)</th>
<th>Nguyen et al. (2022)</th>
<th>Liu et al. (2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gradient Boost Regressor</td>
<td>0.6742</td>
<td>0.5319</td>
<td>0.60</td>
</tr>
<tr>
<td>Random Forest Regressor</td>
<td>0.6619</td>
<td>0.5706</td>
<td>0.51</td>
</tr>
<tr>
<td>Linear Regression</td>
<td>0.5272</td>
<td>0.0502</td>
<td></td>
</tr>
<tr>
<td>Voting Regressor</td>
<td>0.6807</td>
<td>0.3112</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Spearman’s rank correlation coefficient (Spearman’s $\rho$)

Findings of CRT Task
Topic modeling process has been utilized to group texts into several topics. During this process, a topic_id has been assigned to each text, with six topics being used. In this work, the query for the CRT task is related only with Topic 1, as in the following:
- Find Texts that describe/discuss the teaching strategy and the learning process in school. Texts that capture the students’ opinion about their school and stories of students’ school life are also relevant.

Table 2 shows the nDCG@5 scores produced by all volunteers. The results indicates that applying ARI resulted in a higher nDCG score compared to comprehension level only.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Sentence-BERT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply Comprehension Scores</td>
<td>0.651</td>
</tr>
<tr>
<td>Apply Comprehension and ARI Scores</td>
<td>0.778</td>
</tr>
</tbody>
</table>

Table 2. Comparison between the nDCG@5 Scores

CONCLUSION
In the CET task, we utilized various regression models to predict the comprehension level. Among them, the Voting regressor exhibited the highest performance with a Spearman’s $\rho$ of 0.68. For the CRT task, we incorporated the predicted comprehension level from the CET task and the ARI score into the ranking results. The nDCG score for comprehension level alone was 0.65, while the score increased to 0.78 when considering both comprehension level and ARI. Thus, incorporating ARI resulted in a higher nDCG score compared to considering comprehension level alone. In addition, RATE_X_BWD (frequency of the eyes moving back and fixating on certain points), RATE_BLINK (number of blinks), FIXA_X_FWD_tr_max, and FIXA_X_FWD_max-min (forward and backward movement distances) are key features used to predict comprehension level in the models with the best performance. Our research findings offer valuable insights into the processes of human reading and information seeking. These insights also have the potential to drive improvements in enabling them to better meet users’ information needs.
REFERENCES


Usability Evaluation of Kiosks for Visually Impaired College Students

Kim, Yumi  
Kyungpook National University, South Korea  |  yumikim@knu.ac.kr

Kim, Kyounghoon  
Kyungpook National University, South Korea  |  hoonius@knu.ac.kr

Lee, Jongwook  
Kyungpook National University, South Korea  |  jongwook@knu.ac.kr

ABSTRACT
In the rapid flow of digital transformation, kiosks have naturally become part of our daily lives. In this study, we targeted visually impaired college students in their 20s, the primary user group of kiosks. We evaluated the usability of a self-service certificate issuance and fast-food restaurant kiosks. Based on Nielsen's five usability evaluation criteria, we presented experimental tasks to the visually impaired college students, monitored their performance, and conducted interviews to assess usability. Through this process, we aimed to understand the usage difficulties of visually impaired people when using kiosks and identify their specific requirements. Furthermore, we aimed to provide insights into improving the accessibility and usability of kiosks for this population and offer practical implications for developing kiosk education programs.

KEYWORDS
Usability evaluation; Kiosk; Visually impaired people; Under-represented group; Digital divide

INTRODUCTION
The growing reliance on non-face-to-face interactions and social distancing measures caused by COVID-19 has led to the increasing adoption of kiosks worldwide. However, it is worth noting that most existing kiosk products primarily cater to the needs of non-disabled individuals, and there is a lack of accessibility for socially disadvantaged groups. In this study, we aim to address this research gap and enhance understanding of the kiosk usage difficulties among visually impaired people who experience impaired vision and are unable to engage in normal visual activities (Jones et al., 2019; Leat et al., 1999). We constructed tasks based on Nielsen's (1994) five usability criteria and conducted usability evaluations by observing participants' task performance and post-interviews. Furthermore, we selected four non-visually impaired college students as a comparative group for the usability evaluation and compared the results. By understanding their usage difficulties and needs concerning kiosks, we can gain insights to bridge the digital divide for visually impaired people.

METHODS
Selection of Kiosks and Study Participants
In this study, we selected certificate issuance and food court kiosks for ordering food as our evaluation targets. These kiosks were located at College A, a university in South Korea having a high proportion of disabled students. The participants of this study were selected as students with visual impairments in their 20s registered at the Disability Support Center (DSC) of College A. Among the 44 visually impaired college students registered at the DSC, eight participants with prior kiosk experience were selected, considering their types and degrees of disabilities. Additionally, four non-visually impaired college students were selected to participate in the study as a comparative group for usability evaluation.

Data Collection and Analysis
Based on Nielsen's (1994) five usability evaluation criteria (learnability, efficiency, memorability, errors, and user satisfaction), tasks were developed and assigned. The observational evaluation involved participants independently navigating the kiosk, performing the assigned tasks, and achieving task success. The process was observed by the evaluator and recorded through video footage. Furthermore, we conducted in-depth interviews with the participants after they completed the tasks. These interviews aimed to capture their personal opinions and identify any factors that may have been difficult to observe during the observational evaluation. The observation involved measuring and comparing participants' task success rates, task duration, and error frequencies. The interviews were conducted after obtaining the participants' consent, and the transcribed data from the recorded interviews were analyzed. Nielsen's (2000) evaluation criteria were categorized to distinguish the relevant content based on each criterion. Two authors coded the interview results collaboratively, and the third-party expert participated in the analysis phase, minimizing subjective interpretation.

FINDINGS
The study participants used smartphone magnifier apps to explore the screen or brought their faces closer to the screen to touch the buttons and took longer to navigate the screen, as shown in Figure 1. They were conscious of the people standing behind them, and even during crowded hours, they were particularly apprehensive and hesitant about using the kiosk, feeling a significant sense of discomfort or unease.
Findings from Observational Analysis

"Success" refers to whether participants completed the tasks within the given time (5 minutes), and "number of errors" represents the count of incorrect touches made during task execution. As shown in Table 2, the success rates for tasks of both kiosks among participants with visual impairments were 75%, while participants without visual impairments achieved a 100% success rate. Additionally, participants with visual impairments took approximately twice as long as participants without visual impairments to complete the tasks on average. Notably, many errors occurred during the login attempts in the certificate issuance kiosk case. The fast food kiosk, designed for commercial purposes, had a higher touch sensitivity and larger menu size in its user interface compared to the certificate issuance kiosk. As a result, a fast food kiosk exhibited lower error rates and shorter task duration than the certificate issuance kiosk. The participants' learnability, usability, and memorability of kiosks were found to be influenced by their previous task performance. Participants tend to decrease error frequencies as they become more familiar and experienced with the tasks, gradually reducing mistakes and errors.

<table>
<thead>
<tr>
<th>Category</th>
<th>Certificate Issuance Kiosk</th>
<th>Fast Food Kiosk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>with visual impairments</td>
<td>without visual</td>
</tr>
<tr>
<td>Success rates</td>
<td>75 %</td>
<td>100%</td>
</tr>
<tr>
<td>Task duration (mean)</td>
<td>130 s</td>
<td>74 s</td>
</tr>
<tr>
<td>Number of errors (mean)</td>
<td>12.8</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Table 1. Results from observational analysis

Findings from Interview
The qualitative interview identified nine key themes (feedback, consistency, size of button, brightness contrast, content differentiation, font size, physical buttons, zoom-in-out, and tablet-based kiosk) within two categories: satisfaction and requirements. Factors that may influence satisfaction were identified: feedback, UI consistency, size of touch buttons, brightness contrast, content differentiation, and font size. Remarkably, participants who relied on assistive devices (such as smartphone magnification features) experienced difficulties or could not use the kiosk. The requirements include physical buttons, zoom-in-out functionality on the kiosk screen, and a tablet-based kiosk. Participants expressed a need for physical buttons that could be perceived through touch rather than relying solely on touchscreen buttons. They also requested the functionality to zoom in and out on the kiosk screen, eliminating the need for assistive tools like smartphone apps. Moreover, the demand for a tablet-based kiosk, in particular, is interpreted as reflecting the characteristics of individuals in their 20s who are familiar with smartphones.

DISCUSSION AND CONCLUSION

The study aims to observe the use of kiosks by people with visual impairments, identify difficulties and requirements during the usage process, and propose improvement suggestions. By evaluating the usability of both public (college certificate issuance) and private (fast-food restaurant) kiosks, we aim to shed light on the kiosk-related challenges and offer valuable insights. For future work, we aim to gain a deep understanding of kiosks' technical aspects, trends, and implementation strategies by consulting with experts and developers specializing in educational kiosks. This knowledge is a foundation for addressing digital and information inequality issues associated with kiosks, proposing usability improvements, and contributing to developing kiosk education programs. Ultimately, this research has the potential to help bridge the digital divide for people with visual impairments.
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Toward the Conceptualization of Data Quality Assurance in Research Data Repositories

Lee, Dong Joon  
Texas A&M University, USA | djlee@tamu.edu

Ali, Faizan  
Florida State University, USA | fa21g@fsu.edu

Stvilia, Besiki  
Florida State University, USA | bstvilia@fsu.edu

Pang, Yuanying  
Florida State University, USA | yp22c@fsu.edu

Gonthina, Karthik  
Florida State University, USA | kg21g@fsu.edu

ABSTRACT

Data quality assurance (DQA) is critical to research data sharing and reuse. There has been a growing recognition of data transparency, reproducibility, credibility, and validity in research. Although the research data curation literature is large, it lacks data quality theory-guided examinations of DQA practices in research data repositories. This poster paper reports on the preliminary findings of a larger study that examines DQA practices in research data repositories, including their use of DQA ontologies, standards, and metadata vocabularies. In particular, the paper examines two quality standards and an ontology for their conceptualization of DQA activities and their structure. The authors used the findings of the analysis and the data quality literature to synthesize an initial model of a DQA process in research data repositories that conceptualizes three DQA activities: evaluation, intervention, and communication. This paper can inform the development of ontologies and best practice guides for designing and evaluating DQA workflows in research data repositories.

INTRODUCTION

Ensuring the quality of research data has always been important, but recent developments in federal government policy on public access (Marcum & Donohue, 2022; Nelson, 2022) and the adoption of the FAIR principles have highlighted the importance of data quality assurance (DQA). The new government regulation mandates not only sharing of literature, datasets, and associated metadata of federally funded projects but also making that discoverable and high quality (NSTC, 2022). Quality can be defined as fitness for use (Juran, 1992). Data and metadata quality are critical for research reproducibility and replicability (NASEM, 2019). Furthermore, one of the main inhibitors of research data sharing and reuse is concern about the quality of data. Data owners can be concerned about the quality and/or documentation of their data and its potential misuse or misinterpretation by others (Stvilia et al., 2015). The users, on the other hand, need useful, valid, and trustworthy data that represents the phenomena they are interested in (Stvilia & Gibradze, 2022). There are many studies of research data curation communities, and most focus on data curation practices (e.g., Lee & Stvilia, 2017; Witt, 2012) and training/instructions (e.g., Carlson et al., 2011; Xu et al., 2023) in general. There is a lack of best practices on DQA. According to Xu’s scoping review on research data management (RDM) practice in academic libraries (2022), data quality was not even a topic covered by RDM training programs.

Metadata vocabularies, ontologies, and standards encode the needs and requirements of stakeholder communities and representations of their activity workflows (Chandrasekaran et al., 1999). Surveying and analyzing the existing data quality standards, ontologies, and metadata vocabularies can help establish the “state of the art” of DQA knowledge representation. This representation can inform the synthesis of a DQA ontology for research data curation that is grounded in the data and information quality literature and aligned with the DQA practices of research data repositories. This poster paper contributes to that goal by exploring the following research question: What DQA components are modeled in the standards, vocabularies, and ontologies referenced and used in the DQA practices of research data repositories, and how?

DESIGN

This poster paper reports on a part of a larger, exploratory study. The data sample used by the study comprised approved applications of 122 data repositories for the CoreTrustSeal Board for the Core Trustworthy Data Repositories (https://www.worlddatasystem.org/organization/intro-to-wds), interviews with 32 curators and repository managers, and data curation related webpages of their repository websites (109 documents). The data was collected from April 2022 to February 2023. The combined dataset represented 146 unique cases of research data repositories. The analysis of the collected data identified 14 metadata vocabularies, ontologies, and standards that conceptualized and modeled DQA components. This work in progress poster reports on the examination of and synthesis from three quality related knowledge tools most frequently referenced in the data: Data Quality Vocabulary (DQV), ISO 9000 Quality management systems, ISO 19157 Geographic information – Data Quality.

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PRELIMINARY FINDINGS
A research data repository can be conceptualized as a three-module system: data submission, management, and dissemination (CCSDS, 2012). DQA is applicable to any of these modules, and they shape the context of iterative and continuous DQA activities. Our analysis identified three DQA activities referenced in the sample: data and metadata evaluation, intervention, and communication. The following sections conceptualize these DQA activities by mapping and aggregating relevant concepts from DQV, ISO 9000, and ISO 19157 (see Figure 1).

Figure 1. Task flow chart of data quality assurance practices

EVALUATION
Evaluation consists of four different parts, (1) management system (2) measurement action, (3) output, and (4) quality requirements and motivation. As shown in Figure 1, the management system is data curators’ tools for DQA tasks. These elements help establish DQA boundaries, objectives, and processes to achieve the goals of data repositories. Measurement actions include different methods for curators or researchers to determine the quality characteristics and values of submitted datasets. The results of measurement actions based on the management system are documented as measurement values. Then the submitted datasets are categorized either into service or product. Datasets in service require activities of intervention and communication to improve data quality; on the other hand, datasets in product are ready to publish through publishing platforms. Quality issues or problems identified from measurement actions connect to quality requirements and motivations.

Intervention
When datasets are in the service stage with necessary quality requirements and motivations, agents (e.g., researchers or curators) conduct one or more DQA actions (i.e., planning, assurance, control, and improvement) from intervention on datasets to improve the quality of data and its metadata. Quality requirements and motivations are a prerequisite to the improvement actions, and the improvement (and continual improvement) is an iterative process.

COMMUNICATION
Communication accompanies both data quality evaluation and intervention. Data curators and their teams communicate and share DQ information among themselves during the evaluation phase. They also collaborate and share DQ information with providers both during DQ evaluation and intervention activities. Finally, DQ information, as quality provenance, can be communicated to/from the public and end-users of datasets. Quality annotation is a part of documenting and/or publishing any information about the quality of given datasets.

CONCLUSION
This poster paper analyzes three quality related knowledge tools and develops an initial model of a DQA process for research data repositories. This paper can inform the development of ontologies and best practice guides for designing and evaluating DQA workflows in research data repositories. The future related research will refine and extend the model by analyzing additional knowledge representation tools and empirical data of DQA practices in research data repositories.

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Are We on the Same Page about Data Sharing? A Bibliometric Comparison Between Biomedicine and Information Science Literature

Lee, Jian-Sin  
University of Michigan, USA | jianslee@umich.edu

ABSTRACT
Data sharing has been an extensively discussed subject in both the information science and biomedicine communities. However, the two communities do not seem to speak to each other. Such an absence of exchange of perspectives can lead to siloed knowledge, duplicated work, and hindered collaboration. To uncover existing knowledge gaps, this poster depicts the bibliometric relationships between relevant literature in the fields of information science and library science (ISLS) and biomedicine and health sciences (BMHS). The findings demonstrate stronger bibliographic couplings within ISLS publications and between ISLS and multidisciplinary science publications, compared to the BMHS group. In addition, the examined ISLS and BMHS publications exhibit distinct topical foci on open science. This poster is expected to serve as a first step toward stimulating more conversations in the information science community, as well as bringing the discussions to the biomedicine community in the near future.

KEYWORDS
Data sharing; Open science; Biomedical and health data; Scientometrics; Scholarly communication.

INTRODUCTION
As early as 2003, the U.S. National Institutes of Health (NIH) attempted to foster biomedical data sharing by introducing the Statement on Sharing Research Data. In January 2023, the most recent NIH Data Management and Sharing Policy came into effect. Compared to other disciplines influenced more by comparable mandates that the National Science Foundation (NSF) issued in the early 2010s, biomedicine has been recognized for its relatively advanced data-sharing culture (Pampel & Dallmeier-Tiessen, 2014). While promoting open science for the scientific society, information science scholars have investigated the data-sharing practices of biomedical researchers (e.g., Kim & Kim, 2015). Similarly, biomedical scholars continue to advocate among fellows for more data-sharing efforts (e.g., Cristea et al., 2022). However, these two communities do not appear to speak to each other regarding their common ideas about data sharing. Such an absence of communication of perspectives can lead to siloed knowledge, duplicated work, and hindered collaboration.

To help researchers and practitioners from both scholarly communities identify shared and divergent understandings of data sharing, this poster aims to depict the bibliometric relationships between literature related to data sharing for research purposes in information science and library science (ISLS) and biomedicine and health sciences (BMHS). The bibliometric analyses encompass three aspects: bibliographic coupling, highly cited references, and topical similarities. Considering the abundance of renowned articles on the same topic published in multidisciplinary journals (e.g., Tenopir et al., 2011), the present study’s sample incorporates multidisciplinary science (MULT) literature for comparative purposes. Additional methodological details and findings are available on the Open Science Framework platform: https://osf.io/wkh8y/.

METHODS
The bibliographic data analyzed in this study were sourced from the Web of Science (WoS) database. The literature search was conducted within the WoS Core Collection, using the query: (TI=(data sharing) OR TS=(“data sharing”)) AND TS=(research* OR scienti*). The selected date range spans from 2003-01-01 to 2022-12-31, covering the two-decade period between the two NIH statements. The BMHS, ISLS, and MULT literature was derived from their respective WoS Categories: the 59 categories in the Clinical Medicine group, the Information Science & Library Science category, and the Multidisciplinary Sciences category. The titles and abstracts of the associated 870, 353, and 330 resulting records, sorted by relevance, were then manually screened, and the first 250 qualified publications (mostly journal articles) in each group were finalized as the sample (n=750). The data cleansing and exploratory data analysis processes were facilitated using Python, and the network visualization was performed with Gephi and its built-in layout algorithm Force Atlas, which renders most connected nodes closer to each other (Jacomy, 2020).

PRELIMINARY RESULTS
Bibliographic Coupling. Figure 1(a) presents a network visualization illustrating the bibliographic coupling of the 750 sampled publications. Each node represents a publication, with its color indicating the corresponding subject category. The size of each node reflects its degree—the number of edges connecting a node to others. In other words, larger nodes denote publications that share references with a greater number of other publications.

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Additionally, the width of an edge implies the number of shared references between the two connected publications. The color of an edge signifies the subject category of the two publications. In cases where the publications belong to different subject categories, the color of the edge would be a mix of the two respective colors.

Overall, given the closer proximity of larger ISLS nodes, Figure 1(a) shows a stronger bibliographic coupling within the ISLS group than BMHS. This is evidenced by the difference in the average within-group coupling strengths (S) of the two groups: $S_{ISLS}=2.34$, while $S_{BMHS}=1.53$. According to Kessler (1963), coupling strengths represent the number of coupling units (i.e., references) shared between two documents. Additionally, with more and larger MULT nodes embedded in the ISLS cluster, Figure 1(a) suggests a stronger bibliographic coupling between the ISLS and MULT groups compared to the ISLS-BMHS coupling ($S_{ISLS-MULT}=1.86$, $S_{ISLS-BMHS}=1.44$).

![Figure 1. (a) Bibliographic coupling network of the sampled publications; (b) Proportion of sampled publications in each group (n=250*3) citing the top five HCRs from BMHS, ISLS, and MULT venues](image)

<table>
<thead>
<tr>
<th>Venue</th>
<th>Rank</th>
<th>Highly Cited Reference</th>
<th>BMHS</th>
<th>ISLS</th>
<th>MULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMHS</td>
<td>1</td>
<td>Campbell et al. (2002)</td>
<td>1.6%</td>
<td>8.8%</td>
<td>5.2%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>NIH (2003)</td>
<td>3.6%</td>
<td>4.8%</td>
<td>1.6%</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Homer et al. (2008)</td>
<td>6.8%</td>
<td>0.8%</td>
<td>2.4%</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Van Panhuys et al. (2014)</td>
<td>4.0%</td>
<td>3.2%</td>
<td>2.8%</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Kaye et al. (2009)</td>
<td>4.0%</td>
<td>2.8%</td>
<td>2.0%</td>
</tr>
<tr>
<td>ISLS</td>
<td>1</td>
<td>Borgman (2012)</td>
<td>2.0%</td>
<td>25.6%</td>
<td>8.0%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Kim &amp; Stanton (2016)</td>
<td>0.0%</td>
<td>11.6%</td>
<td>2.0%</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Sayogo &amp; Pardo (2013)</td>
<td>0.0%</td>
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<td>4.8%</td>
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<tr>
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<td>4</td>
<td>Borgman (2007)</td>
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<td>9.2%</td>
<td>0.8%</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Borgman (2015)</td>
<td>0.0%</td>
<td>8.4%</td>
<td>1.6%</td>
</tr>
<tr>
<td>MULT</td>
<td>1</td>
<td>Tenopir et al. (2011)</td>
<td>6.0%</td>
<td>33.6%</td>
<td>13.8%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Wilkinson et al. (2016)</td>
<td>7.6%</td>
<td>12.8%</td>
<td>20.0%</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Tenopir et al. (2015)</td>
<td>2.0%</td>
<td>18.4%</td>
<td>6.4%</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Piwowar et al. (2007)</td>
<td>3.2%</td>
<td>14.8%</td>
<td>8.4%</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Savage &amp; Vickers (2009)</td>
<td>2.8%</td>
<td>13.2%</td>
<td>8.8%</td>
</tr>
</tbody>
</table>

**Highly Cited References (HCRs).** Among the top 15 HCRs referenced by the 750 sampled publications, as many as 11 were published in MULT journals, with seven of them specifically appearing in *PLOS One*. Further analysis of the top five HCRs published in BMHS, ISLS, and MULT venues demonstrates that ISLS publications tend to reference specific influential works, particularly from MULT venues. For example, Figure 1(b) highlights that one-third of the 250 sampled ISLS publications have cited Tenopir et al. (2011), and one-fourth have cited Borgman (2012). In contrast, the sampled BMHS publications exhibit minimal citations to the top five HCRs from ISLS venues.

**Topical Similarities.** In a recent study, Lee and Chung (2022) identified nine topic clusters and their 49 associated keywords that form the intellectual structure of open science, based on 1,000 selected articles’ keywords. Drawing upon their findings, this study mapped the 2,238 unique keywords offered by 89.7% of the sampled publications against the 49 keywords described above. The result indicates that while the ISLS-MULT coupling proved to be stronger than the BMHS-MULT coupling ($S_{BMHS-MULT}=1.50$), BMHS and MULT publications share a higher degree of similarity regarding their thematic foci. Specifically, ISLS publications primarily involve Lee and Chung’s topic clusters C1) open access, C3) data sharing, C5) research data, and C8) open innovation and science policy; whereas BMHS publications center on C2) reproducibility, C3, and C7) tools and platforms for reproducible research, and MULT publications on C2 and C7.

**DISCUSSION & CONCLUSION**

This study’s preliminary findings indicate the presence of divergent citation patterns and thematic emphases between the BMHS and ISLS communities, despite both addressing the common topic of data sharing. Greater homogeneity was found among ISLS publications in terms of the literature they referenced. BMHS and ISLS publications exhibit limited convergence in narrative approaches when conveying the idea of data sharing. Unsurprisingly, perspective differences across disciplines can be inherent, and often necessary in practice. Nonetheless, it is precisely because of the nuanced intersections and conceptual overlaps that it becomes valuable to collectively figure out what is lacking and what truly matters. In fact, certain long-standing ISLS concepts related to data sharing such as data lifecycles, data curation, data governance, and research data infrastructures have gained increasing attention in clinical research informatics as a BMHS field (e.g., Solomonides, 2019). This body of literature may serve as a starting point for fostering transdisciplinary communication and collaboration. This poster’s bibliometric analysis is just a first step toward stimulating further conversations in the information science community. Moving forward, to gain a deeper insight into the differences between the two disciplines as described above, it is worthwhile to conduct more comprehensive literature reviews, explore scholars’ viewpoints through interviews and surveys, and more importantly, bring these discussions to the biomedicine community.
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Aggregate-Level Analysis of Information Behavior: A Study of Public Library Book Circulation

Lee, Myeong  
George Mason University, United States | mlee89@gmu.edu
Lee, Jongwook  
Kyungpook National University, Republic of Korea | jongwook@knu.ac.kr
Kang, Wojin  
Kyungpook National University, Republic of Korea | rkddnwls1234@knu.ac.kr
Oh, Sanghee  
Sungkyunkwan University, Republic of Korea | sangheeoh@skku.edu

ABSTRACT
Information behavior research to date has mainly focused specific cases or representative surveys at the individual level, because each individual has unique contexts that shape their behavior. However, they have not fully benefited from aggregate-level analyses due to mainstream theories’ focus on a contextualized understanding of information. To address this gap, we adopt the theory of local information landscapes, that focuses on the material aspects of community dynamics, and analyze national-level aggregate data on book circulations in public libraries across South Korea. By examining the relationship between socioeconomic status and public library book circulation, we discuss the potential to develop scalable theories and relevant data-driven approaches in information behavior research.

KEYWORDS
Information behavior, theory of local information landscapes, public libraries, book circulation

INTRODUCTION
Information institutions such as public libraries aim to meet the information needs of community members (Bishop et al., 1999). Among the diverse roles of public libraries, book loans support the community’s participation in library services and programs through public libraries can not only address the problem of information poverty (McKeown, 2016), but also contribute to the formation of social capital (Johnson, 2012). Consequently, researchers have studied factors affecting library use for a long time. These influencing factors for library use can be divided into individual, institutional, and community factors, as these factors create a contextual environment that enables an individual’s information sharing, using, or seeking (Nardi & O’Day, 1999; Jaeger & Burnett, 2010). As such, theories and empirical studies related to information behavior, especially in library contexts, have focused on a nuanced understanding of the multi-level factors that interact with the characteristics of information users. However, studies about people’s information behavior regarding library use tend to either focus on specific cases or, in the case of large-scale studies, used surveys for representative samples but less relied on aggregate-level national data (Greifeneder, 2014). The wide adoption of these approaches may stem from the need to abide by information behavior theories and the scalability concerns of the methodology. The community-level analysis of information behavior at the aggregate level could be inaccurate due to the diverse individual factors and their entanglements with other environmental factors. For example, let’s say a study tries to quantitatively examine the effects of income on people’s use of library-provided information. In this case, the analysis needs to rely on individual-level data because otherwise, they may have to sacrifice individuals’ contexts (e.g., values, family situations, and institutional characteristics), which may violate theoretical assumptions on the role of contextual factors in behavioral specificity. As a result, community-level analyses such as using county-level aggregate data can be regarded as being weakly informed by information behavior theories, because it is challenging or less accurate to model individuals’ contextual factors as aggregate-level variables. In this study, we attempt to bridge this gap by adopting the theory of local information landscapes (LIL theory) as a framework to analyze the national-level aggregate data about public libraries’ book circulations in South Korea (Lee & Butler, 2019).

THEORETICAL FRAMEWORK
LIL theory has been proposed to complement existing theories of information behavior and access by focusing on community-level dynamics such as information behavior in a geographical region and their outcomes (e.g., social/psychological well-being, economic level, civic participation) (Lee & Butler, 2019). LIL theory explains how the material characteristics of a local community and their information infrastructures influence information provision and access in that area, which in turn impact the outcomes of the local community. While this theory could be limited in understanding contextualized information behavior (e.g., a community nurse’s acquisition of information from patients’ behavior), it focuses on the material aspects of local information, infrastructures, and people’s access to them and allows to scale the patterns at the aggregate level. Looking at library information access through the LIL theoretical lens, book loans are a relatively material type of information behavior (compared to the use of nuanced information) on the socio-material spectrum, which makes it possible to do aggregate-level analysis.
APPROACH
To provide a case study of how LIL theory can inform the design of information behavior and access studies, we conducted a preliminary analysis that examines how socioeconomic deprivation shapes people's use of book loans. We used the 5-year national-level book circulation data from the entire public libraries in South Korea between 2014 and 2018 (Ministry of Culture, Sports & Tourism, 2023). We aggregated the average number of book loans per person each year at the Si-, Gun-, and Gu-levels (equivalent to the county and borough levels in the U.S.) across the 17 provinces, resulting in data for 1,145 municipalities. For measuring socioeconomic deprivation, we collected public open data (Ministry of the Interior and Safety, 2023; Statistics Korea, 2023) following the dimensions of the Multidimensional Poverty Index (MPI), namely 'health,' 'education,' and 'standard of living,' at the same geographical unit as the book loans (Alkire et al., 2020). We utilized the health-related quality of life indicator EQ-5D (2014-2018) for the health dimension. In education, we used the proportion of individuals with a bachelor's degree or higher (2015). Regarding living standards, we employed average monthly income data (2014-2018) and the proportion of households owning houses (2016-2018). To construct the socioeconomic deprivation index (SDI), we conducted principal component analysis (PCA) for the four variables by year. We performed standard scaling before running PCA to eliminate variance distortion caused by differences in the scale of data values across domains. The PCA results indicated that the cumulative variance ratio of the first principal component (PC1) was approximately 40% (on average over the years). We used PC1 values as a proxy of socioeconomic deprivation. Based on these variables, we fitted them to see whether the average number of book loans at the national level is associated with SDI, using a multi-level regression model, where we put random effects on the 17 provinces (because there can be different policies and resources provided to municipalities by province). In the regression model, we controlled for the total population, age of libraries, average number of books per library, number of libraries per unit area (km²), average library budget, and the years. We applied a logarithmic transformation to the number of libraries in unit area, as this variable was heavily skewed to the left.

PRELIMINARY FINDINGS
Table 1 presents the regression results. The regression results show that SDI is significantly associated with the average number of book loans, indicating that higher deprivation may lead to lower book loans in public libraries in the community. Specifically, when SDI increases by 1 (similar to about 12% decrease in socioeconomic status), the average number of books borrowed by residents decreases by 0.278. This means, if there are a municipality with 10K residents, the decrease in the total number of book loans from their public libraries would be about 2,780.

<table>
<thead>
<tr>
<th>Estimates (p-value)</th>
<th>Confidence Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>9.831 (0.000) **</td>
</tr>
<tr>
<td>Socioeconomic deprivation index (SDI)</td>
<td>-0.278 (0.000) **</td>
</tr>
<tr>
<td>Age of libraries (days)</td>
<td>0.004 (0.005) **</td>
</tr>
<tr>
<td>Log(Number of libraries per unit area (km²))</td>
<td>0.286 (0.000) **</td>
</tr>
<tr>
<td>Number of books per library (in thousand)</td>
<td>0.004 (0.000) **</td>
</tr>
<tr>
<td>Average library budget (in million Korean Won)</td>
<td>0.158 (0.017) *</td>
</tr>
<tr>
<td>Population size (in thousand)</td>
<td>-0.001 (0.000) ***</td>
</tr>
<tr>
<td>Time dummy variables, fixed effects (years)</td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>1,145 (Conditional R²: 0.538)</td>
</tr>
</tbody>
</table>

Table 1. Regression results using the multi-level regression model, where random effect is on province

DISCUSSION AND FUTURE WORK
While there could be other mediating factors such as reduced leisure time for low-SDI individuals, the preliminary findings provide implications for information behavior research and public library policies. By utilizing the LIL theoretical lens, we can bridge the gap between information behavior research and community-level research paradigms. In addition to addressing social justice and ethical concerns related to information poverty (Britz, 2004), this approach also enables examination of the effects of community-level factors such as socioeconomic status on people's information behavior at scale. Furthermore, exploring the community-level factors that influence people's use of library-provided information could aid in the further development of LIL theory, especially when contextualized within public information institutions. For instance, empirical studies of community-level factors based on LIL theory could identify control, mediating, or moderating factors—like physical accessibility to libraries and the age of libraries—that shape people's information behavior. Aggregate-level analyses can also provide library policymakers with data-driven insights on key variables. Future research exploring diverse dimensions of library-based information (beyond just books) and geographical factors (e.g., physical accessibility or geospatial autocorrelation) will contribute to a more nuanced understanding of community-level dynamics regarding local information, information institutions, and human information behavior.
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Coactive Vicarious Learning in Danmaku Contexts:
A New Perspective of Informal Learning

Li, Jinhao
City University of Hong Kong, People's Republic of China | lionel_ljh@163.com
Zhao, Yuxiang (Chris)
Nanjing University of Science and Technology, People's Republic of China | yyzhao@vip.163.com
Zhang, Yan
Nanjing University, People's Republic of China | strawberries_z@163.com
Ye, Xujie
Nanjing University of Science and Technology, People's Republic of China | yxj77896@163.com

ABSTRACT
Vicarious learning (VL), a concept widely explored in organizational behavior, has also received attention in social media research in recent years. Compared to live streaming e-commerce and online communities, less VL has been studied based on danmaku, an instant commentary in video sites. We consider the characteristics of human information interaction in danmaku contexts and focus on exploring the core elements of coactive vicarious learning (CVL), where five core elements are identified. We will explore the influencing factors through content analysis and semi-structured interviews. And a preliminary conceptual framework of CVL experience in danmaku contexts will try to be brought out for future empirical investigation.

KEYWORDS
Coactive vicarious learning; danmaku; human-information interaction; informal learning

INTRODUCTION
The concept of vicarious learning (VL) refers to the phenomenon of learning where “an observer learns from the behavior and consequences experienced by a model rather than from outcomes stemming from his or her own performance attempts” (Gioia & Manz, 1985, p.528). In the field of organizational learning, Myers (2018) effectively differentiated between independent VL and coactive vicarious learning (CVL), which emphasizes intentionally interpersonal and interdependent interactions during the process of the model’s work experience (Gittell & Douglass, 2012). In this case, CVL is well suited for informal learning in virtual environments, i.e., facilitating interpersonal interactions through computer-mediated communication (CMC) to stimulate more information-encountering and episodic learning experiences (Benabid & Abdalla Mikhaeil, 2019; Sutton, 2001). Previous studies have explored the positive impact of CVL mechanisms, especially social interactions and reciprocity in commerce and IT collaboration (Chi et al., 2008; Dai & Shi, 2022; Hua et al., 2023). However, vicarious learning is usually treated as a theoretical perspective rather than a direct object of study in these studies. In recent years, the danmaku feature (literally “bullet hell” or “barrage”) has become compatible with many video sites and has greatly stimulated the information behavior of users in creating and reading danmaku comments (Peng et al., 2016; Wu et al., 2019; Zhao & Tang, 2016). Prior work suggests that danmaku comments are often related to the original video content, and the pseudo-synchronized communication afforded by danmaku brings a solid social presence and viewing experience to users (Wu et al., 2018; Zhao et al., 2017; Zhou et al., 2019). However, compared to traditional observational learning through the usage of knowledge systems (Alavi & Leidner, 2001), such danmaku-oriented informal learning information practices have rarely been explored (Zhang et al., 2019), especially the lack of understanding of CVL in danmaku contexts. In this regard, the study aims to be exploratory in general, hoping to discover the core elements of CVL by crawling and coding danmaku in videos. and then further explore how users perform the CVL experience via danmaku behavior (reading and interacting) in videos through interviews.

METHODS
The data collected in this study is from the crawling of danmaku data on video sites. The secondary data were obtained mainly to discover the core elements of CVL interaction in the danmaku context. We used Python to crawl the danmaku data on ten different video genres on the mainstream Chinese video site bilibili.com. For each genre, we filtered two videos for analysis based on the hotness and the number of danmaku (no less than 500) and initially obtained 23,756 danmaku comments. Finally, 6,169 valid danmaku comments remained for analysis after being cleaned. For the danmaku coding, this paper adopts the content analysis method (Stemler, 2001). The initial coding framework draws on Myers’ (2018) categorization of CVL core elements in organizational contexts, while new elements reflecting CMC characteristics emerged in the coding process. The three raters conducted two independent rounds of coding, with a fourth author joining the discussion at the end of each round to improve the consistency of coding. Categories were dynamically adjusted in accordance with the coding process and became stable until the reliability level was acceptable (a score of K=0.87) (Lombard et al., 2002).
PRELIMINARY FINDINGS
Core elements of CVL interaction in danmaku contexts
We adopted Myer’s (2018) categorization of three discursive elements involved in a CVL interaction, i.e., experience, analysis, and support, as our priori coding schema. In the coding process, we refined the original three categories of elements to further characterize CVL interaction in the context of danmaku, including experience sharing, analysis & explaining, and emotional support, and two new categories of elements, i.e., controversy & debate and content extension, were emerged. Table 1 shows the description and distribution of the five types of elements.

In general, the coding process is not entirely mutually exclusive. For example, experience sharing is often accompanied by some emotional support, i.e., some viewers export their personal experiences through the danmaku will cause some other viewers to have emotional resonance, and thus send related emotional support danmaku to echo the experience. At the same time, we also found that the overall percentage of analytical and explanatory danmaku is also very high and widely distributed in various video genres, which to a certain extent indicates that danmaku, a more concise form of commentary, can also explain some issues and thus promote CVL interaction. Interestingly, CVL elements such as controversy & debate emerged in danmaku contexts, which differs from traditional organizational contexts. We infer that the anonymity of the danmaku allows viewers to express their opinions and debate on some topics in this CMC scenario. Meaningful debates promote users' critical thinking and meaning-making, thus stimulating CVL interaction. Finally, we also found that viewers are not completely confined to the content of the original video when sending danmaku comments; the original video and the danmaku together form a discursive sphere that will facilitate some viewers' brainstorming and generate some new content, and the extension of such content will also enhance the possibility of danmaku as a CVL interaction.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Definition</th>
<th>Examples</th>
<th>Video Genres</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience sharing</td>
<td>A response to the content of the video from the perspective of the senders of the danmaku, combined with their own relevant experience.</td>
<td><em>The price of Lucking coffee is much lower than Starbucks, and for me, a person who doesn’t know much about coffee, there is no difference.</em></td>
<td>Food, Living, Sports, Real-time info</td>
<td>32.30%</td>
</tr>
<tr>
<td>Analysis &amp; explaining</td>
<td>A complementary to the video content with a strong correlation of interpretation and evaluation.</td>
<td><em>Note that the uploader means we should be careful to screen before purchasing.</em></td>
<td>Music and dancing, Food, Sci-fi, Science and Technology, Film &amp;TV, Knowledge, Games</td>
<td>26.98%</td>
</tr>
<tr>
<td>Emotional support</td>
<td>A social assistance or emotional resonance in facilitating vicarious engagement.</td>
<td><em>Woow! Fantastic...The video is amazing and the information is really helpful!!</em></td>
<td>Music and dancing, Food, Living, Games, Film &amp;TV, Real-time Info</td>
<td>28.82%</td>
</tr>
<tr>
<td>Controversy &amp; debate</td>
<td>A cognitive or emotional feedback around the original video or another person's point of view, usually in a more direct way to present a refutation.</td>
<td><em>I don't think this claim is plausible. Can you find the scientific basis?</em></td>
<td>Sci-fi, Real-time info, Science and Technology, Games, Knowledge</td>
<td>15.50%</td>
</tr>
<tr>
<td>Content extension</td>
<td>An expansion of other topics based on the original video or other danmaku, which may not be closely associated with the original content, but will also stimulate vicarious interaction.</td>
<td><em>(The original discussion revolved around cooking) Do you guys think her dress is excellent? It seems to be the new Burberry this year!</em></td>
<td>Sci-fi, Food, Science and Technology, Games, Film &amp;TV, Knowledge</td>
<td>10.40%</td>
</tr>
</tbody>
</table>

Table 1. Core Elements of CVL via Danmaku

IMPLICATIONS AND FUTURE WORK
In this study, we argue that the first three elements are identified based on the Myers categorization of CVL, and the last two elements are uncovered through our coding. The differences in the components of CVL in the organizational learning and danmaku context may correlate with the environment of these two learning, where on the one hand, the CVL previous is more likely a kind of serious learning while the CVL in the danmaku context, on the other hand, is more of an informal learning, reflecting the characteristics of the CMC (Joinson, 2001). We will develop a more solid work to examine the assumption. We believe that the classification of the core elements of CVL in the danmaku context will contribute to the literature on understanding the mechanism of vicarious learning in online settings and be helpful in future related work.
REFERENCES


Analysis of the Dissemination Characteristics of Papers on WeChat Official Accounts of Chinese Academic Journals

Li, Lei  
Beijing Normal University, China  | leili@bnu.edu.cn
Wang, Xuyan  
Beijing Normal University, China  | 201911260118@mail.bnu.edu.cn

ABSTRACT
New media platforms have enhanced the efficiency and diversity of information dissemination, providing new possibilities for the dissemination and promotion of academic papers. Currently, a large number of Chinese academic journals from different disciplines have established WeChat official accounts to promote their papers. This study examines WeChat official accounts from three disciplines: social sciences, natural sciences, and medicine. We analyze the existing paper promotion methods employed by these academic journal official accounts from four dimensions: content presentation format, number of papers promoted in a single post, interactive forms, and publishing time. The findings reveal that the current promotion methods for academic papers on WeChat official accounts are relatively limited, with low utilization of multimedia content. Therefore, there is a need for further improvement in new media promotion for academic papers.

KEYWORDS
Papers Dissemination; New media promotion; WeChat official account; Chinese academic journal

INTRODUCTION
With the continuous development of the Internet, various new media platforms have emerged, providing comprehensive coverage and wide-ranging channels for the public to access and disseminate information (Powell et al., 2012). These platforms have also become powerful tools for sharing and disseminating academic knowledge. WeChat, one of the most widely used instant messaging tools in China, had a monthly active user base of 1.308 billion as of September 2022. In addition to providing instant communication functionality, WeChat has developed a new type of account called "Official Accounts." Account creators can use this platform to push messages, provide information services, and engage in interactive behaviors with subscribers. Subscribers can like, comment, share, and even make monetary contributions to the messages pushed by the Official Accounts. An increasing number of academic journals in China are creating official accounts on this platform to promote their papers and enhance communication with readers.

Previously, most studies on the new media dissemination of papers focused on the number of mentions of the papers on social media as a measure of their impact, serving as an alternative to traditional citation metrics (A Bornmann, 2014; Williams, 2017). Few studies have explored how journals, as organizations, promote the papers they publish. Journal promotion is crucial for increasing the visibility and reach of published papers, attracting readership, and enhancing the journal's reputation within the academic community. Therefore, this study focuses on exploring how journals utilize their self-created WeChat official accounts for the dissemination of papers. Such research would contribute to a better understanding of the role of journals in the scholarly communication process and provide valuable recommendations for improving their promotional strategies.

METHOD
Journal Selection
The Overview of Core Chinese Journals of Peking University (2021 Edition) was used as the source for selecting journals. This overview is one of the authoritative standards for journal classification in China, covering a wide range of journal fields and enjoys a high reputation within their respective disciplines. From this overview, we selected three representative subject categories: Social Sciences, Natural Sciences, and Medicine. Within each subject category, we have selected the top fifteen journals with active WeChat public accounts and a long history of operation as the data collection targets.

Data Collection
Using a web crawler program, we obtained all the published posts and related information from the forty-five journals' official WeChat accounts since their inception until the day of crawling. A total of 22,668 posts were collected, each containing the post title, post content, publication time, number of reads, number of likes, number of views, and number of comments.

Dissemination Characteristics Framework
Based on the existing research on academic paper dissemination on official accounts and the actual post data obtained, four dimensions describing the dissemination characteristics can be formulated. These dimensions include...
the content presentation form of the papers, the number of papers promoted in a single post, the form of interaction with readers, and the timing of post publication. The specific features included in each dimension are shown in the results section below.

**Data Cleaning and Annotation**

From the crawled post data mentioned above, 16,246 posts promoting research papers have been identified, including 8,690 in social sciences, 4,447 in natural sciences, and 3,109 in medicine. Subsequently, based on the dissemination characteristic framework, the corresponding features of each post were manually annotated.

**RESULTS**

Figure 1 displays the content presentation forms of journal official accounts for promoting research papers. It reveals significant differences in content presentation among different disciplines. In the field of social sciences, publishing the full text of the paper is the most common form of content promotion, accounting for 7,276 posts (79% of the total paper promotions data in the social sciences). In the field of natural sciences, promoting the abstract of the paper is more commonly observed. Some medical journal official accounts commonly include only the original article link in their posts, a content presentation form not commonly used in the natural and social sciences domains. The content presentation forms adopted in the medical domain are more diverse. Video explanations and paper summaries are rarely used as content presentation forms in various disciplines. Figure 2 illustrates the variation in the number of papers promoted in a single post across different domains. Three disciplines commonly use one post to promote a specific paper. Among them, social sciences have a higher proportion of using a single post to promote multiple papers, accounting for 10% of the total number of paper promotion posts.

![Figure 1. Content presentation formats for promoting papers](image1)

![Figure 2. Variation in the number of papers promoted in a single post across different domains](image2)

Regarding interactive features, Figure 3 shows that, compared to medical, natural and social sciences journals' official accounts have a higher tendency to enable the comment function to engage with readers. Additionally, as illustrated in Figure 4, the forenoon hours are the peak time for promoting research papers on journal official accounts across various disciplines. Natural sciences and social sciences also engage in paper promotion during the afternoon and evening hours, respectively.

![Figure 3. Interactive comments provision for paper promotion across different domains](image3)

![Figure 4. Publication time of paper promotion across different domains](image4)

**DISCUSSION AND CONCLUSION**

This study analyzes the characteristics of paper dissemination on Chinese journal public WeChat accounts and finds that using WeChat public accounts for paper promotion has become a common form of new media dissemination. However, the methods used for paper promotion are often fixed, with most promotional papers simply copying and pasting certain parts of the paper, such as the abstract, keywords, and key points, without much reorganization or processing. While academic journals utilize new media platforms for paper promotion, they rarely incorporate multimedia functions for dissemination. It is evident that the promotional model of journal public accounts needs continuous innovation and development to enhance academic influence.
REFERENCES
Humanities Scholars’ Understanding of Data and the Implications for Humanities Data Curation

Li, Wenqi
Department of Information Management, Peking University, Beijing, China | wenqili@pku.edu.cn

Zhang, Pengyi
Department of Information Management, Peking University, Beijing, China | pengyi@pku.edu.cn

Wang, Jun
Research Center for Digital Humanities, Peking University, Beijing, China | junwang@pku.edu.cn

ABSTRACT
This study addresses the need for a shared understanding of humanities data to enhance data curation. Through interviews with 27 scholars, it identifies two ways scholars conceptualize data - by format or role in research. It highlights three unique aspects: diverse requirements of materiality and processing levels, significance of authorship and perspective, and the dual role of tertiary sources. The study suggests prioritizing provenance, facilitating data documentation, curating tertiary sources for wider use, and establishing scholarly communication mechanisms for effective data curation.

KEYWORDS
Humanities data; digital humanities; research data practice; data curation; data behavior.

INTRODUCTION AND RELATED WORKS
Data curation is a key concern in humanities, particularly with the rise of digital humanities which has transformed scholarship, using new types of digital data and promoting data sharing and reuse (Palmer et al., 2013; Poole, 2017; Given & Willson, 2018; Poole & Garwood, 2020). However, the concept of humanities data remains nebulous, and a shared understanding is essential for effective data curation (Tóth-Czifra, 2019a).

The term "data" is not widely adopted in humanities, although its use has increased with the growth of digital humanities (Borgman, 2012; Schöch, 2013; Kilbride, 2015; Thoegersen, 2018). Despite attempts by funding agencies and scholars, a consensus on data definition remains elusive (Poole, 2016; NEH, 2019). Humanities data can include any record of human activity or publication, particularly when they become study objects (Moulaison-Sandy & Wenzel, 2023), but the boundary between data and publication is obscured (Borgman, 2008). Research has explored characteristics of humanities data, including data formats, levels of processing, multilingualism, and shared ownership (Borgman, 2015; Flanders & Muñoz, 2012; Tóth-Czifra, 2019b). However, few studies have examined how humanities scholars conceptualize their data (Gualandi et al., 2022; Thoegersen, 2018).

This paper aims to explore humanities scholars’ understanding of data and its implications for data curation. We empirically investigate two research questions: 1) What does data mean to humanities scholars? 2) What’s unique about humanities data?

METHODS
We conducted semi-structured interviews with 27 purposefully sampled participants (12 females, 15 males) from diverse academic background. We covered both traditional (10) and digital humanities (17, “DH” hereafter) scholars as their perceptions of data may differ. We asked about their understanding of data and collected data-related artifacts like spreadsheets for triangulation. Table 1 summarizes the academic backgrounds of the participants.

<table>
<thead>
<tr>
<th>Academic rank</th>
<th>4 Master’s students (M1-4), 11 Ph.D. students (D1-11), 2 post-docs (P1-2), 10 faculties (F1-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discipline</td>
<td>8 in history, 5 in language, 5 in philosophy, 4 in philology, 3 in literature, 2 in arts</td>
</tr>
</tbody>
</table>

Table 1. Academic Backgrounds of Participants

We analyzed the data using a codebook derived from an existing framework (Huang & Soergel, 2013), covering data definition, roles of data, and properties like formats, authorship, and quality. After initial coding of six transcripts by two researchers, the codebook was finalized. The same transcripts were then recoded, achieving substantial inter-coder agreement (Cohen’s Kappa=0.71), followed by separate coding of the remaining transcripts.

FINDINGS
What Does Data Mean to Humanities Scholars?
Conceptualization by Formats
Participants tended to define data by formats. Those less familiar with DH typically associated data with numeric or structured formats as in databases. Three participants noted that 'data' is not a common term in their disciplines. As Participant D8 studying Chinese philology noted, “We rarely use the term data. I prefer to call them texts, sources, or research materials.” However, DH-familiar participants had a broader definition, recognizing texts and images as...
data, albeit with certain constraints like *large quantity, machine-operability, or potential to be structuralized*. Original sources, digital surrogates, and transformed formats are all considered data to them.

**Conceptualization by Role in Research**

Participants who inductively identify patterns from large datasets view data similarly to social scientists - as evidence to form or validate theories, including intermediate products like notes and annotations. For many, data is also their research object. For example, DH-familiar Participant P1 in ancient Chinese language stated, “*These three ancient books are both my data and research objects. I study the patterns within them. In many linguistic studies, research objects and data are essentially the same, with data derived from these objects.*” For participants conducting hermeneutic or critical studies based on a narrative structure, the boundary between data and non-data sources is blurred. They consider a source as data if it serves as: 1) a research object for interpretation; 2) an object of dialogue/critique; 3) an example to make an argument. Non-data research materials, on the other hand, are used for referring to other sources or understanding the background to form research questions.

**What's Unique about Humanities Data?**

*The Diverse Requirements of Materiality and Level of Processing*

The diversity of humanities data extends beyond its various formats. Different stages of research may necessitate different materiality or processing levels of a source. For instance, Participant F7 in philology used digital texts for version comparison and note-taking due to convenience, but referred back to the physical book or scanned images for validation. For determining the creation time and place of a rare book, she needed the physical copy to examine paper color and texture.

*The Significance of Authorship and Perspective in Determining the Data Quality and Credibility*

Authorship is crucial to the quality and credibility of humanities data. Participant P1 only trusted textual files proofread multiple times within his team, while Participant F5 only preferred authoritative databases like Chinese Historical GIS (CHGIS), as he had participated in the database's development. He also emphasized transparency in data processing procedures, standards, and potential flaws for a reliable database. Several participants deem internet sources unacceptable due to their informal nature and sometimes unidentified authorship. Additionally, the perspective determines the credibility of a secondary source. For example, Participant D8 avoids Qing dynasty (AD 1644–1912) text editions due to subjective modifications, unless it's the only version available.

*The Importance and Dual Role of Tertiary Sources – As Data and Reference*

Tertiary sources like dictionaries, indexes, bibliographies, and research material compilation are crucial to many participants' research, serving as both references and data sources. Traditional scholar M3 in literature likened the process of using bibliographies to discover documents as “following a knowledge topography map and conducting knowledge archeology”. Tertiary sources can also form preliminary datasets, as with DH-familiar Participants D1 using the object ID in an index, and DH-familiar Participant M1 using the dictionary to construct the word list for her corpus. Some scholars’ data can even be published as tertiary sources. However, several participants observed a decline in the publication of such sources, possibly due to academic evaluation mechanisms that may undervalue compilations or extractions without original thoughts, as suggested by traditional scholar D4 in history.

**CONCLUSION**

This work investigates how humanities scholars across disciplines conceptualize humanities data and its unique characteristics. Many define data by formats, but also consider texts or sources as data if used as evidence (Borgman, 2015), research objects (Moulaison-Sandy & Wenzel, 2023), quotations, or dialogue objects. This role-based conceptualization helps distinguish data from publications (Borgman, 2008; Gualandi et al., 2022).

Three unique aspects of humanities data were highlighted: the diversity of required processing level, the significance of authorship and perspective, and the dual role of tertiary sources. These carry important implications for humanities data curation. For example, it’s important to develop flexible and adaptable data curation strategies catered to various needs of data formats and processing. The emphasis on authorship calls for accountable data curation that prioritizes provenance to foster trust in data reuse. Tools and resources to facilitate proper data documentation are also needed (Moulaison-Sandy & Wenzel, 2023; Tóth-Czifra, 2019a). It’s also important to curate tertiary sources for their wider use in the digital environment (Palmer, 2005), and more established scholarly communication mechanisms are needed to encourage the curation of these resources. Building on this exploratory work, future studies can systematically summarize humanities data types and characteristics, aiming for a more rigorous conceptualization. Efforts should be made to foster dialogue and collaboration between humanities scholars and data curators, ensuring that data curation strategies and tools are developed with a deep understanding of the data needed and used by humanities scholars.
ACKNOWLEDGMENTS
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Linking Allusion Words: A Method of Combining Fine-Grained Co-citation Relationship and Semantic Features

Li, Xiaomin  
School of Information Management, Nanjing University, China | DG21140014@smail.nju.edu.cn

Wang, Hao  
School of Information Management, Nanjing University, China | ywhaowang@nju.edu.cn

Qiu, Jingwen  
School of Information Management, Nanjing University, China | qiujuw@smail.nju.edu.cn

ABSTRACT
It is a common phenomenon for Tang poems to cite the allusions, which can generate a rich relationship network. However, insufficient attention has been paid to investigating the relationship network. To address the research gap, by employing theories and methods of information science, this study presents a method of combining fine-grained co-citation relationship and semantic features to link allusion words. We constructed a fine-grained co-citation network between allusion words by adding cited positions and sentiments. We then transformed the fine-grained weights into relational similarities. Moreover, we also leveraged the explanatory text as semantic information for each allusion word, mapping the semantic embedding vectors and calculating the similarities as the semantic similarities. Finally, we applied the link prediction algorithm to implement the allusion word linking. Our experimental results reveal that adding the cited positions and sentiments as well as semantic similarities can improve the performance of allusion word linking, achieving 0.869 on AUC score. Additionally, we explore the linking results from the perspective of the shortest path and find some regular knowledge. Overall, our study extends the application of information science and promotes the development of Chinese traditional cultural resources.

KEYWORDS
allusion words; fine-grained relationship; co-citation network; semantic feature; link prediction

INTRODUCTION
The phenomenon of citing allusions in both literary creation and daily communication is called “Allusion citation”, which refers to the use of language and stories from ancient classics to express opinions. In the literary creation scene, “Allusion citation” is a common creative method in ancient Chinese poetry, which allows poets to implicitly express their emotions by drawing upon deeds or languages of predecessors (i.e., comparing the present with the history, expressing emotions and aspirations), and strengthens the aura and artistic conception of ancient poetry from the historical dimension (Yang, 2011). At the same time, there is also an association among allusion words through ancient poems or poets using allusions.

At present, studies on allusions mainly focus on translation (Ni, 2023; Yuan & Wang, 2022; Zhou & Cao, 2021), recognition (Tang, Liang, Zheng, Hu, & Liu, 2019; Liu, Chen, & He, 2020; Xu, Lin, Yang, & Xu, 2019), and visualization (Xiao et al., 2019; Lin, Chen, Zheng, & Yang, 2021; Xue, He, Yang, & Wu, 2022) of allusions. The rich associations between allusion words and ancient poetry as well as allusion words are generated through “Allusion citation”. It is significant to utilize existing semantic analysis methods and techniques to effectively mine and exploit these associations. To this end, some studies have analogized “Allusion citation” to “Paper citation”, and conducted theoretical analysis and empirical research on the allusions of Song Ci from the perspective of informatics (Cai & Zhao, 2022), but the depth of mining fine-grained citations such as the sentiment, position, and intensity, is not enough. As a result, in this research, we propose a method of combining fine-grained co-citation relationships and semantic features to link allusion words. More specifically, our main research questions are as follows: first, does adding cited position and emotion to build a fine-grained co-citation network of allusion words as well as semantic feature improve the linking effect of allusion words? Second, do the counts and the average similarities decrease as the values of the shortest path increase?

METHOD
In this study, we crawled Tang poems and their cited allusion words from Sou-yun, a comprehensive poetry website in China, and finally retained a total of 54,736 Tang poems, of which 11,568 cited allusion words, 7,097 cited one allusion word, 4,471 cited two or more allusion words, and 9,483 non-repeated allusion words.

Based on the collected data, we first chose the Tang poems citing two or more allusion words and drew analogies between the relationships of Tang poems and their allusion words of citation, and the relationships of academic papers and their references. If two references are cited by the same paper, they form a co-citation relationship. Similarly, if two allusion words are cited by the same poem, the two allusion words also form a co-citation relationship. A weighted undirected co-citation network $G = (V, E, W)$ thus were constructed, where $V$ denotes the set of nodes (i.e., allusive words), $E$ denotes the set of relationships (i.e., co-citation relationships between one allusion word and another), and $W$ denotes the set of co-citation weights.

86th Annual Meeting of the Association for Information Science & Technology | Oct. 27 – 31, 2023 | London, United Kingdom. Author(s) retain copyright, but ASIS&T receives an exclusive publication license.
For $W$, we calculated it at both structural and semantic aspects. The structural weights include the basic co-citation weight $W_{\text{basic}}$ and the positional co-citation weight $W_{\text{pos}}$. For semantic weights $W_{\text{sen}}$, we first adopted the trained models to recognize sentiments of verses in poems and allusion words of our work. Then, we determined the cited sentiment of each allusion word. Later, the detailed calculations are as following: when the allusion word $a$ and the allusion word $b$ were cited by the same poem or the same verse of the same poem, $W_{a,b}^{\text{basic}}$ and $W_{a,b}^{\text{pos}}$ increased by 1 and 0.5, respectively. At the same time, when there was the same cited sentiment between the allusion word $a$ and the allusion word $b$, $W_{a,b}^{\text{sen}}$ increased by 0.5. Following the strategy, we constructed the preliminary fine-grained co-citation network, consisting of 7,705 nodes and 26,555 edges. However, the co-citation weights are actually various values not less than 1, which are not normalized and fail to reflect the degree of correlation between allusion words intuitively. In this vein, we converted the co-citation weights into the similarities of network relationships as 

\[ UHODWLRQDOVLPLODULW\]

Further, we used the explanatory texts as semantic information for allusion words to produce the similarities among allusion words named ‘semantic similarity’, and integrated it with ‘relational similarity’ with the weight combination of $\alpha$ and $\beta$.

**RESULTS AND ANALYSIS**

In this section, we have two tasks at hand. One is to determine the combination of $\alpha$ and $\beta$ according to the method presented by Lyu, & Zhou (2010), and the other is to compare the performances of linking when adding positional co-citation and sentimental co-citation. To this aim, we constructed three co-citation networks, $G^{\text{basic}}$, where the weights of edges are $W_{\text{basic}}$, $G^{\text{basic+pos}}$, where the weights of edges are the sum of $W_{\text{basic}}$ and $W_{\text{pos}}$, and $G^{\text{basic+pos+sen}}$ (i.e., the fine-grained co-citation network mentioned above), where the weights of edges are the sum of $W_{\text{basic}}$, $W_{\text{pos}}$ and $W_{\text{sen}}$. The results are shown in Table 1.

<table>
<thead>
<tr>
<th>$G$</th>
<th>AUC 0.1_0.9</th>
<th>0.2_0.8</th>
<th>0.3_0.7</th>
<th>0.4_0.6</th>
<th>0.5_0.5</th>
<th>0.6_0.4</th>
<th>0.7_0.3</th>
<th>0.8_0.2</th>
<th>0.9_0.1</th>
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</thead>
<tbody>
<tr>
<td>$G^{\text{basic}}$</td>
<td>0.865</td>
<td><strong>0.866</strong></td>
<td>0.864</td>
<td>0.853</td>
<td>0.860</td>
<td>0.864</td>
<td>0.861</td>
<td>0.858</td>
<td>0.864</td>
</tr>
<tr>
<td>$G^{\text{basic+pos}}$</td>
<td><strong>0.863</strong></td>
<td>0.861</td>
<td>0.857</td>
<td>0.862</td>
<td>0.857</td>
<td>0.862</td>
<td>0.860</td>
<td>0.857</td>
<td>0.861</td>
</tr>
<tr>
<td>$G^{\text{basic+pos+sen}}$</td>
<td>0.861</td>
<td>0.867</td>
<td><strong>0.869</strong></td>
<td>0.858</td>
<td>0.867</td>
<td>0.861</td>
<td>0.866</td>
<td>0.865</td>
<td>0.864</td>
</tr>
</tbody>
</table>

Table 1. Performance evaluations in different networks

The combination of $G^{\text{basic+pos+sen}}$ and 0.3_0.7 outperform other combinations, confirming that adding positional and sentimental weights as well as semantic similarities into the co-citation network significantly improves the performance of the algorithm in the linking task. After the network reconstruction, we employed the link prediction algorithm Node2vec to generate node vectors, and calculated the cosine similarities to represent the likelihood of linking between two nodes without a direct path in the fine-grained co-citation network. Then, we set the threshold at 0.75. When the similarity is greater than 0.75, it indicates the presence of a direct path linking the two allusion words. Based on the results, we successfully completed the linking of allusion words.

To further understand the linking results and explore some regular knowledge, we conducted the statistic analysis on the relationship between values of the shortest path and their counts as well as the average similarities. The results are shown in Figure 1. As the values of the shortest path increase, both the corresponding counts and the average similarities demonstrate a general decreasing trend.

**CONCLUSION AND FUTURE WORK**

The preliminary results of this study support that adding the cited positions and sentiments as well as semantic similarity can enhance the performance of allusion word linking. And we also investigated the link results from the lens of the shortest path value and found some regular knowledge. Limitations resulting from our work serve as a starting point for future research in exploring more relations between the allusion words and the poems as well as poets in different dynasties.
REFERENCES
A Mild Approach to Prebunking Health Misinformation in Social Media: Digital Nudging

Li, Xinyue | Nanjing University, China | lxinyue@smail.nju.edu.cn
Liu, Mandie | City University of Hong Kong, Southern University of Science and Technology, China | liu_mandie@163.com
Lian, Jingwen | Nanjing University, China | jwlian@smail.nju.edu.cn
Zhu, Qinghua | Nanjing University, China | qhzhu@nju.edu.cn
Song, Xiaokang | Xuzhou Medical University, China | sxksxk666@163.com

ABSTRACT
The governance of health misinformation has been a hot topic in both social practice and academic research. Due to its proactive and timely nature, prebunking represents an emerging and efficacious intervention. However, previous research on prebunking primarily focuses on presenting arguments or techniques to the public in a direct and coercive manner, which remains limited in its scope and efficacy. This study aims to implement prebunking in social media by utilizing a milder approach, namely digital nudging. We conduct a web-based pre-experiment to test the effectiveness of warning, social and disclosure nudge, and obtain data from 104 participants. The preliminary results show that the warning and social nudge can mitigate the credibility of misinformation and decrease individual’s sharing likelihood. Furthermore, eHealth literacy acts as the moderator in the impact of social nudge. This study broadens the comprehensions of the misinformation governance and digital nudging, and furnishes practical implications for the implementation of prebunking in social media.

KEYWORDS
Digital Nudging; eHealth Literacy; Health Misinformation; Prebunking; Social Media

INTRODUCTION
The emergence and proliferation of social media have facilitated the easier generation and more rapid spread of health misinformation. Such misinformation not only confuses individuals’ perceptions, but also increases uncertainty in information processing, and potentially misleads their health decisions (Melchior & Oliveira, 2021). Prebunking is considered as a preemptive method to build cognitive resistance against misinformation before it produces or spreads (McGuire, 1961). It includes various forms, such as providing factually correct information in advance or a generic misinformation warning. Existing studies, especially those focusing on fact-based inoculations, utilize direct and coercive methods by simply providing information beforehand, which may still elicit backlash (Basol et al., 2021). Besides, previous studies mainly center on the design of prebunking information content (Cook et al., 2017), disregarding the impact of external features of the technological environment like social media.

When considering initiatives to change public’s perceptions and behaviors in a mild way in social media, the role of digital nudging cannot be ignored. Since digital nudging is an approach based on the libertarian paternalism that applies user interface (UI) element to affect individual’s choices in digital environments (Mirsch & et al., 2017). Some approaches, like fact-check alerts (Clayton et al., 2020), accuracy nudges (Pennycook et al., 2020) and related article nudges (Gimpel et al., 2020), have already been proposed to combat misinformation, and have shown promising effects in lower misinformation credibility and decrease individuals’ sharing likelihood. The timing of intervention is a critical factor for information governance (Vraga et al., 2020). However, most studies only have implemented digital nudging after the user encounters or perceives misinformation (Gimpel et al., 2020), thereby rendering individual perceptions influenced and arduous to rectify. Moreover, individual factors like eHealth literacy may also impact the effectiveness of the intervention (Wang & Jacobson, 2023). Based on the nudge theory and the perspective of prebunking, we aim to explore the effectiveness of various digital nudges in eliminating the negative effects of health misinformation and investigate the role of eHealth literacy as a moderator.

THEORETICAL MODEL AND RESEARCH HYPOTHESIS
Based on Caraban et al.(2019)’s viewpoints, we categorized digital nudging for prebunking into three dimensions: warning nudges (signal), social nudges (spark), and disclosure nudges (facilitator). The former influences user attitudes by warning of potential risks or negative consequences; the middle can steer and impact users by using the behavior of others as a reference under the mechanism of social norms; and the latter follow the logic-based inoculations to help increase advantageous choices and make relevant information more salient. As an intersection of six literacies in e-Health context, eHealth literacy also plays a critical role in identifying and evaluating health misinformation. Figure 1 illustrates the included constructs and hypotheses.

H1: Warning nudges for prebunking will reduce misinformation credibility (a) and sharing likelihood in health misinformation (b) in social media.
H2: Social nudges for prebunking will reduce misinformation credibility (a) and sharing likelihood in health misinformation (b) in social media.

H3: Disclosure nudges for prebunking will reduce misinformation credibility (a) and sharing likelihood in health misinformation (b) in social media.

H4: The effect of warning nudge (a-1), social nudge (b-1), and disclosure nudge (c-1), on health misinformation credibility is stronger when the individual’s eHealth literacy is higher. And the effect of warning nudge (a-2), social nudge (b-2), and disclosure nudge (c-2), on sharing likelihood of health misinformation is stronger when individual’s eHealth literacy is higher.

METHOD
We conducted a web-based experiment to explore the effectiveness of digital nudging. The research model was tested by applying between-subject design, and each participant was randomly assigned to one of four groups. They were told to simulate a scenario in which they saw health information on social media. In this stage, participants were provided with two parts of information: digital nudging information first, followed by health misinformation. The former included four conditions (i.e., no nudge, warning nudge, social nudge and disclosure nudge) created using prototyping tool (modao.cc) while the latter was about “Diet for cancer prevention” which was inspired by prevalent online health misinformation reported by a government-sponsored platform (piyao.org.cn). After reading these materials, participants were required to fill out a questionnaire measuring the misinformation credibility and their sharing likelihood. In addition, the assessment of eHealth literacy was derived from Norman and Skinner’s study (2006). To measure the outcomes, we adapted the credibility scales from Vraga et al.’s study (2020) and also adopted the Nekmat’s scale (2020) to measure likelihood to share. All items were measured on a 5-point Likert scale.

PRELIMINARY RESULTS
We recruited potential participants with the snowball sampling method on social media (i.e., WeChat and Weibo) and offline communities, and the final sample size was obtained as 104 (42% male; range: 18-65 years; almost 70% reported good health status). Four groups finally were ascertained (no nudge: n=25; warning: n=26; social: n=25; disclosure: n=28) after eliminating samples that were deemed inadequate based on manipulative and attention check. First, all variables demonstrated acceptable levels of reliability (Cronbach a >0.9). We then conducted three independent ANCOVA to explore the impact of three digital nudging in prebunking health misinformation. Table 1 shows the significant main effects of warning nudge (p<0.05) and social nudge (p<0.05) on misinformation credibility and sharing likelihood, while the disclosure nudge does not show a significant effect. Warning nudge and social nudge effectively lower misinformation credibility (Crecontrol=3.027, Crewarning=2.461, Cresocial=2.573) and individuals’ sharing likelihood (Sharcontrol=2.466, Sharwarning=1.923, Sharsocial=1.893). Hypothesis 1 and 2 are supported. Then, we further found that eHealth literacy has a significant negative moderating effect between social nudges and health misinformation credibility (Coeff=-0.4729, p<0.01) through Hayes’ Process. People with higher eHealth literacy are more susceptible to the effects of social nudge, exhibit greater attractiveness towards health information and thus demonstrate heightened proficiency in making accurate judgements. H4b-1 is supported.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III sum of squares</th>
<th>d.f.</th>
<th>Mean square</th>
<th>F</th>
<th>p-value</th>
<th>Type III sum of squares</th>
<th>d.f.</th>
<th>Mean square</th>
<th>F</th>
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<tr>
<td></td>
<td>Credibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sharing likelihood</td>
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<td>3.249</td>
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<td>0.021</td>
<td>3.088</td>
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<td>3.088</td>
<td>4.801</td>
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<tr>
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<td>2.512</td>
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<td>0.017</td>
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<td>1</td>
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<td>0.050</td>
</tr>
<tr>
<td>Disclosure nudge</td>
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<td>0.722</td>
<td>1.242</td>
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<td>1</td>
<td>0.722</td>
<td>1.242</td>
<td>0.271</td>
</tr>
</tbody>
</table>

Table 1. Results of ANCOVAs: Effects of Warning Nudge, Social Nudge and Disclosure Nudge

CONCLUSION
In this paper, we argued for exploring a mild way towards prebunking health misinformation by synergistically leveraging the principles of both the nudge and prebunking. We found that the warning nudge and social nudge exhibit the potential to mitigate the credibility of misinformation and decrease the individual’s sharing likelihood. However, the disclosure nudge did not have a significant effect, possibly because health-related facts or logic skills cannot be absorbed through a nudge in a short time. Moreover, initial results identified a moderating effect of eHealth literacy. Next, we will collect data from a larger sample to test our experimental design and hypotheses, and explore underlying mechanisms of these nudges for prebunking health misinformation.
REFERENCES
ABSTRACT
This study introduces and examines the “Multi-dimensional Interaction-Attitude-Usage Model” (MIAU Model), drawing from cross-disciplinary theories. The MIAU Model proposes dimensions of interactive data retrieval, including resource, technology, context, and dual-process-based cognition, and explores their relationships with user attitude toward systems and usage intention. To test the MIAU Model, a structural equation modeling analysis was conducted on the questionnaire data. The results support the proposed model. The MIAU Model suggests that resources, technology, contexts, and individual characteristics directly impact data searchers’ dual-process-based cognition. System 1-based cognition has a direct influence on system 2-based cognition. Moreover, dual-process-based cognition and contexts directly affect attitude and usage intention. Additionally, resources, technology, contexts, and individual characteristics indirectly affect system 2-based cognition through system 1-based cognition, and similarly, these factors indirectly influence attitude and usage intention through dual-process-based cognition.

KEYWORDS
Interactive data retrieval; Multi-dimensional interaction; Dual process; Cognitive model

INTRODUCTION
In the field of interactive information retrieval (IIR), scholars have made significant progress in developing theories and models that aim to understand the interaction between information searchers and information retrieval systems. Examples include the Stratified Model of Information Retrieval Interaction (Saracevic, 1997) and the Cognitive Model of IR Interaction (Ingwersen, 1996). These theoretical frameworks provide valuable insights into the various dimensions involved in IIR, including information, technology, cognition, and contexts. By establishing a solid theoretical foundation, these theories and models contribute to enhancing the effectiveness of information retrieval systems (Li & Liu, 2019). Given the growing significance of open data reuse in advancing scientific discovery (Kim & Yoon, 2017), researchers actively engage in discovering reusable data through their interactions with data retrieval systems (DRS). However, existing DRS have limitations in effectively supporting the entire interaction process and the associated cognitive processes (Li et al., 2023). Despite these limitations, there is still a lack of comprehensive understanding regarding researchers’ interaction with DRS and the role of cognition in this process. Furthermore, due to the distinctions between information search and data search (Li et al., 2023), current IIR theories and models fall short in fully capturing the intricacies of interactive data retrieval (IDR). To address these research and practical gaps, this study aims to develop a cognitive model of IDR that offers a holistic perspective on researchers’ interaction with DRS.

THEORETICAL MODEL DEVELOPMENT
Based on theories and models from the fields of IIR, cognitive psychology, social psychology, and information systems (Figure 1), this study proposes a theoretical model of IDR named the “Multi-dimensional Interaction-Attitude-Usage Model” (MIAU Model) (Figure 2).

Figure 1. Theoretical background

The MIAU model proposes several key relationships. Firstly, it examines the impact of resources, technology, contexts, and individual characteristics on data searchers’ dual process, which comprises two distinct cognitive systems: system 1 and system 2. System 1 operates based on emotion and experience, functioning rapidly and
automatically, while system 2 relies on logic and evidence, operating slow and deliberately (Evans, 2008). Secondly, the model explores the influence of system 1 on system 2, as well as the mediating role of system 1 in the relationships between resources, technology, contexts, individual characteristics, and system 2. Lastly, the MIAU model examines the effects of dual-process-based cognition and contextual factors, on data searchers’ attitudes toward DRS and their intention to use the system. It also considers the mediating role of cognition in the relationships between resources, technology, individual characteristics, attitude, and usage intention.

METHOD
We conducted an empirical examination of the MIAU model through a questionnaire-based survey. We received a total of 251 questionnaires, out of which 236 responses were deemed valid after removing incomplete ones (Figure 3). Measurement items for each construct were adapted from previous studies and assessed using seven-point Likert scales. Structural equation modeling analysis was employed to analyze the collected data.

RESULTS AND DISCUSSION
After confirming the reliability and validity of the measurement model (Figure 4), the structural model was evaluated to demonstrate the relationships among the constructs. As shown in Figure 5, the goodness-of-fit indices indicate an acceptable fit for the sample data. The results of the structural model analysis primarily indicate that: (I) Resources, technology, contexts, and individual characteristics have an impact on data searchers’ dual-process-based cognition. Specifically, system quality, resource quality, and user expertise directly affect positive emotions or predispositions, while social influence positively affects negative emotions or predispositions. System quality directly influences performance expectancy, while system quality and user expertise directly affect effort expectancy. (II) System 1-based cognition directly affects system 2-based cognition, while resources, technology, contexts, and individual characteristics indirectly affect system 2-based cognition via system 1-based cognition. Specifically, positive emotions or predispositions and negative emotions or predispositions have significant influence on effort expectancy and performance expectancy. In terms of the mediating role of system 1-based cognition, resource quality, system quality, and user expertise indirectly affect system 2-based cognition through system 1-based cognition. (III) Dual-process-based cognition and contexts directly affect attitude and usage intention. Resources, technology, and individual characteristics indirectly affect attitudes and usage intention through dual-process-based cognition. Specifically, positive emotions or predispositions, negative emotions or predispositions, performance expectancy, effort expectancy directly affect attitude. Positive emotions or predispositions, attitude, and social influence positively influence usage intention. Besides, the indirect effects of system quality, resource quality, and user expertise on attitude via cognition and the indirect effects of system quality, resource quality, and user expertise on usage intention via cognition and attitude are significant.

CONCLUSION & FUTURE WORK
This study introduces and conducts a preliminary test of the MIAU model, offering a theoretical framework for further exploration of interactive data retrieval. The dimensions of resource, technology, and context and individual characteristics encompass a diverse set of constructs. Through a literature review, significant constructs within these dimensions and individual characteristics were identified, providing a preliminary assessment of the MIAU model. Future research should incorporate additional relevant constructs to further investigate and validate this model.

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How Digital Humans Help Libraries Promote Reading

Liang, Shaobo  
School of Information Management, Wuhan University, China | liangshaobo@whu.edu.cn
Wu, Dan  
School of Information Management, Wuhan University, China | woodan@whu.edu.cn
He, Xiaoyang  
School of Information Management, Wuhan University, China | hexiaoyang.whu@qq.com

ABSTRACT
This study investigated how digital humans can help libraries promote reading. This study recruited 103 participants for a user experiment to explore their satisfaction with reading promotional videos using digital humans. At the same time, the effect of using digital humans in library reading promotion was analyzed from the perspective of whether users are willing to share and interact. Research has found that user satisfaction with them is not high due to digital human presence in their voice and intonation. But users are more interested in using anime digital human videos. This discovery can help libraries better carry out reading promotion and digital services.

KEYWORDS
Digital human; Reading promotion; Digital library; User behavior

INTRODUCTION
Digital humans are a complex of human features such as appearance, performance, and interaction that exist in the virtual world and are generated through the application of multiple artificial intelligence technologies such as speech synthesis, facial modeling, image driving, image processing, and deep learning (Strohmeier, 2020). With the development of digitization, the wave of digitization has swept across various industries. Digital humans have achieved personalized customization from multiple aspects such as voice, facial expressions, clothing, language, etc., and have been commercialized in various fields such as virtual customer service, virtual anchors, and virtual idols.

The popularity of digital humans is often reflected on video platforms, but it is more concentrated in fields such as news broadcasting and idol entertainment. Alley and Hanshew (2022) found that videos with vital humanization and interest can better attract readers' attention. Therefore, due to their high openness, digital humans can help librarians create interesting videos and promote reading. In recent years, with the popularity of short video platforms such as TikTok, libraries have begun to use them to publish information (Merga, 2022), such as recommending books.

A digital human is a convenient tool for satisfying the need to reduce the design cycle to save time and money (Yang et al., 2007). Zhen et al. (2023) designed the human-computer interaction system framework, which includes speech recognition, text-to-speech, dialogue systems, and virtual human generation. Libraries and other public cultural institutions are typical application scenarios for intelligent digital services. In China, some libraries use digital human provide services such as bibliographic retrieval and online reading. The digital human can primarily play the role of "versatile librarians". Therefore, this research utilizes a user experiment to study how digital humans can help libraries promote reading. Research questions include: (1) What are users' preferences for differences in the digital human image when watching the reading promotion videos? (2) Are there any differences in the effectiveness of digital human with different images in helping libraries promote reading?

RESEARCH DESIGN
User experiment procedure
This study conducted a user experiment and recruited 103 users to participate. Before the experiment began, researchers produced four reading promotion videos (see the following sub-section). The participants filled out four questionnaires in the experiment: about the user's experience after watching the video, their impression and evaluation of the digital person in the video, and so on. Participants fill out questionnaires separately and then watch each video. After watching the video, each participant was invited to interview with suggestions on using digital humans in the library.

Experiment materials and participants
This study first selected reading promotion videos posted on the official account of Shaanxi Provincial Library on the video platform. Based on the content of this video, we created anime digital characters, male digital characters, and female digital characters, respectively. We created a reading promotion video using these three virtual digital humans, as shown in Figure 1. Each video lasts around 80 seconds that recommends a health book. The four videos' character images differ, the content is identical. The inconsistent duration of the video is due to different speaking speeds.

We recruited 103 participants (47 males and 56 females, over 68% under 23) to participate in the experiment by posting recruitment on social media. Of all participants, 23 are librarians, and 70% have watched reading promotion videos published by different libraries on short video platforms. Each participant received a reward of $5.
Measurement item
This study aims to compare the user satisfaction and promotion effects of real human and different digital humans, and explore the optimal application strategy. Table 1 lists the measurement items of satisfaction with character images in videos and the measurement items of effectiveness in videos with different character images. All questions were measured using the Likert 5-level scale.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with character image</td>
<td>The appearance of the characters in the video is attractive. (AP)</td>
</tr>
<tr>
<td></td>
<td>The voice speed of the characters in the video is appropriate. (VS)</td>
</tr>
<tr>
<td></td>
<td>The movements and behaviors of the characters in the video make me comfortable. (MB)</td>
</tr>
<tr>
<td></td>
<td>The facial expressions and expressions of the characters in the video are positive. (FE)</td>
</tr>
<tr>
<td>Effect of video promotion</td>
<td>I am willing to click on this type of video to watch. (WC)</td>
</tr>
<tr>
<td></td>
<td>I am willing to interact with this video (like or comment). (WI)</td>
</tr>
<tr>
<td></td>
<td>I am willing to share this video with my family and friends. (WS)</td>
</tr>
<tr>
<td></td>
<td>I am willing to follow the library account that posted this video on. (WF)</td>
</tr>
</tbody>
</table>

Table 1. Measurement of questionnaires

RESULTS
Based on the measurement in the questionnaires after participants watched each video, Table 2 showed the satisfaction with the character image and the effect of video promotion. Interestingly, the average total score of real human images in reading promotion videos is the highest. Among all character types, the MB is the lowest among the four dimensions, indicating that this aspect needs optimization. Regarding the effect of digital human usage, we found that participants are more interested in anime digital human. They will be more willing to click on and share videos using anime digital human. Young participants especially have the highest acceptance of anime digital human.

<table>
<thead>
<tr>
<th>Character type</th>
<th>AP</th>
<th>VS</th>
<th>MB</th>
<th>FE</th>
<th>WC</th>
<th>WI</th>
<th>WS</th>
<th>WF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real human being</td>
<td>4.2</td>
<td>4.35</td>
<td>4.09</td>
<td>4.23</td>
<td>4.23</td>
<td>3.96</td>
<td>3.69</td>
<td>3.74</td>
</tr>
<tr>
<td>Animes digital human</td>
<td>3.63</td>
<td>3.74</td>
<td>3.52</td>
<td>3.56</td>
<td>4.4</td>
<td>3.98</td>
<td>3.81</td>
<td>4.06</td>
</tr>
<tr>
<td>Male digital human</td>
<td>3.84</td>
<td>3.71</td>
<td>3.46</td>
<td>3.54</td>
<td>3.42</td>
<td>3.21</td>
<td>3.03</td>
<td>3.02</td>
</tr>
<tr>
<td>Female digital human</td>
<td>4.2</td>
<td>3.87</td>
<td>3.75</td>
<td>3.84</td>
<td>3.74</td>
<td>3.42</td>
<td>3.28</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Table 2. Satisfaction with character and effect of video promotion

CONCLUSION AND FUTURE STUDY
This paper is an exploratory research that analyzes the application of digital humans in promoting library reading. The limitation is that the video content of different characters is consistent, which may affect the participants' experience. In the future, we will build more prosperous evaluation indicators to evaluate the application of digital humans, and I develop a corresponding theoretical model.

ACKNOWLEDGMENTS
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Informal Learning Trends on YouTube during the COVID-19 Pandemic: A Topic Modeling Analysis

Lim, Kok Khiang  Nanyang Technological University, Singapore | w200004@e.ntu.edu.sg
Lee, Chei Sian  Nanyang Technological University, Singapore | leecs@ntu.edu.sg

ABSTRACT
This study explores the impact of the COVID-19 pandemic on informal online learning behavior through the lens of online video tutorials hosted on YouTube. Over 40,000 YouTube comments were collected for topic modeling analysis and uncovered thirteen latent topics related to three learning behavior types, that is, environment structuring, help-seeking, and self-evaluation. These learning behaviors underwent varying degrees of change after the pandemic declaration and normalized after that, highlighting the importance of adapting teaching methods to meet the changing needs of learners in response to any learning disruptions.

KEYWORDS
Informal learning, learning behavior, topic modelling, pandemic, YouTube

INTRODUCTION
Informal learning refers to learning outside formal education that is not organized or structured regarding objectives, time or learning support (Marsick & Watkins, 1990; Yu et al., 2021). It is often undertaken to supplement formal learning by filling gaps in the formal learning materials and curriculum or to improve the understanding of formal learning content, as well as to enhance competencies and develop skills (He & Zhu, 2017; Werquin, 2010). During the COVID-19 pandemic in early 2020, informal learning faced significant challenges due to the closure of schools and restrictions on social gatherings (World Health Organization, 2020). Learning was abruptly transitioned to online platforms (Li & Lalani, 2020; Smith, 2021). In response, online platforms, such as YouTube and Massive Open Online Course providers, reported a significant increase in viewership and an upsurge in course enrolments (Shah, 2020; YouTube, n.d.). Despite the significant shift to online platforms, few studies have examined how the pandemic has affected informal learning behaviors and their changes.

This study aims to explore the impact of the pandemic on informal online learning behavior by analyzing learners’ comments posted to the online video tutorials hosted on YouTube. The self-regulated learning (SRL) theoretical framework, referred to as one’s ability to understand and control their own learning needs and environment to achieve one’s desired goals (Barnard et al., 2009; Zhou et al., 2020; Zimmerman, 1998), is used to guide the identification of learners’ informal online learning behavior on YouTube. This study is timely as it investigates learners’ responses to the changing learning environment and compares their learning behaviors one year before and after the pandemic’s announcement from the context of informal learning on the online platform YouTube. Hence, the research question is: What are the informal online learning behaviors and their changes in response to the COVID-19 pandemic on the YouTube platform?

METHOD
This study examined online video tutorials hosted on YouTube’s freeCodeCamp channel, which provides extensive video instructions on coding subjects such as Python and SQL. It serves as an informal learning space for learners to enhance their learning and explore new skills and knowledge outside the classroom (Lange, 2018; Tan, 2013). Comments posted between March 2019 and March 2021 were collected to enable a comparison of learning behaviors before (T1) and after (T2) the pandemic announcement in March 2020 (World Health Organization, 2020). In total, 42,541 comments (M = 3,867, SD = 5,467) were collected from eleven online video tutorials with at least a million views and more than 100 comments. The collected comments were pre-processed to clean up the data before performing the structural topic modeling (STM) analysis. STM has the advantage of incorporating documents’ metadata (e.g., date) as covariates into its model to estimate the moderation effects on the topics.

The analysis was performed in three steps to uncover the latent topics and detect the changes in learning behavior within the comments. First, an optimal number of topics was established using three metrics: held-out likelihood estimation, semantic coherence, and residuals (Naab & Sehl, 2016; Roberts et al., 2013), to build a good model fit for STM analysis to uncover the latent topics. Next, comments associated with each topic were automatically summarized into succinct sentences using the extractive text summarization method to provide meaningful descriptions and context for the manual labeling of the topic (Khabiri et al., 2011). These details were further used to code the topics into the five appropriate SRL behaviors (goal setting, environment structuring, task strategies, help-seeking, and self-evaluation) based on the SRL definitions and examples (Barnard et al., 2009). Lastly, STM’s topic prevalence tool was used to trend the topics’ changes and their significance across the two-time frames, T1 and T2.
RESULTS
The dataset saw an increase of 39.2% more comments during T2. After data pre-processing, 31,197 comments remained in the dataset. Thirteen topics were determined to be the optimal number to represent the dataset. They were identified to be related to three SRL behaviors: environment structuring, help-seeking, and self-evaluation. Topics 1, 3, 6, and 11 were mapped to environment structuring, with a total topic proportion of 39.5%. Help-seeking was identified with seven topics, 2, 4, 7, 8, 10, 12, and 13, at a total topic proportion of 44.7%, making it the dominant SRL behavior. Topics 5 and 9 were related to self-evaluation at a total topic proportion of 15.8%. The topic prevalence (Figure 1) showed that topic 1 had the highest topic proportion and was significant in T2 (Figure 2). The remaining twelve topics coalesce during T2 into two clusters. The first cluster comprised three topics (5, 6, and 7) with an average topic proportion of 10.4%, while the remaining topics clustered at an average topic proportion of 6%. Topics 3 and 6, related to environment structuring in the areas of usefulness of coding and content accessibility, respectively, as well as topic 8 on help-seeking, were significant and trending upwards during T2. On the other hand, topics 2, 4, 9, 10, 12, and 13, associated mainly with help-seeking, declined during T2. As for topic 11, the environment structuring behavior had a relatively stable topic proportion throughout T1 and T2.

DISCUSSION AND CONCLUSION
Drawing on the SRL theoretical perspective, this study examines learning behaviors revealed through the comments posted between March 2019 and March 2021, and compares their changes before and after the pandemic announcement. Latent topics were uncovered through topic modeling, while the topic prevalence measured the topics’ trends and significance over time. Overall, the findings showed an intriguing trend that points to a change in SRL behaviors following the onset of the pandemic. Environment structuring, being a significant behavior during T2, highlighted the importance of a conducive informal online learning environment especially during the pandemic period to engage and encourage learning. The many help-seeking topics, identified as the dominant SRL behavior, reflected the nature of online tutorials, where learners were more likely to seek help. Therefore, educators and content creators should pay close attention to guiding the learners or improving their content. Interestingly, the clustering of the topics after the pandemic announcement indicated significant behaviors changes aligned with the theoretical perspective of SRL, where the environment influences behavior, and learners would self-regulate their behavior to adapt to a different learning environment. Another plausible explanation could be derived from the normalization process theory (NPT; May et al., 2009), which explains three interrelated issues, (1) implementation - bringing practices into action; (2) embedding - incorporating into routine practices; and (3) integration - sustaining practices over time (May et al., 2009), would promote or impede new changes into routine processes. Thus, along this vein, the online environment being the primary learning mode during the pandemic, represented a disruptive and innovative change to the educational system. Indirectly, the pandemic sped up the education transformation, affecting and altering learners’ expectations and learning behaviors.

This study may be limited by the biased responses presented in the learners’ comments (Lange, 2014). However, these are likely to be sparse and considered outliers (Veletsianos et al., 2018) and would be cleaned during data pre-processing and algorithmic processes. Next, the data collected cannot ascertain diversity in demographics and cultures, generalizing for all populations impossible. We plan to broaden this perspective to provide a more granular understanding in future studies. Additionally, exploring learners’ emotions and sentiments from their online video comments could provide additional insights into understanding behavioral changes. Future studies based on the NPT could investigate the topic convergence phenomenon and the underlying mechanisms that influence normalization behavior. Such a study could provide valuable knowledge to educators for future educational system development.
REFERENCES


Exploring Humanities Researchers’ Perceptions of “Data”: A Phenomenological Approach

Lin, Chi-Shiou  
National Taiwan University, Taiwan | chishioulin@ntu.edu.tw

ABSTRACT
This poster reports on the preliminary findings of a phenomenological investigation of humanities researchers’ perceptions of “data” to develop workable strategies for future collection and curation of research materials used for humanities research. An archival approach is proposed to curate individual humanities researchers’ research materials.

KEYWORDS
Data curation, research data management, humanities research

INTRODUCTION
Data curation and research data management (RDM) is now essential issue in the sciences communities. Some data sharing advocates also extended the call for the inclusion of qualitative data and data used in humanities research (Borgman, 2010). Although some humanities researchers do employ data like what their sciences and social sciences peers do, others might hold very different views and demonstrate diverse behaviors. As Burrows (2011) powerfully described: “There is a tendency among commentators to assert that primary sources are the humanities researcher's data and therefore that primary sources (including documents, texts, and images) and data are one and the same thing… [t]his is not particularly helpful, since it blurs the distinction between data and sources of data or between evidence and sources of evidence. It also conflates the objects of research with the descriptive and representational data derived from them by researchers… [F]or the humanities is that they do not deal exclusively with physical phenomena. They are also concerned with more abstract entities like texts and works, which are conceptual entities as well as their physical manifestations.”

With that understanding in mind, this author interviewed ten experienced humanities researchers from a prominent research university in Taiwan to explore the concept of data for them – whether they held similar views of data like the scientists and social scientists do or how different they envisioned their relations with the documents, images, and records that are often blurred denoted as “data” by the outsiders. Specifically, the investigation aimed to identify what could possibly be archived and shared for the humanities research, and how, from the RDM standpoint.

METHODOLOGY
A phenomenological approach was adopted for this study. As Lin (2013) summarized from previous literatures, phenomenology is reflective analyses of the life-world experiences. It is a recommended methodology when the study goals are to understand the meanings of human experiences or to explore concepts from new and fresh perspectives.

The author conducted in-depth interviews with ten professors from the College of Liberal Arts: three from the Department of Chinese Literature (CL), three from Foreign Languages and Literatures (FLL), two from Japanese Language and Literature (JLL), one from Philosophy, and one from Musicology. The selection of the interviewees was based on the diverse study approaches in humanities. Even in the same department, humanities researchers vary significantly in their research conventions. For instance, in the Department of Chinese Literature, the faculty often described their differences as “doing literature research” (e.g., studying the Tang Dynasty literature) versus “studying thoughts” (e.g., Confucianism, Taoism). In the Department of Foreign Languages and Literatures, a similar distinction existed, known as “doing literary analyses” (e.g., studies on particular works, authors, and literature of particular regions and/or periods of time) versus “doing theories” (e.g., studies of theoretical literary approaches like Foucauldian discourse analyses, psychoanalysis). Other distinctions existed such as to what extent the research relies on primary sources or non-textual sources of evidence, whether archival or historical materials matter for those studies. In summary, the author adopted the theoretical sampling principle to seek interviewees with varying degrees of reliance on and diverse usages of “data” in their research processes. A brief list of the interviewees is as follows:

- C1 (from CL): literature research (Tang Dynasty novels); great reliance on primary sources and literary works
- C2 (from CL): studies of thoughts (Taoism, Pre-Qin Confucianism); great reliance on classic works
- C3 (from CL): Chinese bibliography and book histories; great reliance on primary sources and ancient books
- F1 (from FLL): literary analyses (American literature); great reliance on historical information and some primary sources
- F2 (from FLL): studies of theories (Foucauldian analyses); great reliance on other research works and little reliance on primary sources
- F3 (from FLL): studies of theories and comparative analyses of literature; great reliance on other research works and modern literary texts and little on primary and historical sources
Phenomenological analyses involve three conceptual moves. First, epoche, or “bracketing”, is to temporarily suspend one’s existing beliefs and preconceptions about the studied phenomenon – in this case, the concept of data and its meanings for humanities researchers. Trained as a social scientist who had also taught undergraduate social sciences research methods for years, the author wrote down his understanding of what data are and how data function in the sciences and social sciences. The most important preconceptions included that data are condensed representations of the interested empirical phenomenon, systematically and objectively collected to ensure the subsequent relatively unbiased and reliable analyses and that data are recorded, processible, and storable entities -- they are concrete “things” external to a researcher’s mind and not just abstract thoughts.

Second, eidetic reduction is the process of ridding the phenomenon of its surface appearances to reveal the “essence” of things – in this study, to identify what in the concept of data works and what does not for the humanities as well as how to better describe and denote the research materials utilized in humanities research. Third, the imaginative variation is to examine the meanings of the studied concept by altering the frames of reference to re-approach it from divergent perspectives – in this study, the concept of data as the author previously perceived was reviewed, modified, and abandoned/considered irrelevant for some humanities research; instead, the author considered data curation for humanities research should focus on the relevance and linkages of the documents, records, or “things” used for the formation of a research paper; it should also attend to their relations to a researcher’s research moves during the entire research process, or among a series of works, even that researcher’s real life achievement.

MAJOR FINDINGS

Due to the page limits, this poster reports only specific themes emerging from the phenomenological analysis:

- The concept of “data” worked for some humanities researchers, although they often prefer other terms: only J1 who does linguistic research found the concept of data relevant and fully compatible with their research community. The other interviewees who employed primary sources, ancient books, and classic/literary texts understood the concept of data as perceived by scientists and may found it equivalent to how they used research materials in some cases. However, they generally prefer the more encompassing term “research materials” or “primary sources” to data because, in their respective communities, there are already established distinctions of document types and the associated use behaviors.

- The concept of data as external entities and representations of the empirical world is too rigid for the humanities research: when humanities researchers approach classic works, literary texts, ancient books, or historical materials, they often do not just look for objective or representational evidences. They might also look for new inspirations and insights from the materials, seek to re-understand the meanings, and/or re-appraise the values and significance of those studied texts. In other words, primary sources and other research materials serve dual functions – both as “data” and as “the source of information/inspiration” like what research papers are to scientists and social scientists. As such, the current popular concepts of data curation and RDM are incompatible with the humanities world.

- The concept of data is almost irrelevant for researchers who study literary theories and schools of thought, including the studies of philosophies. Papers and documents for those researchers – whether older or contemporary texts — serve almost entirely as sources of abstract ideas. The researchers’ jobs are to compare, relate, evaluate, reconstruct and/or propose ideas. They hardly viewed research material as “evidence of fact” for this type of evidence is seldom required for their analyses.

- The concept of data might work in some humanities research, but not the concept of “dataset”: Existing RDM and data repositories built for sciences and social sciences aim to collect and store distinct datasets, that is, distinctive and separate entities containing definite representations of the empirical phenomenon. However, for the humanities research where the concept of data might work and where data do denote objective evidence or source of evidence, the interviewed researchers hardly viewed the use of the data as a one-time thing. The use of the “humanitarian data” may span across several related projects, one forming the foundation of those that follow, even throughout the researchers’ entire academic career. Most of the interviewees had built one or more huge repertoires of research materials including books, papers, documents, primary sources, along with their compilations of bibliographies, notes, annotations, and so on. It would be hard and irrelevant for them to say which distinct part of the personal collection constitutes the dataset for a particular project. More importantly, they have developed individualistic and unique knowledge of the associations of the documents and that’s how their research works are founded. The storage of those documents alone might not help outside users. As such, this author considered an archival approach to curating a researcher’s research materials with the use contexts of the entire collection preserved as a better way to develop data curation plans for humanities research.

· J1 (from JL): Japanese linguistics; great reliance on electronic text corpus
· J2 (from JL): Japanese poems; great reliance on primary sources and literary texts
· P1 (from Philosophy): Western philosophies, philosophy of science; great reliance on other research works and some reliance on philosophy classics texts, little on historical and primary sources
· M1 (from Musicology):
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Information Borderlands in the U.S. Southwest

Lischer-Katz, Zack
University of Arizona, USA | zlkatz@arizona.edu

ABSTRACT
This paper proposes “information borderlands” as a framework for bounding a unique information environment that is constituted by individual and community level practices, physical landscapes (natural and human-shaped), as well as large-scale sociotechnical systems and systems of documentality. Taking the borderlands of the Southwestern U.S. as an unique case, the concept is developed and directions forward for future research are suggested. The goal is to begin to develop a framework that can take into account information practices and infrastructures that shape the creation, flow, storage, preservation, and retrieval of information and data within information borderlands, as unique, multi-layered information environments. The U.S.–Mexico border has become notorious and a politically charged topic of public debate in the U.S. over the last three decades. It demarcates international state boundaries and the sociotechnical infrastructure of border enforcement controls the passage of people and goods between the two countries. As Heyman (2022) points out, the influence of the U.S. border enforcement regime extends 100 miles north of the border itself, making the borderlands a unique space of surveillance and control where millions of people live, work, and travel every day. With the spread of fortified and militarized borders (including the use of military-grade barriers and weapons) across the Americas, the Middle East, and other regions under U.S. political influence, an increasing portion of the global population is engaging with borderlands as extensions of the U.S. “homeland” (Miller, 2019). Studying borderlands is important because the communities and individuals that live and move through these spaces have pressing information needs that may face barriers, and because these areas have special economic, health, and other social needs (Chen et al., 2013). Understanding borderlands as systems that impact different groups of inhabitants (classified by institutions along racial, socioeconomic, or legal attributes) in different ways is helpful in this regard. Information practice research has considered individual information practices (Veinot, 2007), including individual’s immediate information spaces (Hartel and Thomson, 2011), as well as the information practices of groups. However, integration of information practice research at multiple scales, with a geographic region as the bounding strategy is not widely pursued. Information studies occasionally draws on infrastructure studies and other STS subfields, but this is notably absent from information practice research, where the scale is usually at the individual or group level of analysis. I have argued elsewhere that understanding visual information practices requires considering multiple dimensions and levels of analysis, at the levels of materiality, practice, discourse, and institutions, and utilizing multiple forms of data generation and analysis (Lischer-Katz, 2022). Similarly, the idea of “information borderlands” suggests a multi-perspectival approach that integrates analysis of practices and discourses in situ, situated in relation to the networks and systems, institutional structures, and sociotechnical infrastructures, which also need to be integrated into the analysis. Providing a holistic approach that integrates multiple levels of analysis can also help to integrate findings from disparate areas in information research that are not often integrated.

INFORMATION RESEARCH ON THE BORDERLANDS
Since the 1990s, the north side of the U.S. border has become increasingly surveilled and policed by a militarized border security regime that makes everyone (documented and undocumented people alike) objects of intrusive data collection regimes. At the same time, illegal border crossing is an increasingly deadly endeavor, with border policy designed to encourage border crossing at the most treacherous desert areas - the so-called “funnel effect” (Rubio-Goldsmith et al., 2006). “Borderlands theory” was first developed by Gloria E. Anzaldúa in her book Borderland/La Frontera: The New Mestiza (1987), which conceptualized the borderlands as a physical and metaphorical space that shapes and generates new cultural identities. Reviewing the literature on the borderlands, a whole range of stakeholders and social actors can be identified inhabiting or traveling within this region: migrants (including migrant day laborers, refugees seeking asylum, and many other types); border tourists (visitors crossing the border to purchase goods or services, or visit family and friends for short time periods) and borderland campers and others exploring the natural features of the Desert Southwest; border patrol and other types of law enforcement officers; cartel members and other criminal actors; American vigilante groups that circulate along the border and engage in surveillance and harassment of other groups; and groups providing support for migrants, including activists.

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migrant-aid workers, and search and recovery volunteers. Research that focuses on these social actors specifically in the borderlands is rare in information research. A few exceptions include, the information practices of migrant-aid workers (Newell et al., 2020) and information seeking and technology use of border crossers (Newell et al., 2016), and the information practices of law enforcement, more generally, in contexts outside of the borderlands, but studied in relation to local sanctuary laws (Tian et al., 2021). Areas of information research related to the information practices of transnational migrants more generally include studies on the information practices of immigrants (Caidi et al., 2008, 2010), refugees and forced migrants (Lloyd, 2017), and information practices of immigrants settling in cities (Allard, 2021; Lingel, 2011; Shuva, 2018). Baron et al. (2014) studied the use of ICTs by migrant day laborers; Fisher and Marcoux (2004) studied the information behavior of migrant Hispanic farm workers; and Leonardi (2003) studied the perceptions of ICT-use by Latinx communities (Leonardi, 2003). In information studies, immigrants have been considered as key users of information institutions, particularly libraries. For instance, Dali (2021) studied how immigrants viewed libraries. Srinivasan and Pyati (2007) have argued for an approach to immigrant-focused information science that mediates between place-based studies that focus on individual practices and the broader trends of globalization and diaspora. The border security apparatus, including the 100 mile border perimeter zone of checkpoints, sensors, and drones, contributes to an information landscape that is shaped by the dueling logics of secrecy and concealment, and surveillance and exposure (Latham, 2014).

DEFINING INFORMATION BORDERLANDS

I define information borderlands within a social constructionist paradigm (Talja et al., 2005; Tuominen et al., 2002, 2003, 2005; Tuominen and Savolainen, 1997), as the frontier spaces that surround international borders, and which may contain overlapping networks of surveillance, data collection, and competing documentary and record-keeping regimes and memory practices. They are conceived as assemblages of naturally-occurring and human-built environments that are hybrids integrated with physical and digital sociotechnical infrastructures that shape the environments and the movements of human and non-human actors into, out of, and across borderland spaces. Studying information borderlands requires studying multiple scales, from the micro level of individual and small group information practices, to the meso level of community and institutional activities, to the macro scale of large geographic regions and the complex sociotechnical systems that overlay or undergird them.

INFORMATION RESEARCH APPROACHES TO THE BORDERLANDS

Information borderlands opens up several interesting information studies areas of research. First, information borderlands are rich spaces of visual information, so emerging techniques in studying visual information practices (Lischer-Katz, 2022) could be used to understand these spaces in terms of the visual landscape of physical features and the wayfaring and navigation of people, as well as the systems of cameras, sensors, drones, etc., that collect data on the movement of people through these spaces. Second, information borderlands offer a unique space for expanding notions of digital curation and thinking about the ways in which social groups in the borderlands curate their personal information as they are seeking and using information (following Dallas’s (2016) call to study digital curation “in the wild frontier”). Third, information borderlands are complex sites of overlapping systems of surveillance and recordkeeping. Counter-archiving activities also exist: activist groups are documenting migrant deaths and mapping them to produce political messages; groups are creating shrines and memorials to migrants who have died in the borderlands (Auchter, 2013); and libraries are collecting and archiving stories and artifacts from the borderlands (Mellon Foundation…, 2020; The Documented Border, n.d.). Researchers who study archives, record keeping, and memory practices can contribute in this area. Fourth, the ethics of border technologies and the role played by data policies in migrant deaths and intrusive documentary regimes can be studied by researchers in information ethics, critical data studies, and infrastructure studies. There is already growing interest in this area, e.g., the ethics of border technologies (Hendow et al., 2015); data governance across borders (Metcalf & Dencik, 2019); algorithms, AI, automation, and ethics of border enforcement (Hendow et al., 2015; Lara, 2022; Sánchez-Monedero & Dencik, 2022); the data privacy of migrants (Vannini et al., 2020); and experiences of surveillance (Newell et al., 2017). Applying these approaches to borderlands research will provide an important perspective on how data are collected and used by governments to establish regions of data hegemony, power and control.

CONCLUSION

What does the information borderlands framework offer us? Better understanding how governments assemble and maintain data collection regimes, the impact of these regimes on the privacy and well-being of citizens and non-citizens alike, and the ways people navigate and seek information in the desert landscape, have the potential to guide public policy and data governance. Practically, gaining a holistic view of information borderlands by integrating findings on the information practices of social groups with an enhanced understanding of data archiving (and counter-archiving regimes) can guide the development of tools to support the information practices of at-risk inhabitants. It also can provide useful information for libraries, archives, and other institutions to support the information practices and archival needs of these groups. It is hoped that information borderlands will be useful for guiding research on borderlands in other parts of the world.
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Social Network Analysis of Misinformation Spreading and Science Communication during COVID-19

Liu, Jieli  
Indiana University Bloomington, USA  | liujiel@iu.edu
Regulagedda, Ravi Maithrey  
Indiana University Bloomington, USA  | raregul@iu.edu

ABSTRACT
The outbreak of COVID-19 has resulted in an increase in health misinformation spreading on social media, emphasizing the need for effective science communication to combat this issue. This study aimed to analyze the relationship between misinformation spreading and science communication network. We identified misinformation spreaders, scientists, and laypeople from COVID vaccine-related tweets, and we carried out a network analysis to examine the ingroup and intergroup interactions. We found that individuals in all three groups tended to interact with people who were dissimilar to them. Additionally, we found that the spreading of misinformation and the science communication network are polarized. Finally, suggestions were provided to achieve higher engagement in science communication.

KEYWORDS
Misinformation, Science Communication, Social Network Analysis

INTRODUCTION
Social network sites have provided effective platforms for laypeople to engage in scientific discussions. However, they have also become a fertile ground for stakeholders to spread misinformation (Nguyen & Catalan-Matamoros, 2020). The outbreak of COVID-19 has amplified the spread of vaccine misinformation, leading to a widespread problem of vaccine hesitancy among many individuals (Loomba, de Figueiredo, Piatek, de Graaf, & Larson, 2021; Pierri et al., 2022). It not only significantly erodes public trust in scientific institutions but also puts marginalized groups at greater risk of exposure to misinformation and make them less likely to have access to accurate information (Kahan et al., 2012). To better communicate with laypeople, healthcare institutes have adopted effective communication strategies, such as tailoring information sharing to meet people's health needs (Rousseau et al., 2015). However, the mechanism of how science communication can combat the spreading of misinformation remains unclear. Thus, this study aims to investigate the relationship between the spreading of misinformation and scientific knowledge sharing.

RELATED RESEARCH
Misinformation spreading and network analysis
Numerous studies have investigated the spread of misinformation through network analysis. Previous studies have developed metrics to identify misinformation spreaders, including the creation of original posts containing low-credibility websites, which provides a valuable method for identifying misinformation spreaders on social media (DeVerna, Aiyappa, Pacheco, Bryden, & Menczer, 2022; Pierri et al., 2022). Additionally, many studies have examined the characteristics of information-sharing networks concerning different political beliefs and opinions. For example, research has found that pro- and anti-vaccination users form two polarized networks that hardly interact with each other (Milani, Weitkamp, & Webb, 2020), which suggests that human group properties may influence the characteristics of information dissemination network. Our first research question is: What are the characteristics and differences among the communities of misinformation spreaders, scientists, and laypeople?

Misinformation combating and public engagement with science
Previous research has shown that media literacy can help with mitigating the effects of misinformation (Guess et al., 2020; Jones-Jang, Mortensen, & Liu, 2021). Furthermore, Gu and Feng (2022) found that public engagement with science (PES) attitudes and activities positively predicted scientific information literacy. We are interested in whether PES will be effective in restraining the spreading of misinformation. Specifically, we expect that the more engaged individuals are with science, the less they will engage in spreading misinformation. Our second research question is: How do laypeople interact with misinformation spreaders and scientists?

METHOD
We obtained random one-day data (November 11, 2022), consisting of approximately 140K tweets, from the CoVaxxy dataset (DeVerna et al., 2021), which is a complete set of Twitter posts related to COVID-19 vaccines. We built the network based on this dataset, nodes were defined as Twitter users, and the edges denote the retweet relationship. We classified misinformation spreaders based on their tweets’ content, whose original tweets contain links to low-credibility websites (Pierri et al., 2022). We identified scientists in the network by examining users' Twitter bios. If a bio contained a professional title that corresponded with one of 45 specific titles related to vaccines and health (such as “immunologist” or “virologist”), the user was classified as a scientist. Using this method, we
were able to classify 523 users as scientists within the whole network (see Table 1). The remaining users were classified as laypeople nodes. We sampled the largest connected component for network analysis which could maintain the characteristics of the whole network and simplify the calculation at the same time.

RESULTS AND DISCUSSION

RQ1: What are the characteristics and differences among the communities of misinformation spreaders, scientists, and laypeople?

We found that there were some hubs in the network, with one node having 4242 edges, while 42% (N=36373) of the nodes had no edges. The proportions of misinformation spreaders and scientists in the whole network are 1.13% and 0.60% respectively, while the proportions in the largest connected component are 1.63% and 0.49% respectively (see Table 1). The number of scientists aligns with the distribution of researchers surveyed by UNESCO, stating that researchers accounted for 0.1% of the global population.

<table>
<thead>
<tr>
<th></th>
<th>Misinfo spreaders</th>
<th>Scientists</th>
<th>Laypeople</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td># of nodes in the whole graph</td>
<td>976 (1.13%)</td>
<td>523 (0.60%)</td>
<td>85086 (98.27%)</td>
<td>86585</td>
</tr>
<tr>
<td># of nodes in the largest component</td>
<td>726 (1.63%)</td>
<td>220 (0.49%)</td>
<td>43564 (97.87%)</td>
<td>44510</td>
</tr>
<tr>
<td>Assortativity</td>
<td>-0.49</td>
<td>-0.48</td>
<td>-0.21</td>
<td>-0.21</td>
</tr>
</tbody>
</table>

Table 2. Community Characteristics

The assortativity values are negative in all three groups, indicating that all three groups tended not to connect with people with similar degrees (see Table 1). We speculated that the reason is that there were some giant hubs in these communities linked to marginalized people. The larger assortativity value of laypeople group indicates that laypeople are more likely to interact with people with similar degree compared to misinformation spreaders and scientists.

RQ2: How do laypeople interact with misinformation spreaders and scientists?

We calculated the fraction of connections to all three types of groups and plotted the fraction of connections to scientists and misinformation spreaders (see Figure 1). The scatterplot shows that laypeople tended to interact with either scientists or misinformation spreaders, but not both. This suggested that there was a divide between those who sought scientific knowledge and those who believed in misinformation, meaning that science communication and misinformation spreading networks were polarized. It echoes the findings in the previous study that pro- and anti-vaccine groups are polarized (Milani et al., 2020). To combat this situation, scientists should improve the science communication skills and target diverse audiences including those who are skeptical or hesitant about scientific knowledge.

Figure 1. Scatterplot of connections from laypeople to other groups.

CONCLUSION

This study analyzed the community characteristics and interactions among misinformation spreaders, scientists, and laypeople by conducting a network analysis of tweets about COVID vaccine. Our study suggested that the misinformation spreading network and science communication network are polarized. For ingroup interactions, individuals in all three groups were likely to connect with people who were dissimilar to them.
REFERENCES


The Longitudinal Relationship Between Negative Emotions and Pandemic Protective Behaviors in Older Adults: Moderating Effect of Online Health Information Seeking

Liu, Tianchang  
Nanjing University, China | njutcl@smail.nju.edu.cn
Song, Xiaokang  
Nanjing University, China | sxksxk666@163.com
Zhu, Qinghua  
Nanjing University, China | qhzhu@nju.edu.cn

ABSTRACT
The aim of this study is to investigate the reciprocal relationship between negative emotions and protective behaviors of older adults and the moderating effect of online health information seeking (OHIS) change on the relationship. Based on a sample of over 20,000 individuals from the Survey of Health, Ageing and Retirement in Europe project, the study used a cross-lagged panel design (CLPD) on 2 waves of Corona Survey to analyze the relationship between negative emotions and protective behaviors with OHIS change as a moderator. The findings suggest that the number of negative emotions can positively predict protective behaviors, and OHIS can have moderating effects on negative emotions and protective behaviors. The result pinpoints the substantial potential of mental health and OHIS to combat infectious diseases in this vulnerable population.

KEYWORDS
Online Health Information Seeking; Older Adult; Pandemic Protective Behavior; Negative Emotion; Cross-lagged Panel Model

INTRODUCTION
The COVID-19 pandemic has caused a significant impact on older adults because COVID-19 has a high prevalence, severity, and mortality rate among them. According to the Common-Sense Model of Self-Regulation (CSM, Leventhal, Meyer, & Nerenz, 1980), negative emotion is closely related to threat perceptions and is a crucial factor in determining protective behaviors (Myrick, 2017). CSM contains a “feedback loops” framework which describes the dynamic process that individuals modify their emotional representations through an appraisal of the coping strategies (Hagger, Koch, Chatzisarantis, & Orbell, 2017). Besides, it is found that taking protective behavior may mitigate negative emotions of older adults during the early stage of the pandemic, but not during the later stage (Xiang, Luo, Zhou, & Zhou, 2022). Thus, the long-term reciprocal relationship between negative emotions and pandemic protective behaviors is complex and worth further study.

During the pandemic, older adults are increasingly turning to the Internet for information about the pandemic not only for information needs but also for maintaining mental connections in coping with isolation and loneliness (Lund & Ma, 2022). However, due to lower familiarity with information and communication technology usage, there are some obstacles during the seeking process, such as misinformation and information overload, which further increase negative emotions and the reluctance to engage in protective behaviors. Therefore, it is necessary to explore the moderating effect of OHIS between negative emotions and pandemic protective behaviors.

METHODS
Sample
The data used in this study are from the “Survey of Health, Ageing and Retirement in Europe” (SHARE) project (Börsch-Supan et al., 2013), which is a large European social science panel study. Specifically, the study used data from the first SHARE Corona Survey (Wave 1, June–August 2020) and the second SHARE Corona Survey (Wave 2, June 2021- August 2021). This study selected samples who were older than 55 years old and participated in both waves of SHARE Corona Survey. The final samples consist of 21111 individuals from 26 European countries and Israel.

Measures and Data Analysis
In this study, OHIS change was measured by the usage frequency of the Internet for finding information on health-related issues since the outbreak compared with before the outbreak. Response options were “not at all”; “less often”, “about the same”, “more often”. Protective behavior was measured by the number of protective actions including “always or often staying distanced from others outside the home”, “covering coughs and sneezes”, “not meeting with more than 5 people from outside household”, “taking drugs for coronavirus prevention”, ranging from 0 to 4. Negative emotion was measured by the existence of negative emotions in the last month, including four types of negative emotions: nervous, depressed, lonely, trouble with sleep, ranging from 0 to 4. Each emotion was measured by a question about whether they felt nervous, felt sad or depressed, had trouble with sleep or recent change in...
pattern, often felt lonely in the last month. Protective behaviors and negative emotions were measured in both Wave 1 and Wave 2. OHIS Change was measured in Wave 2. The study also added some covariates related to protective behaviors, including demographic variables such as gender, age, education, marriage, household income, and employment, as well as health indicators such as subjective health, number of chronic diseases, and COVID-19 involvement in both waves.

The study used an auto-regressive cross-lagged panel design (Selig & Little, 2011) to analyze the longitudinal effect of negative emotions on the protective behaviors of older adults. The study first analyzed the relationship between negative emotions and protective behaviors with OHIS as a covariate. Then, a multiple-group approach was used for OHIS moderator analyses (Ulrich, Lux, Liel, & Walper, 2022). Samples were divided into 4 groups according to their changes in OHIS frequency. The CLPD was built in the structural equation model with robust standard error, and full information maximum likelihood estimation was used because of missing data in some covariates.

**PRELIMINARY RESULTS**

Figure 1 illustrates the results of the auto-regressive cross-lagged panel model. Model A is for the whole sample (N=21111) and model B-E are for different changes of OHIS behavior frequency. There was no measurement invariance between the groups. The result of our study shows that negative emotions can positively predict protective behaviors of older adults (β = 0.041, p < 0.001). This is possibly because older adults have more life experiences and tend to become more cautious and have better compliance with preventive measures after experiencing negative psychological emotions. Also, adhering to protective behavior is not a sufficient solution to older adults’ mental health issues and further coping strategies are needed. As for the moderating effect, only for older adults who have reduced OHIS, negative emotions do not have long-term effects on protective behaviors (β = 0.027, p = 0.306) and the decreased OHIS among older adults indicates the possible existence of information avoidance. Besides, the correlations between negative emotions and protective behaviors remained significant in Wave 2 in Model D and E (β = 0.023, p = 0.03; β = 0.027, p = 0.048, respectively) but not in Model B and C (β = 0.019, p = 0.230; β = 0.027, p = 0.280, respectively). The result suggests that the influence of negative emotions on disease prevention may vary over time. During the initial stage of a crisis, cognitive factors such as risk perception may play a more significant role in shaping protective behaviors, while during later stages, factors such as habit formation and health awareness may become more salient. Therefore, older adults who engage in OHIS may have greater access to information about the pandemic, which can help them better understand the risks and benefits of protective behaviors as well as stick to protective behaviors.

The study advances the understanding of the reciprocal relationship between emotional representation and coping strategy in CSM, proves the applicability of CSM to older adults’ pandemic prevention, and demonstrates the value of fostering OHIS in resolving long-term public health crises and the prevention of infectious diseases.
ACKNOWLEDGEMENTS
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“Have a Flare with Me!”: Disability Storytelling on TikTok

Lundy, Morgan
University of Illinois Urbana-Champaign, USA | melundy2@illinois.edu

ABSTRACT
People with shared health conditions, including contested conditions like central sensitivity syndromes (CSSs), are utilizing TikTok to both seek and tell visual illness stories—and to co-create health information in creative, mimetic, and platform-specific ways. This poster presents results from a pilot qualitative content analysis study of 100 TikTok videos and comments by people personally experiencing #fibromyalgia, a pilot codesign session with a CSS TikTok community member, and late breaking results from a dissertation in progress. These studies are the first stages in the goal to understand and support these embodied, creative, and often-collective storytelling abilities, necessary within the CSS community experiencing invisibility, stigma, and difficult diagnoses. The visual poster format enables discussion, with examples of TikTok videos illustrating 7 identified themes, iconographic elements, and examples of recurring creative choices and collective storytelling features. Last, of broader interest in our field, this poster presents methodological challenges and sparks for discussion of best methods for TikTok research, including: (1) a novel sampling approach addressing gaps in current research and the slippery definition of TikTok communities, (2) a brief description of preliminary codesign findings and the method’s promise in this domain, and (3) discussion of critical disability studies perspectives guiding this research.

KEYWORDS
TikTok; disability and information technology; storytelling; human information behavior; health information

INTRODUCTION
The purpose of this dissertation in progress is to understand the individual and collective storytelling and information creation practices of a particular algorithmically mediated online health community (OHC), people experiencing central sensitivity syndromes (CSSs), in a specific sociotechnical environment, TikTok, —and then, building on theory through participatory methods, to codesign creative storytelling materials to support others’ health storytelling in diverse contexts. This poster shares the first stages of reaching these research goals – (1) results from a pilot, exploratory qualitative analysis of TikTok videos and top-comments, (2) a pilot interview and codesign session, (3) discussion of methodological challenges, and (4) late breaking results.

Central Sensitivity Syndromes (CSSs) are a family of chronic illnesses that share a mechanism that is central—located at the level of brain and spinal cord—and is defined by hyper-sensitivity to stimuli (Neblett et al., 2018), with widespread, persistent pain as the most predominant feature (Bettini & Moore, 2016). There is a significant information need for patient expertise (Hartzler & Pratt, 2011), or experiential advice, due to lack of understanding of CSSs in the medical field (Adams & Turk, 2015), and a need for strong storytelling abilities to express invisible disabilities and combat stigma in many life settings (Lyons et al., 2013).

To address these needs, people have created online health communities (OHCs) to connect and exchange support (Johnson & Ambrose, 2006) in platform-specific ways (Sannon, 2019). While research on TikTok and health has blossomed in the field in recent years, especially around COVID-19 (e.g., Basch, Fera, Pierce, & Basch, 2021), most research takes a public health perspective, rather than a disability or community perspective. This research aims to understand this phenomena, using qualitative methods and a small sample size due to the complexity of videos, to ultimately engage in skills-building efforts to address these specific needs.

METHODS, FINDINGS, AND METHODOLOGICAL DISCUSSION POINTS
The research questions addressed in this poster are (1) what narrative and visual themes appear in the 100 top-trending #fibromyalgia videos on TikTok, (2) what iconographic, cinematographic, and TikTok-specific elements are utilized, (3) what support types appear in top-5 comments of these 100 videos, and broader, in-progress questions of (4) if codesign methods can enrich findings and (5) ideas for best practices for TikTok research.

Pilot Study Methods
The top-100 most viewed TikTok videos under the hashtag #fibromyalgia, and each videos’ top-5 comments based on comment-likes, were manually collected in April 2022. Only videos by people personally experiencing this CSS were included. A deductive codebook was developed drawing from existing research, for categories such as platform-specific affordances used, cinematographic choices, and recording specific audio, visual, and gestural (dance) memes. Thematic analysis (Braun & Clarke, 2006) based on the overall meaning of text, speech, and satirical queues was used to identify 7 core themes, and inductive coding of iconographic elements (Elsaesser & Hagener, 2015) distilled 8 recurring visual themes. Deductively coding comments based on established support types from literature (e.g., Klaw et al., 2000), including patient expertise (Hartzler & Pratt, 2011), and self-disclosure (Wang et al., 2017), illuminated collective forms of information creation and storytelling.

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Pilot Study Findings & Discussion

Creative Storytelling: Icons, Audio Memes, Bodies & Platform Norms

Creators used icons, objects, and visual aids to underscore their points, including mobility aids (12, Figure 1), heating implements (2), pill bottles (14), comfort items (2), completed recipes, and medical settings (9, Figure 3). Creators also used their bodies as visual evidence, painting their body to better represent their pain, performing dances with mobility aids (Figure 2), and many creators documenting their bodies as they struggle to move. Audio memes, arguably the driving template for content production on the platform (Abidin, 2021), were frequently used, as background sound, a basis for dance (Figure 1), or to create a twist on a common trend, challenge, or meme to express a specific shared experience (Figure 3). Cinematography included intimate first-person point of view (Wang, 2021), and creative panning, zooming, and timelapse choices. Text on screen was the most common modality, with the platform norms of pointing to text, layering text over lip-synched lyrics, and using text to adapt audio memes. A third of videos contained satire or humor.

The Stories We Tell: Video Themes & Mechanics of Collective Storytelling

Thematic analysis identified 7 core themes: patient expertise (27), symptoms (17), medical care (14), celebrating success (13), stigma (13, Figure 2), mental health (9), and social issues (7). These story types describe medical and physical experiences, and advice on how to manage those chronic symptoms, but also discussion of the social aspects of disability. Through the generative storytelling triangle of story-storyteller-and audience (McDowell, 2021), creators collectively told stories through replying to comments (8), replying to stitch prompts (4), and duetting others’ videos (1). Most story types correlated with commenters disclosing their own personal experiences, either scaffolding layers of patient expertise or contributing to discussion of their shared social experiences. The remaining 3 themes—celebrating success, mental health, and social issues—were more correlated with comments providing emotional support, where community members offered encouragement, congratulations, or sympathy.

Methods Challenges & Discussion Points

Sampling TikTok Videos and Identifying TikTok Communities

This pilot study highlights an issue in the dominant approach to sampling videos from TikTok: collecting the top-100 videos from a specific hashtag—one logic of the platform—without addressing the additional logic and experience of TikTok’s algorithm(s) and For You Page, excluding many relevant videos. In the in-progress continuing data collection of this dissertation research, a novel approach is used to address this sampling issue in the field, by taking a multifaceted approach as introduced in (Lundy, 2023): engaging in hashtag searching, but also algorithm training, snowball sampling of adjacent hashtags, and community language hashtags (i.e., #spoonie). These methods, as well as identifying community members’ own sense of the boundaries and slippages of the community, offer one route to a more accurate understanding and definition of what I call algorithmically mediated online health communities, a shift from previous OHCs that are actively sought and self-selected into.

Where to Go From Here: Co-Design in TikTok Research

Codesign (Costanza-Chock, 2020) is another potential method of interest for TikTok research because it offers collaborative opportunities between researchers and users. In a pilot interview and codesign session, with the aim of creating a health storytelling “toolkit” of brainstormed ideas like TikTok prompts, features, and story scripts (Figure 4), there were opportunities for member checking the findings described, as well as better understanding the needs of folks with CSSs. For example, information creation support needs in this one pilot session included easy to follow instructions, easier ways to identify sounds and trends to use, and distinct ways to tell ‘micro-stories’ rather than ‘full illness history’ stories.

CONCLUSION: CRITICAL DISABILITY STUDIES PERSPECTIVES FOR TIKTOK BEST PRACTICES

Overall, this research aims to pursue research guided by critical disability studies (Goodley et al., 2019), by focusing on the lived experiences and perspectives of disabled people; conducting TikTok research “with” rather than “about” disabled folks through methods like codesign; and offering ideas on how to best care for research collaborators through visual ethical fabrication, negative consent, or attribution. CDS perspectives highlight avenues for TikTok research, such as focus on collective, embodied, affective (Costello & Floegel, 2021) and interdependent information practices, and sparking ideas of how research can collaborate with and support the creators we study.
REFERENCES


A New Ontology for Restaurant Review Sentiment Analysis

Luo, Manman  University of Wisconsin-Milwaukee, USA | mluo@uwm.edu
Mu, Xiangming  University of Wisconsin-Milwaukee, USA | mux@uwm.edu

ABSTRACT
Understanding the aspects of a restaurant that contribute to people's sentiment is crucial for restaurant owners and marketers to improve customer experiences. A sentiment ontology for restaurant review sentiment analysis was proposed in this study. The proposed ontology identified six aspects of a restaurant evaluation: food, service, ambience, cleanliness, location, and price, based on 1,000 annotated Yelp data. Applying the proposed ontology in the annotated Yelp data showed that it helped improve the sentiment analysis accuracy by 11.2% on average. We believe that this study provides insights into the key factors that contribute to restaurant review sentiments.

KEYWORDS
Sentiment analysis; restaurant review; ontology; data analysis

1. INTRODUCTION
Sentiment analysis is a technology that aims to analyze opinions expressed in a textual document and determine whether the opinions are positive or negative. Sentiment analysis can be applied to restaurant reviews to gain insights about customers’ evaluation of a restaurant. Specifically, identifying and determining sentiment towards an aspect of a restaurant, such as food, service, ambience, known as aspect-based sentiment analysis, can help restaurant owners understand customer feedback to improve their offerings and enhance customer satisfaction. The goal of this preliminary study is to propose a sentiment ontology focusing on describing restaurant aspects that impact customers' restaurant evaluation.

2. LITERATURE REVIEW
In recent years, aspect-based entity sentiment analysis has received growing attention from the research community. Aspect-based entity sentiment analysis involves analyzing people's attitudes or sentiments towards specific aspects of an entity mentioned in a review text, such as a product, restaurant, or person (Luo et al., 2019; Meškėlė & Frasincar, 2020; Pontiki et al., 2014; Vechtomova, 2010; Zhao et al., 2021). In the restaurant review context, several approaches, including syntactic- and knowledge-based, have been proposed to identify aspects mentioned in restaurant reviews to help analyze their associated sentiment towards restaurant entity. Dependency relationships between words were utilized to analyze aspect-associated sentiment polarity in restaurant review data sets (Zhao et al., 2021). Pontiki et al. (2014) proposed a model for aspect-based entity sentiment analysis using restaurant features on top of other variables such as words, POS tags, and syntactic dependencies. The training dataset consists of restaurant reviews annotated with five aspects (food, price, service, ambience, anecdotes/miscellaneous) and their sentiment. External knowledge was further utilized to help identify aspects of restaurants. Meškėlė & Frasincar (2020) proposed an ontology that categorized sentiment terms based on aspect-binding sentiment polarity, such as “warm” is negative when describing beer but positive for pizza. The proposed ontology in this study aims to identify the key terms associated with six aspects important in restaurant review using a semi-automated data-based approach.

3. RESEARCH METHODS
To understand what aspects contribute to customers’ sentiment towards a restaurant, a sentiment ontology focused on describing restaurant aspects and most related terms was developed in multiple stages. Six main aspects were first identified by the analysis of a combination of initial interview data, literature review data, and findings from coded Yelp restaurant review data. A coding schema was developed for the six aspects and 1,000 Yelp restaurant reviews were annotated based on the coding schema. The 1,000 reviews were sampled from a publicly available review data set provided by Yelp (https://www.yelp.com/dataset). From this set, 10 restaurant businesses with an average rating between 2.5 and 3.5 were selected, and their reviews were chosen to comprise the sample data set. We randomly selected from 1000 reviews from this set. The key terms associated with each aspect were first extracted based on their tf-idf score in the annotated reviews. Noise terms were removed from the list manually to generate the next version used in the ontology. Finally, the ontology was applied in a dataset with annotated Yelp restaurant review dataset using supervised machine learning to finalize 20 terms for each aspect in the ontology.

4. RESULTS
4.1 Sentiment Ontology for Restaurant Review Entity Sentiment Analysis
The result of validating proposed ontology based on annotated reviews were listed in Table 1. 20 terms were identified using the method mentioned before in the methodology. We chose 20 terms for each aspect to achieve
great sentiment analysis performances without introducing too many terms. The performance improvement will be presented in the next section (section 4.2)

<table>
<thead>
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<th>Aspect</th>
<th>Terms associated with six aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>food, service, oysters, good, great, delicious, yummy, really, restaurant, ordered, best, chicken, amazing, time, try, taste, rude, dinner, menu, coffee (achieved accuracy of 0.77, improved 4.1% in accuracy)</td>
</tr>
<tr>
<td>Service</td>
<td>service, time, staff, wait, friendly, nice, waiter, table, minutes, amazing, menu, server, order, experience, definitely, recommend, seated, awesome, long, asked (achieved accuracy of 0.73, improved 16.2% in accuracy)</td>
</tr>
<tr>
<td>Ambience</td>
<td>outside, nice, sit, sat, bar, pretty, table, amazing, atmosphere, ambiance, vibe, area, busy, spot, large, looking, decor, cozy, quiet, noisy (achieved accuracy 0.77, improved 10.9% in accuracy)</td>
</tr>
<tr>
<td>Cleanliness</td>
<td>clean, place, cleaning, stomach, disgust, disgusting, table, covid, apologize, just, nice, hair, told, appetite, bathroom, cleanliness, sick, worm, roach, dishes (achieved accuracy of 0.81, improved 10.2% in accuracy)</td>
</tr>
<tr>
<td>Location</td>
<td>location, place, chinatown, hotel, parking, convenient, inconvenient, staying, nice, located, music, came, favorite, vicinity, sucks, middle, visit, walking, walked, center (achieved accuracy of 0.81, improved 13.3% in accuracy)</td>
</tr>
<tr>
<td>Price</td>
<td>price, worth, expensive, inexpensive, money, waste, discount, discounts, service, happy, hour, hr, less, pricey, overpriced, dollars, spend, charged, pay, cheap (achieved accuracy of 0.81, improved 12.5% in accuracy)</td>
</tr>
</tbody>
</table>

Table 1. Proposed Sentiment Ontology with Aspects and Associated Terms for Restaurant Review

4.2 Validated Sentiment Ontology

The results of using the proposed ontology and their impact on accuracy of aspect-based entity sentiment analysis were depicted in Figure 1.

As shown in the Figure 1, overall, the accuracy of aspect-based entity sentiment analysis using proposed ontology achieved great improvement when the number of ontology terms used was around 20. On average, the proposed ontology helped improve accuracy of sentiment analysis by 11.2%. In terms of the amount of improvement using proposed ontology-based features, the model that considered the proposed ontology feature improved accuracy most for entity sentiment analysis in service aspect (27.4% of improvement) compared with other aspects, followed by ambience aspect (19.4%), price aspect (18.3%), location aspect (14.7%), cleanliness (12.9%) and food aspect (5.4%). From Figure 2, it demonstrates great performance improvement even we choose 20 terms for each of the aspect, with food 4.1% improvement, service 16.2%, ambience 10.9%, cleanliness 10.2%, location 13.3%, and price 12.5%.

5. CONCLUSION AND FUTURE WORKS

The preliminary findings from this study led to a proposed ontology based on 1,000 annotated restaurant reviews from a sample data set from Yelp. The proposed ontology identified six main aspects of restaurant evaluation: food, service, ambience, cleanliness, location, and price. The proposed ontology was validated and shown capable of improving restaurant review sentiment analysis. Next step, we plan to expand the annotated reviews to optimize the ontology with term weighting and utilize expert review to further improve quality of ontology. Interesting terms such as “really”, “asked” will be explored in their effectiveness in improving restaurant review sentiment analysis.
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Expanded Model of Everyday Information Practices with Information Avoidance in Digital Environments

Matsubayashi, Mamiko  University of Tsukuba, Japan | mamiko@slis.tsukuba.ac.jp

ABSTRACT
Until recently, research on information behavior and practices has focused on a series of actions, including having information needs, seeking information to satisfy those needs, and utilizing the resulting information. However, in digital environments with an enormous distribution of information, it is necessary to consider information practices by focusing on their relationship with negative behaviors, such as information avoidance. Based on the discourses by Japanese Canadian seniors on information behavior during the COVID-19 pandemic, this study attempted to construct an expanded model of everyday information practices (EIP) that incorporates the concept of information avoidance into the EIP model proposed by Savolainen. Findings suggest that information avoidance is likely related to an individual's social context and that, as a result of information avoidance, different means of information acquisition are chosen from a person’s stock of knowledge, resulting in different aspects of the individual's information practices.

KEYWORDS
information practices; information avoidance; information acquisition in the social context; COVID-19

INTRODUCTION
Research on information behavior and practices has thus far focused on a series of actions, including having information needs, searching for information to satisfy those needs, and utilizing the resulting information. The situation is similar in information practices research, which has attempted to expand its view of information behavior research. For example, in the two-dimensional model of information practices proposed by McKenzie (2003), positive information behaviors, such as information seeking and information acquisition by chance, comprise the everyday information practices (EIP) model. Savolainen’s (2008) model also incorporates the positive information behaviors of information seeking, use, and sharing, which are included in information practices. Case & Given (2016) mentions various concepts related to information behavior and included information avoidance, which is a negative information behavior, in the concepts; however, they do not focus on it.

In contrast, information avoidance has recently attracted attention as an information-related behavior. Such negative information actions have been frequently observed during COVID-19 pandemic. In recent years, information overload has become a substantial issue in the digital environment, and negative information behaviors, such as information avoidance, have become increasingly common. To consider information practices in digital environments, we should focus on the relationship between negative actions and positive information behaviors.

Therefore, this study proposes an expanded EIP model that incorporates information avoidance based on discourses on information practices during the COVID-19 pandemic by Japanese Canadian individuals. Savolainen’s (2008) EIP model, specifically the idea that EIP consists of everyday projects and an actor's stock of knowledge, is adopted as the fundamental concept.

PREVIOUS STUDIES
In recent years, research on information avoidance is dominantly increasing. Especially during and after the COVID-19 pandemic, the concept of information avoidance has been focused on, since an overload of negative information was prominently observed.

Information avoidance is divided into two categories: hedonically-driven and strategically-driven (Golman et al., 2017). In the research on health information behavior during the pandemic, there are many investigations that focus on the hedonically-driven information avoidance, and attempt to clarify the factors that cause and affect the behavior. For example, Soroya et al. (2021) conducted an online survey of Finnish adults for their information behaviors during the pandemic, and revealed that information overload predicted information anxiety, which further resulted in information avoidance. Meanwhile, Heinström et al. (2022) clarified information avoidance as a strategic action for emotional regulation, although their investigation did not limit the context to the pandemic.

Narayan et al. (2011) focuses on the role of information avoidance in the context of everyday life information behavior, however, they have not considered the relationship between information avoidance and information behavior or the modeling of information practices.

DESIGN/METHODOLOGY
Interviews were conducted in September 2022 and March 2023 with 20 Japanese Canadian seniors living in British Columbia, Canada who were recruited through snowball sampling. They were asked to share their experiences of
information behavior during the COVID-19 pandemic. More precisely, they were asked to tell about their information needs, information sources they used, and their feelings which come along with their actions. They narrated memorable events that occurred in the two to three years between March 2020, when the lockdown took place in Canada, and the time they were interviewed. Many shared their experiences immediately after the lockdown.

A hypothetical EIP model was then proposed based on the relationship between information avoidance and information acquisition, as revealed by the discourses obtained from the interviews.

RESULTS
Many participants stated that they "watched TV news daily" as part of their routine information behavior during the COVID-19 pandemic. The following comments were especially common:

"At first, I tried to watch the news on TV, but the same gloomy news kept coming up over and over again, so I became more depressed, and eventually, I stopped watching it so intently."

"The news (on TV) was somehow making the argument that Asian people are to blame."

For these reasons, there has been a phenomenon of gradual distancing from the information reported by TV news and other media.

However, the participants believed that it was important for them to know the current status of COVID-19 in their everyday lives; therefore, they used other methods to seek and acquire information. For example, a person could exchange information about COVID-19 with neighbors who lived in the same condominium and take combined measures they thought were efficient to prevent the infection [word-of-mouth communication]. Another person checked public announcements about infection numbers because they believed that all they needed to know were facts and not comments or sentiments [public announcements by the government or specialized agencies]. Some people religiously watched videos on YouTube instead of watching the news on TV or reading newspapers [social media].

DISCUSSION
Combining the discourses mentioned in the previous section with the findings of prior information practice research, especially Savolainen's (2008) EIP model, we considered an expanded model that incorporates information avoidance (see Figure 1).

Individuals habitually acquire information in a familiar manner [an actor’s stock of knowledge] for certain purposes [everyday projects]. Many participants indicated that they watched TV news to learn about the COVID-19 situation. However, habitual behavior is interrupted when the information obtained is inappropriate or uncomfortable for an individual. Various reasons were mentioned in the survey. For example, one person mentioned that this is due to excessive negative news on TV shows. Based on their own social context, another participant stated that they felt that people of Asian descent were being blamed in the news. Individuals were forced to change their information practices. In this case, information avoidance was not affected by "everyday projects" but by the "actor’s stock of knowledge." In other words, the need to know about the current status of the pandemic and gain more knowledge about the disease and vaccines remained the same. Instead, they abandoned TV news, a means that contained uncomfortable information, and switched to a method of acquiring information that they believed would be more effective for them. The choice of the alternative method depends on the actor's stock of knowledge about information acquisition.

CONCLUSION
Based on participants' discourse on their information behavior during the COVID-19 pandemic, this study proposes an expanded EIP model that incorporates the negative concept of information avoidance. Using this model as a theoretical framework allows for a more detailed analysis of how actors' social and cultural backgrounds influence their information practices in digital environments. In addition, we observed cases in which people who flocked to social media acquired mis/disinformation. Therefore, we consider the relationship between information avoidance and mis/disinformation in the context of EIP can be another important factor to be involved in the model.
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Solidarity and Care: Information Activism in the Death Panel Podcast Community

May, Emma  
Rutgers University, USA | emma.may@rutgers.edu

ABSTRACT
This poster highlights the connections between independent media, information activism, and disability through a case study of the podcast Death Panel and its listeners. Death Panel is a leftist podcast that explores issues of affordability in medical care and the dearth of public health resources. The ongoing project explores the independent media created by disabled people that concern their frustrations with societal and governmental neglect, and their desires to build community and a collective political movement for social change. Since the COVID-19 pandemic, the podcast’s listenership has grown substantially. Similarly, the number of members in the Death Panel Discord group has increased to over 2,000 members over the past two years. As of February 21st, 2023, there are 2,954 members in the Discord server. For many members, especially those who are disabled and chronically ill, the podcast’s Discord has served as a significant site of politicization and community-building during the COVID-19 pandemic. Through semi-structured interviews, this project will explore the political and activist implications of information for marginalized people.

KEYWORDS
Disability; activism; care; podcasts; independent media

INTRODUCTION
As stay-at-home orders were instituted worldwide at the onset of the COVID-19 pandemic, disability communities were optimistic about the newfound possibilities for nondisabled people to show solidarity and the reimagination of everyday life (Goggin & Ellis, 2020; Thelwall & Levitt, 2020). However, inequalities nonetheless worsened while many called for a “return to normal.” As nondisabled people returned to their previous ways of living in what many declared the “post-pandemic,” disabled and chronically ill people continued to stay at home. As the general population’s solidaristic sentiments waned, disabled people grew frustrated. The Death Panel podcast responded to these frustrations. Founded in 2018, the leftist podcast gained international recognition during the pandemic as it commented on the multiple failures of COVID-19 policies and the privatization of healthcare, internationally. The podcast employs a leftist, disability justice-informed approach to examine how the profit-driven healthcare ecosystem utilizes constructs of “health,” “disability,” and “illness” to distinguish those who do not adhere to capitalist notions of the ideal worker as “surplus” populations. The podcast explores how these exclusionary logics adversely affect those at the margins due to racism, ableism, sexism, and classism and their intersections, as well as undermine solidarity between different populations.

The project involves a case study of Death Panel podcast and its listeners. Over the past three years, the listener base has increased exponentially (Doran, 2020). For many listeners, especially those who are disabled, the podcast’s online community on the instant messaging application Discord has served as a significant site of politicization and community-building during the pandemic (McNamara, 2021). This project explores information activism in the Death Panel community, with particular attention to how information is politicized for disabled and chronically ill people during health crises such as the ongoing COVID-19 pandemic.

The project builds upon critical information science research that explores the information practices of activists (McKinney, 2020) and multidisciplinary research that explores political participation within disability communities. Unlike existing research within information science, the project aims to make novel connections between critical approaches in disability studies, Black feminist theory, and feminist studies. The approaches intersect in their interrogation of the institutions and structures that further inequality. As critical research methods, they underscore how identities, institutions, and social practices are linked to broader relations of power. The approaches are similarly concerned with exploring the overlooked nuances and operations of power within an issue, rather than proving or disproving predetermined hypotheses (Myers & Klein, 2011). By mapping the connections between information activism and “ethics of collective care” (Silber, 2022), this project will outline the informational aspects of activism that enumerate possibilities for a coalition-based politics of care.

The case study of the Death Panel podcast and its surrounding community underscores how information is integral to the cultivation of radical politics and solidarity-driven activism. The project departs from existing research within information science that examines disabled people’s isolation through one-dimensional, single-axis frameworks of identity (Sum et al., 2022; Trevisan, 2020), and instead embraces a political interpretation of disability that challenges racist conceptions of deviance and normality.
While there are interdisciplinary information science scholars who locate themselves within feminist and disability studies scholarship, it is uncommon that they situate racism and white supremacy as central concerns of their work (Brilmyer, 2022; Goggin & Newell, 2007; Hill, 2013; Olson, 1997). To further expand on the intersectional issues surrounding information science’s engagement with disability studies, this project explores disabled people’s community-and movement-building practices with attention to how ableism is connected to systems of power such as white supremacy and heteropatriarchy. This is not to conflate the differential material realities of racism and ableism, but rather to explore the interrelations between ableism and white supremacy as they are produced by logics that devalue individuals based on deviations from white supremacist ideals of race, class, gender and ability. These connections have not yet been deeply explored in critical information science research.

PROJECT OVERVIEW
The project explores the activist implications of information during an ongoing pandemic through a case study that examines leftist independent media and the information practices that surround it. More specifically, the project explores the independent media created by disabled people that concerns not only their frustrations with regards to societal and governmental neglect, but their desires to build community and a collective political movement toward radical social change. The aim of this project is to explore the political implications of information and its connections to emancipatory movement-building practices utilizing an interdisciplinary lens with a foundation in feminist-of-color disability studies (Schalk & Kim, 2020). Therefore, this research project will undertake a novel bridging between critical information science, disability studies, and feminist-of-color theory. Relevant literature concerning information activism, feminist ethics of care, and online disability activism will be explored. The theoretical implications of the study lie within its interdisciplinary approach and expanded definition of political participation that considers the role of information within the networks of care integral to social change. However, the impact of this study extends beyond academic discourse. The reformulation of political participation and coalition building is relevant to policy concerning political access and engagement in disability communities.

METHODS
The research design consists of a qualitative case study of the Death Panel podcast and its listeners, which includes qualitative semi-structured interviews as its primary method (Lareau, 2021). The semi-structured interview method is utilized to garner an in-depth understanding of listeners’ own perspectives on their communal information activism. Archival and textual analysis methods will also be utilized to provide historical context of associated disability activist movements (Brennen, 2022; Moore et al., 2016). To trace the lineage of the podcast’s political economic and disability justice-informed analytical approaches, the author will consult past health policy documents and mainstream media accounts of policy decisions using textual analysis methods. The researcher will also use archival methods (Caswell, 2021; Moore et al., 2016) to examine the archives of radical health- and disability-related movements in the United States such as the Disability Rights and Independent Living Movement Project at the University of California Berkeley.

Through the use of multiple qualitative methods including semi-structured interviews, textual analyses and archival methods, the study aims to provide a multimodal analysis that clearly articulates the connections between the interrelated histories of health policies, governmental austerity measures, activist movements and the healthcare crisis of the contemporary moment. Using archival and textual analysis methods, the study follows a Foucauldian genealogical approach to examine such issues (Ben-Moshe, 2020; Foucault, 1972; Foucault & Bouchard, 1977). In utilizing such an approach, the study aims to situate the podcast within historical context.

CONCLUSION
The project makes several contributions to the information science and disability studies literature. First, it broadens the scope of political participation to encompass activities such as creating zines, exchanging leftist literature, and hosting reading groups. The existing literature often focuses on disabled people’s exclusion from dominant forms of political participation such as voting and policy creation with focus on their isolation from such activities (Mhiripiri & Midzi, 2021; Trevisan, 2020). This project explores disabled people’s political participation through their engagement with independent media. Rather than focusing on structural exclusion, the project centers community- and movement-building as means of political participation. Additionally, the project opts for a broader definition of political participation that includes activities such as zine-making and the sharing of radical literature.

The study extends the subset of feminist information science literature within critical information science (Floegel & Costello, 2022; Gray, 2020; McKinney, 2020). The feminist information science literature has not built upon disability studies literature and Black feminist theory. By adopting a critical information science lens, this project explores how information is integral to the cultivation of solidarity that is foundational to activism and societal transformation. The project underscores the importance of a transformative coalition-based politics of care that arise from these often-overlooked affinities. Additionally, this project will combine complementary critical information science concepts and feminist theoretical approaches that have yet to be explored jointly in the literature.
REFERENCES

What Should I Believe In? This Is about My Child's Health! Exploring Information Behavior and Attitudes towards Vaccination: A Comparative Study of Polish and Ukrainian Parents

Mierzecka, Anna  
University of Warsaw, Poland | anna.mierzecka@uw.edu.pl

Brylska, Karolina  
University of Warsaw, Poland | karolina.brylska@uw.edu.pl

Gromova, Anna  
Institute for Social and Political Psychology, NAES of Ukraine, Ukraine; University of Warsaw, Poland | h.hromova@uw.edu.pl

Łaczyński, Marcin  
University of Warsaw, Poland | m.laczynski@uw.edu.pl

ABSTRACT
This study delves into the realm of information behavior research, examining the attitudes and information-seeking patterns of Polish and Ukrainian parents regarding vaccination. Amidst rising vaccine skepticism globally, understanding how individuals acquire and evaluate information about vaccinations is crucial for effective public health communication. Through in-depth interviews and surveys, the study examines how parents acquire information about vaccinations, evaluate the credibility of this information, and identify cognitive authorities that enhance information credibility. Preliminary findings demonstrate distinct information-seeking strategies between pro-vaccination and skeptical parents. Parents in favor of vaccination tend to rely on a single source, typically their doctor, emphasizing the authority associated with their role. In contrast, skeptical parents consult various sources, prioritizing close personal relationships and shared experiences. In contrast, skeptical parents consult various sources, prioritizing close personal relationships and shared experiences. Moreover, opponents of vaccination exhibit a stronger affective dimension when assessing source credibility. The study also highlights the distinctive use of books and articles among vaccine opponents, despite their general mistrust of science. This study contributes to the field of information behavior research, offering insights into parental information-seeking dynamics, and their implications for public health policy and communication strategies.

KEYWORDS
Credibility of information; Cognitive authority; Health information behavior; Vaccination

INTRODUCTION
Since the publication of an article by A. Wakefield suggesting a potential link between MMR vaccines and autism, there has been a surge in vaccine skepticism. This phenomenon is particularly prominent in Europe, where diseases like measles have experienced a resurgence, leading to significant outbreaks in countries such as Ukraine and subsequently spreading to other nations (Hadjipanayis et al., 2020). The outbreak of the SARS-CoV-2 coronavirus has further intensified the discourse surrounding vaccines and caused a deepening polarization of opinions. The issue of vaccinating children with mandatory vaccinations holds particular significance. Various factors influencing the acceptance of vaccinations have been analyzed, although the results of these studies often diverge. Demographic factors such as age, gender, number of children, place of residence, and level of education (Harmsen et al., 2013; Smolarczyk et al., 2022; Kowalska et al., 2019), as well as other factors like past health experiences, medical knowledge (Januszek et al., 2022; Krasnica et al., 2020), trust in the healthcare system, ideological attitudes related to professed values (Kwan et al., 2022), and political beliefs (Bilewicz & Soral, 2022; Kossowska et al., 2021), have all been considered. Notably, there are evident differences in attitudes among residents of different countries (Hadjipanayis et al., 2020; Bilewicz & Soral, 2022; Zaprutko et al., 2022). Studies conducted in Poland among Ukrainian migrants have shown changes in attitudes upon relocation (Januszek et al., 2022; Chabasinska, 2021), with vaccines in Poland being perceived as safer than Ukrainian vaccines (Ganczak et al., 2021). Furthermore, studies indicate a high level of distrust among Ukrainians regarding vaccination (Januszek et al., 2022; Zaprutko et al., 2022; Ganczak et al., 2021). In a 2018 survey, only 28% of Ukrainian respondents considered vaccines to be safe (Gallup, 2019).

Currently, we are confronted with the largest refugee crisis since World War II. Therefore, supporting the integration process of this social group is crucial. A significant portion of the refugee population comprises mothers with children, making the issue of vaccinating children socially important. In this project, an exploratory study was conducted among parents of both Polish and Ukrainian nationalities. Most of the previous research in the literature review on parental attitudes toward vaccination was quantitative in nature, with 114 out of 116 analyzed projects adopting this approach. Much of the research was conducted based on the Health Belief Model or Theory of Planned Behaviour (Hadjipanayis et al., 2020), which provided a general understanding of the factors influencing attitudes toward vaccines. The theoretical framework for this study is P. Wilson's "cognitive authority" theory (Wilson,
According to Wilson's theory, when dealing with the knowledge that does not arise from personal experience, the assessment of a message's credibility is largely based on the authority (author, source) behind it. An individual may refer to different authorities in different areas of life. The assumption of Wilson's theory underpinned the design of interview questionnaires aimed at identifying what sources of information were considered by respondents as authorities in the decision-making process about vaccinating children.

The aim of this study is to deepen our understanding of parents' information behavior when it comes to vaccinating their children and to identify differences between Polish and Ukrainian parents. The study addresses the following research questions: RQ1: How do parents seek information about vaccinations? RQ2: How do parents assess the credibility of this information? RQ3: What cognitive authorities enhance the credibility of information in the eyes of parents?

For each question, an attempt was made to explore whether there were differences based on attitudes towards vaccination and parents' nationality.

METHODS
The study comprises two stages of empirical research: in-depth interviews and surveys. At the ASIS&T conference, we intend to present the results of the interviews, which have already been completed. Of the 25 interviews conducted, 12 were carried out with Ukrainian parents (six in support of vaccination, six skeptical or opposed to vaccination), and 13 with Polish parents (seven in support of vaccination, six skeptical or opposed to vaccination). Participants were recruited through questionnaires distributed in kindergartens with a request to share them with parents, as well as through social media platforms, particularly groups and pages aimed at parents, and among refugees gathered at refugee assistance centers. The interviews primarily consisted of open-ended questions designed to gain deeper insights into the respondents' experiences, following the recommendations of the Sense-Making methodology by B. Dervin (1999). The interviews were conducted anonymously, either online or through face-to-face meetings, and were transcribed. In the case of interviews conducted in Ukrainian, translations into English were performed. The transcribed interviews were then analyzed and coded using qualitative content analysis, with category validity ensured through a team approach.

FINDINGS & CONCLUSIONS
The analysis of the interviews is currently ongoing, but several preliminary conclusions have emerged, highlighting differences in the information behavior of the two groups studied. Parents who support their children's vaccinations tend to rely on a single source of information, usually their doctor, perceiving the authority of the source based on the doctor's role. In contrast, parents who are against vaccinations seek information from various sources. In the case of personal sources, they valued the closeness of the relationship, such as family members or close relatives, emphasizing the importance of mutual understanding and shared life experiences as indicators of source credibility.

Another notable finding pertains to the approach parents use to assess the credibility of information. Parents supporting vaccination exhibit a cognitive approach, relying on personal information sources and emphasizing factors such as experience and the professional position of the source. Conversely, opponents of vaccination demonstrate a more complex situation. When evaluating personal sources, they primarily consider affective factors, such as whether the person can provide support and whether they share a common understanding or similar experiences. This observation is intriguing, although prior research has established the significant influence of emotions on both health-related information behavior and the evaluation of information credibility (Johnson et al., 2011; Neal & McKenzie, 2011; Han et al., 2018; Suh et al., 2019). However, this study is novel in considering the cognitive/affective approach as a differentiating factor among groups with distinct perspectives. Furthermore, this finding aligns with R. Savolainen's assertion (Savolainen, 2022) regarding the necessity to redefine the construct of cognitive authority and its relevance in networked information environments, where traditional where the traditional picture of authoritative information sources is eroding.

Parents opposed to vaccination often mentioned turning to books and articles as sources of information, whereas none of the parents supporting vaccination mentioned this. This finding is intriguing because, during the interviews, those opposing vaccination clearly expressed their distrust of science as a whole, including publications appearing in the official scientific mainstream. The publications they referred to were characterized by content tailored to their individual life situations or by describing specific cases and stories related to vaccination. This is another distinguishing feature between parents who vaccinate and those who do not. The former cited information confirming the benefits of vaccines for the general public and the rarity of complications, among other factors, to justify their behavior. On the other hand, opponents of vaccination demanded information, including from doctors, that would consider their specific situations and be tailored to their child's health outcomes.

The aforementioned observations represent only a few of the conclusions that have emerged from the study. A survey is currently underway to quantitatively validate these observations, and we also plan to further explore differences related to nationality.
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Do Black-Owned Restaurants Matter?:
Yelp and Platform Visibility amid a Racial Reckoning

Moy, Cameron  
University of Michigan, USA | moycam@umich.edu
Bui, Matthew  
University of Michigan, USA | mattbui@umich.edu

ABSTRACT
In Spring 2020, the murder of George Floyd catalyzed calls for racial justice across the United States, ushering in a series of organizational and institutional responses. One response from Yelp, a popular review-based platform, included its addition of a searchable Black-owned attribute, a tag intended to signal its solidarity with Black businesses and communities. Analyzing a repository of over 300,000 Yelp reviews from Black and non-Black-owned restaurants in Los Angeles, CA, USA and Detroit, MI, USA, we pose the question: How did the addition of the Black-owned tag impact the online reputation of Los Angeles and Detroit Black-owned restaurants on Yelp? To examine this, we use restaurant review counts and average star ratings as proxy measures for online reputation and track these metrics over the year following the platform design intervention. We find that the addition of the Black-owned tag did not create positive, sustainable change for Los Angeles and Detroit Black-owned restaurants. In all, we call attention to the disparate impacts of platform design features on users and communities, especially for Yelp and digital platforms seeking to effect racial justice through novel platform design interventions.

KEYWORDS
Digital Platforms; Online Reputation; Racial Justice

BACKGROUND
Digital platforms play a vital role in everyday life. Specifically, the quantification of social interactions has led to observable and measurable patterns of human behavior. Such digital metrics can serve as proxies for acceptance, popularity, economic opportunity, and we later argue, reputation across digital platforms (Scissors, Burke, & Wengrovitz, 2016; Christin & Lewis, 2021). Yelp is a digital platform that creates a space for business owners and their customers to interact. On the platform, businesses have pages that advertise key metrics, such as their average star rating, number of reviews, and information about the business, including attributes describing unique features.

We draw from Cioppi et al. (2019) to define online reputation in the context of Yelp as a business’ perceived appeal and credibility. Adopting Luca’s (2017) basis for online reputation on Yelp, mainly that businesses with more reviews (and converging at a similar rating) contain less noise and thus invoke the greatest market responses, we identify three features that influence reputation on Yelp: average star rating, review count, and review quality. As noted, the average star rating and review count are easily identifiable datapoints on the platform.

Following the murder of George Floyd in 2020, Yelp was vocal in their support for the Black community (Stoppelman, 2020). On June 18th, 2020, Yelp announced the addition of a Black-owned attribute to their platform, with the goal of increasing the visibility of Black-owned businesses (Lewis, 2020). In January 2022, Yelp reported over 45,000 businesses had utilized the Black-owned attribute with an average 33% consumer interest increase after identifying as Black-owned (Spence, 2022). We find intrigue in the effects of this increased visibility on Black-owned businesses, specifically restaurants. For these reasons, we investigate the role of Yelp’s Black-owned attribute on Black-owned restaurants’ online reputation and ask the following:

RESEARCH QUESTION
How did the addition of Yelp’s Black-owned attribute impact the online reputation of Los Angeles and Detroit Black-owned restaurants?

METHODS
We collected Yelp reviews from Black-owned restaurants in Los Angeles (n=193) and Detroit (n=165), using the Pyscraper module and Beautiful Soup, a Python HTML parsing package (Zhao, 2017; Moy, 2023). To ensure a complete dataset, we sourced comprehensive Black-owned restaurant lists from local Los Angeles and Detroit residents (Lewis & Kaila, 2020; Pereira, 2021). We chose to center our research in Los Angeles and Detroit for two independent reasons: Los Angeles hosts the most Black-owned businesses out of any U.S. city; and Detroit Black-owned restaurants had the greatest loss in visitation during the pandemic of any U.S. city (Spence, 2022; Huang, et. al., 2022). Upon the completion of our data collection period, we created a running review count and average star rating for each restaurant and saved these metrics at each of our identified significant timepoints – June 18th, 2020, the day Yelp introduced their Black-Owned attribute, as well as one month prior, one month following, three months following, six months following, and one year following June 18th, 2020 (Lewis, 2020). We then removed restaurants that met one or more of the following two criteria and were thus deemed unviable: 1) The restaurant
received its first review during the analyzed time period, and 2) The restaurant did not receive any reviews during the analyzed time period. Our final Black-owned restaurant dataset included roughly 100,000 Yelp reviews from 115 and 71 Los Angeles and Detroit restaurants. We then generated a comparable random sample of non-Black-owned restaurants using the Yelp Fusion API, resulting in a complete database of over 300,000 Yelp reviews of Los Angeles and Detroit Black and non-Black-owned restaurants. (Yelp Developer Portal, 2023). Finally, we plotted review counts and average star ratings using the seaborn API and ran regression models to determine linearity (Figure 1; Seaborn, 2023).

RESULTS
Our analysis raises concerns with Yelp’s efforts to promote the visibility of Black-owned restaurants through its 2020 Black-owned. In accordance with Luca (2017), change in online reputation would take the quantitative form of 1) a nonlinear change in number of reviews and 2) a change in average star ratings. Answering our research question, we first analyze linearity. The increase in number of reviews for both Los Angeles and Detroit Black-owned restaurants remained linear (p<0.001) in the year following the design change (Figure 1). Los Angeles Black-owned restaurants’ average star rating increased slightly around the addition of Yelp’s new attribute but plummeted 0.04 stars in the following year, indicating a net negative change in online reputation (Figure 1). Detroit Black-owned restaurants’ average star rating increased by roughly 0.01 stars in the month following the attribute addition, only to plateau and fall to its original average, resulting in non-sustained change on the platform (Figure 1). Through the combined lens of Los Angeles and Detroit Black-owned restaurants, we conclude that Black-owned restaurants’ increased visibility on Yelp generated by the Black-owned attribute failed to create sustainable, positive change to their online reputation.

Expanding on the findings from our research question, when comparing the online reputation metrics of Black-owned restaurants to those of non-Black-owned restaurants, Yelp exhibits disparities present in society. Black-owned restaurants have fewer reviews and are reviewed at a lower rate, initializing an inequitable disadvantage to Black-owned restaurants (Figure 1). As such, Black-owned restaurants are susceptible to more dramatic changes in average star ratings, which is consistent with our findings (Figure 1). This builds on the understanding the Black Americans were disproportionately affected by the COVID-19 pandemic, which coincided with our timeframe, and social issues throughout history (Reyes, 2020). Identifying Yelp’s failure to uplift Black-owned restaurants’ online reputation through the, we further unveil racial inequities prevalent on the platform and call for greater action.

CONCLUSION & FUTURE WORK
In the collection and analysis of Black-owned and non-Black-owned Yelp reviews, we apply public information and quantitative data to uncover the disparate impact of well-meaning design interventions. Mainly, despite attempts to uplift Black restauranteurs through its Black-owned attribute, Yelp was unable to create sustainable, positive impacts for its targeted community. As such, we call attention to the limitations of quantified online reputation and further examine nuanced, sociohistorical understandings of user behavior and racial inequality: that is, greater business visibility within a universalized consumer base is not inherently beneficial for all groups and subcommunities. Future work looks to understand the impact of individual user behaviors and design features on online reputation through textual and qualitative analysis, unpacking how these actors can reinforce and/or amplify racist structures and discursive ways such disparities manifest within digital platforms.

Figure 1. Average number of reviews and star ratings for Detroit and Los Angeles Black-owned and non-Black-owned restaurants
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Seven-Layer Model for Creating Organizational KM Excellence

Nakash, Maayan
Bar-Ilan University, Israel | Maayan.Nakash@biu.ac.il

Baruchson-Arbib, Shifra
Bar-Ilan University, Israel | Shifra.Baruchson@biu.ac.il

Bouhnik, Dan
Jerusalem College of Technology, Israel | Bouhnik@jet.ac.il

ABSTRACT
This paper proposes a practical seven-layer model that provides a holistic framework for creation an optimal foundation for organizational knowledge management (KM). The research corpus consists of three data collection tools; In the physical field we conducted personal interviews and a focus groups with 52 KM professionals. In the online arena we conducted a web ethnography, in which we surveyed tens of thousands of posts and comments which were posted in two virtual KM groups on the Facebook social network. The research is based on the qualitative-constructivist paradigm. The data were analyzed according to the thematic analysis method, relying on the grounded theory approach. The proposed conceptual framework contributes to the empirical knowledge of the KM field, and may stand to guide practitioners in successful implementation of KM practices in organizations.

KEYWORDS
Knowledge management; organizations; model; business performance; excellence

INTRODUCTION
KM excellence refers to an organization's ability to create, capture, store, share, and utilize knowledge effectively in order to achieve its' goals. Organizations which achieve KM excellence are able to leverage their knowledge assets to gain competitive advantage, improve performance and motivate innovation. They will also be more capable of adapting to the frequent changes occurring in the dynamic business environment, and will be able to react quickly to new challenges and opportunities (Allen et al., 2021; Harrington & Voehl, 2007; Mat Nor et al., 2020; Schwartz & Te’eni, 2011; Zaim et al., 2019). Various scholars recognize that the correct combination of technology, people and processes may create a knowledge-friendly organizational culture (Edwards, 2011; Pee & Kankanahalli, 2009). Although organizations are still struggling with the question how to properly manage organizational knowledge, it appears that the research literature lacks a systemic viewpoint which guides the practical application of KM in organizations. In order to close this gap, the main research question proposed here is: what are the key elements which, based on KM professionals' experiences, will promise successful, stable and long-lasting organizational KM?

METHOD
During 2020-2022 we conducted 46 semi-structured in-depth personal interviews and two focus groups with 52 KM professionals; Of them, 27 are organizational consultants for KM and 25 are knowledge managers in organizations. Furthermore, as part of a web ethnography, we surveyed 20,349 posts and comments which were posted over 4 calendric years (2019-2022) in two public Facebook groups aimed at the members of the KM community. All the participants are active in organizations belonging to various sectors, among them: technology, media and communication; public and government; financial; health; industry and consumer goods; energy and resources. Some operate in the local industry, while others are active in the global market. According to the accepted ethical principles, anonymity of the participants and secrecy of the information were strictly maintained during the data collection. Thematic analysis was used to analyze the collected protocols both in the physical field and in the online arena, based on the grounded theory techniques.

RESULTS
According to the meanings that the participants attribute to the KM discipline, it seems that KM excellence will be achieved by relying on seven interwoven tiers (see Figure 1). These layers constitute the central elements which enable an organization to achieve consistent, methodical and coherent KM.

1. Strategy – KM strategy will be derived directly and indirectly from the general organizational strategy and will outline the policies for preservation, sharing, access and development of knowledge. A comprehensive analysis of the existing state will precede the launch of KM initiatives in the organization, and will be conducted with the aim of identifying existing problems and new requirements that will be useful for closing knowledge gaps.

2. Leadership – KM programs will receive the attention and financial support in accordance with leadership demands. A governance mechanism will describe the functions responsible for decision-making and the application of resolutions with relation to the KM setup within the organization. This mechanism – centralized, decentralized or hybrid – will map the central knowledge creators, define the position holders involved in each knowledge flow process, and will describe the tasks with which they are trusted.
3. Processes – Successful KM will be founded on organized processes for knowledge flow – including, creation, capture, documentation, validation, transfer and consumption of knowledge – and will constitute an integral part of the organizational routine work processes. Knowledge will flow from the management to the "field" (Top-Down), as well as between the knowledge employees and up to the management (Bottom-Up).

4. Content & Context – The organizational contents will be organized in a performance supportive manner and will be accessible to the right person at the right place and time, relying on techniques for tagging, categorization and metadata. The organizational taxonomy will constitute the hierarchical scheme of classification thus providing a foundation for a uniform language between the various bodies within the organization, while setting a strong basis for orientation in and retrieval of contents from the databases.

5. Technology – The application of technological platforms which enable KM is considered a necessary in the age of digital transformation. A well embedded KM system will efficiently support knowledge-related processes, to such a degree that in some units it will be considered critical for the business functional continuity. Machine learning and artificial intelligence developments herald the future of the field and KM professionals need to be aware of them.

6. People & Culture – A recurring and central motif in the results was the claim that the main player in KM is none other than the human being. The assimilation of organized KM practices requires the recruitment of the employees to the issue and encouraging them to share their knowledge with their colleagues, while minimizing resistances whose source is usually based on the conception that knowledge is power. Successful KM efforts are rooted in deep cultural change, which will cultivate a positive knowledge culture and be supported by high management commitment.

7. Measurement Routines – KM effectiveness evaluation will constantly examine the need for changes in the knowledge flow processes, content improvement, and enhancement and renewal of the technological tools. Regarding KM initiatives, the informants call for a change in the discourse from that of ROI (Return on Investment) – an accounting index for calculation of the financial returns on investment – to that of VOI (Value on Investment) – an index that evaluates the comprehensive value obtained from the investment.

CONCLUSION
In this paper we present a holistic model for practical implementation, which may maximize the value of KM initiatives in organizations. The model consists of seven essential elements which are codependent and exist one from the power of the other. The visual multi-layer representation provides an integrative point of view and expresses the fact the existence of the layers as a whole is what actually enables the success of KM in the organization over time. On the other hand, absence of one of the layers means that the infrastructure for KM is not complete, which may ultimately lead to the failure of the KM program. In fact, the seven-layer model simplifies, on the one hand, and expands, on the other hand, the traditional conceptual model that is known in KM literature and which includes three pillars: technology, people, and processes. The seven-layer model is a practical model which organizes and redefines the key elements for KM excellence from the unique perspective of the professionals themselves. By laying out a conceptual framework for KM we connect theory to practice, contribute to the development of the body of empirical knowledge and shed light on the discipline as a whole. KM practitioners will be able to rely on the model design to motivate and promote effective KM activities in their organization. Future research may cross reference the professionals' perspective with the actual practice of the model in the real world, while presenting multiple case studies from organizations that differ from each other in size and fields of activity.

Figure 1. KM's Seven-Layer Model
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Exploring the Information Privacy Practices of Persons with Diverse Sexual Orientation and Gender Identities (SOGI)

Nobbs, Breanna  
University of Technology Sydney, Australia | breanna.nobbs@student.uts.edu.au

ABSTRACT
This poster describes the research design to study the information behaviours of individuals with diverse sexual orientation and gender identities (SOGI) and how they negotiate between their personal privacy and their social and public identities in the digital world. In Australia, there is no legal right to privacy, and our increasing reliance on new technologies has created legal and regulatory challenges, especially for vulnerable populations such as persons with diverse SOGI. The poster will outline the literature review, research questions, aims, and methods guiding the research. Methods proposed for this study include an analysis of legal frameworks and policies, a survey of approximately 100 people with diverse SOGI about their use of digital social technologies, and in-depth interviews with a sub-set of self-selected survey participants. Information behaviour theories and privacy literacy theories will be used to understand participants’ behaviours and experiences regarding how they use digital social media, and the practices they have in place to manage their privacy.

KEYWORDS
Digital privacy literacy; information behaviours; privacy management; digital social media; diverse sexual orientation and gender identities.

INTRODUCTION
Our data is collected through every interaction we have online. Fragments of our identities are disclosed with every email, message, call, and social media post we make. In isolation, these interactions may seem harmless, but the curation of an online identity through an amalgamation of personal data reduces the amount of privacy one has online. While persons with diverse sexual orientation and gender identities (SOGI) use technology to connect, belong, and explore their identities, this digital place of belonging brings the risk of “exposing personal details of one’s life to those who rather they did not exist” (Johnson, 2020, p. 1).

The advent of new technologies has seen a variety of legal and regulatory challenges emerge within the realms of big data and online privacy. Specifically, how to ensure an individual’s personal information and data is managed (i.e., collected, used, stored, disclosed, and accessed) ethically. Persons with diverse SOGI may already face many hurdles with respect to managing unwanted disclosure of their diverse SOGI status. This research aims to explore how Australia’s legal and regulatory framework influences and impacts the online privacy management practices, and information behaviours, of persons with diverse SOGI in Australia. The findings of this research have implications beyond Australia as most digital social media platforms are spread across the globe, and both the users and their data move across national boundaries.

LITERATURE REVIEW
Digital Privacy
Privacy can be defined as “the claim of individuals, groups or institutions to determine for themselves when, how, and to what extent information about them is communicated to others” (Westin, 1967, p.7), with the desire individuals have for disclosure and communication being one of the most significant issues societies will have to manage as long as technology continues to evolve so rapidly (Nissenbaum, 2004, p.101). As the debate surrounding personal privacy heightens, so does social anxiety about personal security, the gap between our intentions and our behaviours regarding privacy, or the privacy paradox (Barnes, 2006), and the need for privacy literacy (Pingo & Narayan, 2016). Never have we seen data carry such a significant amount of power; there is now the ability to “monitor the present and predict future behaviours of not just individuals, but entire populations” (Pinto, 2018, p. 16). There has since been large-scale interconnection via the internet of computing devices embedded in everyday objects, allowing them to send and receive data (‘big data’). Not only is data collected from every digital activity and Internet of Things (IoT) device we own, but so are our behavioural patterns and interactions with others, constructing a picture much larger than that of which most people are aware. Even though privacy awareness has increased, individuals are still willing to allow surveillance of their online interactions and behaviours by the private sector, for the benefit of an improved user experience, in a “broken system of systemic privacy erosion and data extractivism” (Pinto, 2018, p. 16).

This pattern-seeking behaviour assists in processing large amounts of data to form profiles that can be used in many ways, such as health care, national security, and anti-terrorism, to marketing and consumer-related activities. These distinct areas each come with inherent data collection and use risks, presenting an entirely different set of socio-
political consequences (Lyon, 2014). In the context of people with diverse SOGI, this means that an individual decide to conceal certain parts of their identity, they will still inevitably share data that creates a picture of their behaviours, personality, and even their diverse SOGI.

**Navigating Digital Privacy as a Person with Diverse SOGI**

For people with diverse SOGI, online interactions with others are an essential component in forming communities, information seeking, exploring identity, and sharing and learning from the experiences of others. These online interactions also serve to experiment and explore the outward expression of persons with diverse SOGI in circumstances where an individual's daily life may not be a safe space or it is difficult to do so (Bates et al., 2020; Duguay, 2016; Kuper & Mustanski, 2014). The digital world not only constructs relationships in public but also exposes them to critique, with our intimate details being dissected by strangers, corporations and even those we consider acquaintances. However, it is important not to assume all individuals will have the same concerns and considerations when managing our online privacy (Cho, 2018).

Social media platforms are struggling to balance the need to provide a customised platform for public discourse with the need to protect the privacy of its users, as privacy concerns “strongly influence users’ decision to use a service” (Harborth & Pape, 2020, p. 52). For example, persons with diverse SOGI are at high risk of adverse implications to their private life, as they already “experience disproportionately high rates of discrimination, marginalization, harassment, abuse and violence” that, in the current online era, extends to digital communications (Powell et al., 2020, p. 206) and may seek greater privacy protections online. Therefore, in a heteronormative, cisgender-dominated, and often white-dominated society, managing our identity across multiple social media platforms and other online profiles requires careful consideration of the requirements and audiences of each (Perrin & Anderson, 2019).

**METHODOLODY**

This poster presents the research design planned to answer the question: how do our current sociotechnical and legal frameworks influence and impact the online privacy management practices of persons with diverse Sexual Orientation and Gender Identities (SOGI) in Australia? Sub questions to be answered by this research are: (1) How do persons with diverse SOGI in Australia manage their interactions and identities online?; (2) What role does the design of social technologies play in the online lives of persons with diverse SOGI?; and (3) What are the strengths and weaknesses of current privacy laws and policies for protecting personal information for persons with diverse SOGI?

The poster will describe the methods proposed for this study including: an analysis of legal frameworks and policies; a survey of approximately 100 people with diverse SOGI about their use of digital social technologies; and in-depth conversations with a sub-set of self-selected survey participants. A survey of people with diverse SOGI will be used to gather high-level data including demographics, internet usage and general privacy awareness and concerns, and will also serve as a way for participants to self-select for a semi-structured interview which will explore their information behaviours in regard to digital social media use. The semi-structured interviews will be complemented by a structured component using the ‘walkthrough method’ or a ‘live observation’ of their online interactions (with permission), to understand participants’ observable actions ‘in the moment’ (Talip et. al., 2016) in their online environment (e.g., observing privacy settings in regularly used applications and during account creation). As there is existing research on the experiences of young people (aged 12 – 18) with diverse SOGI and how they manage their privacy and interactions online (Byron et al., 2019; Cho, 2018; De Ridder, 2017; O'Neill, 2014), this research will explore the online privacy management practices of participants through three discrete case studies, with people aged: 18 – 25; 26 – 40; and over 40. Information behaviour theories such as knowledge gaps and information poverty, information grounds; and information avoidance/ selective exposure will be used to understand how individuals interact with information, and how privacy needs are changing as society becomes increasingly digital. Privacy Calculus theory and Communication Privacy Management theory will also be used to understand how individuals balance the perceived benefits of sharing information online, with the perceived risks of disclosure of personal information online, and how boundaries and rules are created when sharing information online.

Any early results from the above data will be presented in the ASIS&T poster in October 2023.

**CONCLUSION**

This research will build an understanding of the online information behaviours of persons with diverse SOGI in Australia, especially in regard to how they manage their online privacy and to what extent the legal framework influences the decisions they make, and whether existing privacy-enabling policies are inclusive of the unique experiences of persons with diverse SOGI. Understanding and improving the privacy protections for persons with diverse SOGI will help us understand and improve them for everyone, including other vulnerable communities.
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Artificial Intelligence Mediating the Everyday Information Practices of Young People

Nygård, Tuula  
University of Oulu, Finland | tuula.nygard@oulu.fi

Huttunen, Aira  
University of Oulu, Finland | aira.huttunen@oulu.fi

Hirvonen, Noora  
University of Oulu, Finland | noora.hirvonen@oulu.fi

ABSTRACT
Artificial intelligence (AI) technologies shape the ways information is created, delivered, accessed, evaluated, and used, but empirical research on AI and human information practices has remained scarce. This study makes use of a nexus analytic research strategy and co-research methods to study AI systems in the everyday lives of young people with an emphasis on the information practices that are reshaped due to the use of these technologies. The overall aim is to better understand how AI systems mediate young people’s information practices and thereby shape their autonomy, wellbeing, possibilities to participate in society, and access to rights. The empirical research will engage young Finnish people in meaningful conversations about their everyday encounters with AI systems and, using co-research methods, explore these interactions in their information environments and in connection to their practices, agency, and identities.

KEYWORDS
Artificial intelligence; Co-research; Everyday life; Information practices; Young people

INTRODUCTION
Artificial intelligence (AI) systems are already an integral, but often unnoticed, part of the everyday lives of young people in digitalized societies. These systems that collect, process, and “react intelligently” to data in ways that simulate human intelligence (Elliot, 2019) directly impact the lives of young people several times a day – determining things like the videos they watch, the ads they see, the routes they choose to walk to school, and more broadly how they communicate, express themselves, learn, and develop their identities. Public discourse on AI tends to foreground the technological achievements in developing “an AI” (Elliot, 2019) and human-centered research on AI focuses on technical or legal concerns or on specific applications (Wachter & Mittelstadt, 2019), whereas the daily practices that are re-shaped as new technologies are being appropriated into them are left understudied. Even less examined are the ways AI systems are embedded in and transform the lives of young people who live and grow up surrounded by these technologies (Council of Europe, 2019; UNICEF, 2021). While the ways algorithms shape information practices have been examined to some extent (e.g., Lloyd, 2019, Haider & Sundin, 2021), more recent developments in AI-powered technologies enabling increased automatic generation, personalization, and targeting of information, for example, have not been thoroughly addressed. Better understanding of AI use and experiences in everyday life is needed to recognize the actual use and operation of these technologies among diverse groups of people. Young people can be considered specifically vulnerable to the impacts of AI and have specific needs and rights that should be considered when developing and using AI technologies. Yet, currently, they are only briefly mentioned, or not mentioned at all, in most AI policies, strategies, and guidelines.

The present study is informed by sociocultural and practice theoretical research on everyday life information practices, which directs attention to the ways information activities are woven into social practices (Cox, 2012). The objectives of the study are to 1) explore how young people experience and understand AI systems as part of their everyday information practices and in constructing their identities and agency and 2) create new knowledge and resources with young people for AI education and decision-making.

METHODOLOGY
Everyday practices are challenging to study, as they tend to appear invisible or largely unquestioned. To address this challenge of “rendering the seemingly invisible visible” (Willson, 2017, p. 138), this research follows a nexus analytic research strategy (Scollon & Scollon, 2004) and makes use of co-research methods to unpack the ways AI systems are enmeshed with everyday information practices of young people. Nexus analysis allows disrupting the traditional roles between researchers and participants, changing their relationship into a partnership (Scollon & Scollon, 2007) and offers analytical tools to consider connections between multiple factors that intersect in every human action. In this study, these include the life histories, experiences, and identities of individuals; the social arrangements that allow relationships between people; and discourses that circulate in material and virtual places, home, and school environments and AI powered social media platforms alike (Scollon & Scollon, 2004).

This study focuses on 15–24-year-old young people (UN, n.d.), being the most active Internet users (UN, 2023). At this age, young people in Finland are on the threshold of adulthood, between the end of compulsory education and the transition to working life. In this study, young people act as co-researchers and take an active role in research.
activities (Boylorn, 2008) including data collection through, for example, their own observations of their everyday life, specific platforms, technology use, peer observation, and/or peer-interviewing (Vaughn & Jacquez, 2020) and analysis of the jointly compiled multimodal data. Moreover, the participants are involved in determining the research topics specified during the research process. Co-research methods allow research done with rather than on young people (Corsaro, 2011, 47) and gaining the kind of knowledge about their everyday lives that cannot be reached with traditional, adult-centric methods (Willumsen et al., 2014). Due to its methodological approach, the project requires careful consideration of the ethical implications of the research and reflecting upon the participants’ and researchers’ positions and roles (Pink et al., 2015). The project seeks to implement democratic principles such as valuing the contributions of researchers and young people equally and creating research results that are valid for both parties (Magnoler, 2015). The research will comply with applicable laws and the ethical research guidelines of the European Union, the Finnish Advisory Board on Research Integrity (2019) and the guidelines of the University of Oulu in regulations on empirical research.

PRELIMINARY FINDINGS
The study commenced in June 2023 with pre-research that sought to explore ways to find common ground in discussing AI in young people’s everyday life and brainstorm related research ideas. The pre-research involved twelve 15 to 17-year-olds who were recruited as co-researchers through an open call to work at the University of Oulu, Finland, for a two-week period. The co-researchers worked with AI-related topics with different research teams, spending two full working days with this team discussing AI in everyday life, specifically in social media. Data collected from the pre-research includes observational notes, photographs, recordings of joint discussions, and feedback questionnaires and material created by the co-researchers.

With the help of researcher mentors, the co-researchers explored AI-related research articles and based on the articles, created popularized content on the project’s Instagram account. The purpose of this task was to discuss AI in the everyday lives of young people in an ethically sound manner, without going into the co-researchers’ private experiences, and to combine the expertise of the mentors and the co-researchers. This task also prepared the group for brainstorming future research ideas. The brainstorming resulted in 51 distinct ideas which were then developed further in two groups. The first group categorized the ideas after which the second group checked and labeled the categories. After a final joint discussion, 9 themes for future research on AI and young people were identified including, for example, Education and human development, Ethics, and Future jobs/professions. Finally, the co-researchers voted the most important theme for future research to be ‘Human relationships’ including topics such as the impact of AI on human relationships and emotional bonds with chatbots.

In the pre-research phase, the co-researchers were hired to work at the university which means that they were being compensated for their efforts. This potentially contributed to the co-researchers' engagement since nearly all of them expressed interest in continuing with the research activities. Besides connecting with these co-researchers, the pre-research provided important insights in terms of co-research with young people and notions on young people’s perspectives on AI.

CONCLUSION
This study seeks to create knowledge of the impact of AI systems in the everyday lives of young people with an emphasis on the information practices that are reshaped due to the use of these technologies. The theoretical-methodological approach of this study directs attention to young people’s active agency both when interacting with AI (Fanni et al., 2022) and in the research process. As its theoretical contribution, the study adds knowledge on the ways digital technologies shape the information practices of people in diverse situations. Beyond the academic context, the findings are important from the perspective of AI literacy, media and information literacy, and multiliteracy instruction. Perhaps most importantly, the study will provide researchers, designers, policymakers, and other adults committed to promoting youth welfare with clear, evidence-based examples of AI systems’ influence on young people’s everyday activities and decision-making. AI is a fundamental influence on young people’s lives today and for the foreseeable future. The better we understand how it shapes their everyday life experiences, the more easily we can advocate for the design and regulation of AI for the future public good.

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ABSTRACT
A paradigm shift is currently underway with the emergence of the Collections as Data movement, which advocates the creation and dissemination of cultural heritage collections that are amenable to large-scale computation to empower both collection managers and users. Although this discourse is beginning to gain some traction in the literature, critical evidence-based assessments of the opportunities and risks of this process are underexplored. This paper presents the results of a content analysis of the official position statements (n=83) produced in the Collections as Data forums and written by international professionals working with digital collections. Although preliminary, the analysis presented and discussed here sheds light on the initial reception of the idea of Collections as Data and its articulation in practice. The study represents the first systematic attempt to explore the complexities of the intersection of ethics and artificial intelligence in the context of cultural heritage, aiming at providing a valuable precedent for further elaboration and discussion.

KEYWORDS
Collections as Data, artificial intelligence & ethics, content analysis, R language.

INTRODUCTION AND BACKGROUND
In recent years, the online availability of digitised heritage collections has increased exponentially, in part due to technological advancements, the commitment towards improving the access to mass-digitised collections (Terras, 2015) and the success of the open licensing agenda (Hamilton & Saunderson, 2017). This progress has broadened access to digital heritage materials and expanded opportunities for their potential use and reuse. Within the scholarly community, various groups have emerged to study and apply computational methods to heritage collections (Brügger, 2016; Manovich, 2020; Marciano, 2022), often including Artificial Intelligence (AI). In 2016, the Library of Congress’ National Digital Initiative (NDI) team organised a workshop to lay the groundwork for Collections as Data (CaD). As noted by Padilla, the lead researcher and originator of the concept, the definitions for CaD are varied, but at the heart of the initiative is an “ethically grounded, responsible use of collections” (Padilla, 2018) that resonates with several recent papers trying to address the ethical use of AI in the context of historical data (Jo & Gebru, 2020; Pisoni et al., 2021; Thylstrup, 2022). There is a growing emphasis on ensuring that ethical considerations are incorporated into the implementation of AI systems, to prevent the occurrence of algorithmic injustice, discrimination and misrepresentation. But how is the ethical and responsible use of collections characterised by the contributors to the CaD, and does it consider the use of AI? This is the composite research question that drives our contribution, which aims to become a valuable evidence-based precedent for broadening and developing the discourse in the European context.

MATERIALS
The Always Already Computational: Collections as Data project (2016-2019) and its successor, Collections as Data: Part to Whole (2019-2022) sought to refine the original conceptual framework and pave the way for informed and ethical production, dissemination and use of CaD. Activities included a national forum (1-3 May 2017) and an international summit (25-26 April 2023) to outline and discuss the future direction of the initiative. Prior to attending these two events, participants were asked to prepare a brief position statement. The prompt was the same in both the events, asking participants to focus on highlighting any gaps in the proposal or the existence of unrepresented communities/issues. A total of 83 position statements (n=26 published in 2017 and n=57 published in 2023) were collected and made publicly available at Zenodo (Bailey et al., 2019; Chambers et al., 2023).

METHODS
Content analysis is a research technique for drawing inferences rooted in the texts analysed, which can be approached using either a qualitative or quantitative approach (Krippendorff, 2019). We used a mixed-methods approach, starting with text-mining (based on Silge & Robinson, 2022), confronting the outcomes of bag-of-words, bigrams and sentiment analysis to identify potential categories, and then examining their articulation in the text using inductive inference to build sub-themes (informed on Drisko & Maschi, 2016; Krippendorff, 2019; Silverman, 2019). The decision to use a quantitative method to drive the subsequent qualitative analysis was made to maximise the reliability and replicability of the study, although this approach may have distracted attention from the identification of implicit categories, as Silverman points out (2019). The position statements were used as units of
analysis and extracted from the documents via Adobe Acrobat Pro, by creating heading bookmarks as split unit. The obtained PDFs were then processed in R Studio (Posit Team, 2023) using a wide array of packages (incorporated in the references); the analysis pipeline is characterised in Figure 1.

Figure 1. Content analysis pipeline, original elaboration based on (Wickham et al., 2022). The R packages on use are listed using a monotype font.

RESULTS AND DISCUSSION
Figure 2 summarises the results of our analysis. On the left are the sentiment analysis outcomes (upper: “negative”; lower: “positive”; words with no thematic relevance for this analysis are struck through) and on the right are the two major subthemes, incorporating the categories (monograms and bigrams with their absolute frequencies) that mainly contributed to their identification.

Figure 2. Sentiment bag-of-words and sub-themes with their components. Monograms are not fully represented in the bag-of-words, as they result from further processing steps.

The lack of diversity in data and the potential issues resulting from limited representativity is identified by Berry (2023), Hardesty (2019) and Maemura (2023) as an open question. The establishment of curatorial processes aiming to “identify, document and contextualize any problematic content” is suggested by Neudecker as a mitigation strategy to address potential ethical representation concerns associated with AI (2023, p. 31). Bailey (2023) stresses that the risks AI applications pose should not create room for access anxieties, given a certain attention towards “protections and mediations” as suggested by Tindall (2023, p. 125). Access design – although not explicitly linked with AI – is proposed by Okumura as a tool to support a more ethical data presentation standpoint (2023). Last, del Rio Riande reflects upon the dichotomy in providing open access to data and contemporarily “feeding the monster” or companies dedicated to AI development (2023, p. 49). The analysis shows that there is a degree of interconnectedness between the ethics of data (re)presentation and the use of AI; however, the lack of a unified framework of established best practices and the fragmentation of the discourse is indicative of the early stage of development of the debate.

CONCLUSION
This article presents the preliminary results of a mixed-method content analysis of position papers produced for two CaD initiative events. The aim was to explore the nature of the discussion on the intersection of artificial intelligence and ethics in relation to digital heritage collections. The analysis identifies some emerging concerns, potential challenges and ethical considerations with the aim of promoting a more critical approach to these issues.

Finally, it provides a basis for future research, suggesting possible avenues for more in-depth analysis. These include the collection of primary data from the European context, the refinement of quantitative analysis and the integration with abduction to retrieve latent themes.
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Exploring an Online Community of Blind Programmers by Using Topic Modeling and Network Analysis

Park, Jaihyun  
University of Illinois at Urbana-Champaign, USA | jaihyun2@illinois.edu

Seo, JooYoung  
University of Illinois at Urbana-Champaign, USA | jseo1005@illinois.edu

Lee, Jae Young  
University of Illinois at Urbana-Champaign, USA | jyl11@illinois.edu

ABSTRACT

Much work has been carried out to highlight the accessibility challenges of blind programmers. Yet, relatively little has been known about how blind programmers help each other to solve problems. We present a data-driven approach to explore collaborative problem-solving of users in the Program-l community of, by, and for blind programmers. We collected 8,344 longitudinal email threads from 778 users from 2004 through 2022 to observe the dynamics of collaborative problem-solving among blind programmers. Our embedding-based topic modeling and assortativity network analysis reveal that the knowledge of blind programmers diverges between when asking and answering questions. Our findings also suggest that users who have a high cluster level in the first year of activity and members are more likely to interact with other members with different roles. Our paper contributes to the field of social computing by introducing the first large-scale study of a unique community of blind programmers.

KEYWORDS

Social computing, Collaborative problem-solving, Online community, Blind programmers

INTRODUCTION

With the increasing demand for programming skills in various domains (Lu & Fletcher, 2009; Jacob & Warschauer, 2018), the importance of programming has grown significantly. Online platforms such as StackOverflow and GitHub have been instrumental in facilitating access to programming resources and enabling people to learn and share programming knowledge. Despite these advancements, however, programming remains a challenging field for blind individuals (This paper uses identity-first language when addressing visual impairments and blindness following the philosophy of the National Federation of the Blind) (Siegfried, 2006), who face unique obstacles when navigating code (Albusays et al., 2017) and require special strategies to comprehend it (Armaly et al., 2018). As a way of creating a unique community that connects blind programmers, blind programmers created an email listserv called “Program-l” to ask and answer questions about programming. The Program-l community (https://www.freelists.org/archive/program-l/) served as a place for sharing their knowledge and collaborating to solve their unique problems that the sighted programmers may not understand (Johnson et al., 2022). The Program-l community provides an ideal platform for unobtrusively observing the natural discussions of blind programmers, which are not controlled by researchers. Therefore, this paper aims to explore the collaboration of blind programmers by answering the following research questions:

- RQ 1: In what ways do the patterns of knowledge differ between askers and answerers?
- RQ 2: What are the network characteristics of the Program-l community?
  - RQ 2-1. How does a temporal trend of cluster level of askers and answerers differ?
  - RQ 2-2. How does a temporal trend of homophily (askers collaborate with askers and vice versa) differ?

METHODOLOGY

Data Collection

We collected 56,159 emails from 806 unique users, and we found that there are 8,344 threads from 778 unique users from October 31st, 2004 to November 10th, 2022. We further operationalized askers and answerers by calculating the proportion of asking (initiating email thread) and answering (replying emails). With this definition, total 459 askers and 319 answerers were identified.

Topic modeling

We estimated the knowledge by topics of the thread that askers and answerers collaborated on to address RQ 1. We used the topic modeling algorithm which takes word embeddings and estimates distinctive topics in the vector space (Angelov, 2020), which was enabled through several deep learning natural language processing (NLP) frameworks (Park & Jeoung, 2022). As we used a thread as the unit of analysis and the topic vector will be given to threads, we can estimate which topic the users asked and answered. To investigate how the knowledge of users diverges or converges, we used the non-parametric Mann-Whitney U test (Mann & Whitney, 1947) as we do not expect the topic to be normally distributed.

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Network analysis

One measurement to examine the density of the network to answer RQ 2-1 is to look at triadic closures in the network. The concept of triadic closure in network analysis is important to understand how the social network works Saramäki et al. (2007). Triadic closure assumes that if node A is connected to node B and node C, then there is a high probability that node B and node C are connected. Therefore, the concept of triadic closure is used to measure the clustering coefficient, which again helps us to estimate how the node is deeply forming the cluster in the given network.

To answer RQ 2-2 where we addressed whether the collaboration is homophilic or not, we used the assortativity coefficient (Newman, 2002). The assortativity coefficient is a measure to examine the tendency of nodes to connect with other similar nodes. This measure shares the same theoretical ground of homophily (McPherson et al., 2001) which states that people tend to socialize with others who are in the same group. However, we took advantage of the assortativity coefficient to calculate the degree of collaboration between askers and answerers to study how collaboration between the askers and answerers.

FINDINGS

Based on topic modeling, we found that 101 topics were existing in the entire dataset. We measured the topic distribution when asking and answering and calculated how many users showed statistically different topic distributions each year. In 2004, there were no askers who showed different topic distributions when they are asking and answering. However, the proportion of askers who showed different topic distributions when they are asking and answering tended to increase as time flows on ($\beta=0.0004, p=0.0399$). For askers, it was in 2012 when the proportion of askers who had different knowledge when asking and answering was the highest (0.0179) and the lowest was in 2007 when the proportion was 0.0019 (excluding 2004). The pattern of an increasing proportion of users who showed different knowledge in asking and answering was found in answerers as well. In 2004, the proportion of answerers who had different topic distributions when asking and answering was the lowest (0.0039). However, the highest proportion of answerers with different knowledge was reached in 2012 (0.0419). Likewise, the proportion of answerers who have different knowledge in asking and answering tended to increase ($\beta=0.0009, p=0.0286$) faster compared to that of askers. (Supplementary figures and tables are available at https://osf.io/7gnvm/?view_only=2ff2ef28c5e4d62b7762012019710ff.)

We measured how deeply askers and answerers engaged in communication of problem-solving in Program-l. Even after showing their first activity, users can become lurkers. We found that both askers and answerers formed a high cluster in the first year of their activity. However, as time goes by, the clustering coefficient score tends to decrease. We found that answerers show a relatively higher clustering coefficient compared to askers in the year that they showed the first activity. However, there was a pattern of decreasing clustering coefficient for both askers and answerers. In general, the average clustering coefficient of the entire network in each year for both askers ($\beta=0.009, p=7.7752e-09$) and answers ($\beta=0.008, p=3.4096e-06$) tended to increase.

The assortativity coefficient indicates the level of connection between askers and answerers, who have different roles in the Program-l community. We found that 2007 was when the assortativity coefficient was the lowest (-0.3437) while 2020 (-0.2199) was the highest. This indicates that the homophily of connection with the same role (e.g., askers connect to askers and answerers connect to answerers) was the strongest in 2007 but later in 2020, the degree of homophily became the lowest. We found that there is a trend of increasing ($\beta=0.0049, p=0.0009$). Increasing assortativity coefficient scores indicate that the askers and answerers are connecting to the users who have different roles (e.g., askers connect to answerers and answerers connect to askers) as time flows on, which in turn, making the Program-l community mixed and forming an integrated network.

CONCLUSION

The online community can not only serve as a place for argument (Öcal et al., 2021), but also function as a place for collective problem-solving. In this study, we found (1) the number of users who showed different knowledge when asking and answering tend to increase during the observation period of our dataset. (2) both askers and answerers show the highest level of clustering when they showed activities for the first time. However, the level of commitment decreases similarly to any other social media users (Sun et al., 2014). While we observed divergence in topic distribution, we observed convergence in the network, helping regardless of users asking more or answering more.

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Measuring Citizen’s Perceptions of AI Adoption for Instrumental and Value-Added Tasks

Park, Min Sook  University of Wisconsin-Milwaukee, USA | minsook@uwm.edu
Bak, Hyerin  University of Wisconsin-Milwaukee, USA | hbak@uwm.edu
Park, Hyejin  Florida State University, USA | hpark5@fsu.edu
Kim, Hyejin  Wright State University, USA | hyejin.kim@wright.edu

ABSTRACT
This preliminary study reports citizens' perceptions of using artificial intelligence (AI) in instrumental and value-added decision-making. We analyzed 5,153 responses from the Pew Research Center's American Trends Panel Survey, collected in 2021. The findings suggest that concerns outweigh excitement when it comes to adopting AI systems for complex value-added decisions while they welcome AI systems for instrumental tasks on behalf of humans.

KEYWORDS
Artificial Intelligence, Decision-making, Information Technology

INTRODUCTION
This preliminary study presents the initial findings of the authors' project, which aims to understand how information users utilize outputs from artificial intelligence (AI) in their decision-making processes. In recent years, AI has experienced significant advancements and widespread adoption in various domains, including marketing, healthcare, and security, thanks to the rise of big data and information and communication technologies. Consequently, people are increasingly being assisted by AI systems in a wide range of tasks, from relatively simple jobs such as customer service, travel planning, and personalized marketing to complex decision-making processes like scarce resource allocation (Claudy et al., 2022) and public service delivery (Ingrams et al., 2022). Despite intense debates regarding algorithmic fairness and possible overreliance on AI for decision makings (Buçinca et al., 2021; Schemmer et al., 2022), there is growing anticipation that AI could replace humans in simple repetitive tasks and even assist in making complex decisions.

The ultimate challenge for information users in utilizing AI lies in how to meaningfully leverage AI systems in a way that meets their needs. Understanding information users’ perceptions of AI adoption serves as the initial step toward empowering users through meaningful leverage of AI systems. Previous research shows that citizens' attitude toward AI systems varies by the context of AI adopted (Ingrams et al., 2022). For instrumental purposes, citizens generally hold positive views regarding AI adoption (e.g., tax filing and educational program registration) whereas their attitudes towards AI being used for value-added judgments exhibit significant variation (Araujo et al., 2020; Busuioc, 2021; Starke & Lünich, 2020). For instance, Starke and Lünich (2020) found that people trust AI-based decision-making for grading job suitability due to the blindness of AI to possible discrimination based on race or gender. On the other hand, Easton (2018) found that stakeholders express concerns about negative impacts on the public when AI is involved in decision-making processes of public service delivery, which may undermine trust in government trustworthiness. These previous studies suggest that citizens may have different attitudes when utilizing outputs from AI systems. However, prior research has primarily focused on specific domains, yielding mixed results. Furthermore, little research has been conducted on how citizens respond to different types of tasks delegated to AI. To address this gap, we examine people's general perceptions of AI for two distinct types of tasks: instrumental and value-added decision-making tasks.

METHOD
Data
This study analyzed Pew Research Center’s American Trends Panel (ATP) Survey conducted in November 2021. The ATP survey panel consists of over 10,000 randomly sampled adults in the United States who are 18 years old or older and is designed to be nationally representative (Pew Research Center, 2023). In this study, a total of 5,153 responses from those who answered all four selected questions (see the following section) were analyzed.

Measures and Data Analysis
Four survey questions were selected to examine if citizens react differently to the willingness to AI adoption for instrumental tasks and value-based judgments using the following question and its four types of tasks: “how excited or concerned would you be if artificial intelligence computer programs could do each of the following?” Two types of tasks associated with this question were selected to measure citizens’ perception of AI use for instrumental purposes: “perform house chores” and “perform repetitive workplace tasks”. Two others were selected to measure value-based complex decision-making tasks: “make importance of life decisions for people” and “diagnose medical problems”. The question originally had five response options: very excited, excited, equal excitement and
concerned, concerned, and very concerned. We recategorized the options into three ratings: excited = 3, equal excitement and concerned = 2, and concerned = 1. We also considered demographic and socioeconomic characteristics: Gender (female, male, in some other way), age (18–29, 30–49, 50–64, 65 or older), education levels (high school graduate or less, some college, college graduate or more) and ethnicity/race (white non-Hispanic, black non-Hispanic, Hispanic, Asian non-Hispanic, other). Chi-square tests (Pearson, 1900) were carried out using SPSS version 28 to examine the relationship between two examples of instrumental tasks and two other examples of value-added decision-making tasks (see Table 1 for the example roles of AI systems).

RESULTS
Approximately 55.1\% (n=2,840) of the sample consisted of females. The largest age group was between 30 and 49 years old, accounting for 31.9\% (n=1,642) of the participants, followed by the age group between 50 and 64 years old, representing 29.3\% (n=1,509) of the sample, and those aged 65 years or older, making up 29.6\% (n=1,527) of the respondents. Approximately half of the participants (50.8\%, n=2,620) held a college or graduate degree. Most of the sample identified as non-Hispanic white, comprising 69.9\% (n=3,601) of the respondents.

The chi-square test results indicate that citizens’ perceptions toward AI adoption for instrumental tasks and value-added decision-making tasks significantly differed across the given examples. The proportions of responses regarding the adoption of AI for performing house chores and making important decisions varied by the respondents' ages old, representing 31.9\% \((\text{value-added decision-making tasks})\) (see Table 1 for the example roles of AI systems).

Approximately 55.1\% \((\text{value-added decision-making tasks})\) \((\chi^2(4, N = 5,153) = 294.44, p < 0.001)\). Respondents are more likely to feel excited about using AI systems for house chores but are more likely to be concerned about using AI for important life decisions. Similarly, respondents’ attitudes toward using AI systems for medical decisions are more likely to be negative compared to using the systems for performing house chores, \(\chi^2(4, N = 5,153) = 1136.96, p < 0.001\). The relations between the other example of instrumental tasks (i.e., performing repetitive workplace tasks) and the two types of value-added decision-making were also statistically significant. Respondents are more likely to be excited when using AI systems for repetitive workplace tasks than for important life decisions \((\chi^2(4, N = 5,153) = 448.77, p < 0.001)\) or medial decisions \((\chi^2(4, N = 5,153) = 1055.12, p < 0.001)\). (see Table 1)

<table>
<thead>
<tr>
<th>If AI could do... n (%)</th>
<th>Instrumental Tasks</th>
<th>Chi-Square Tests of Independence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform House Chores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concerned</td>
<td>810 (20.1)</td>
<td>(\chi^2(4) = 294.44)</td>
</tr>
<tr>
<td>Neutral/no opinion</td>
<td>1,019 (25.3)</td>
<td>(p &lt; 0.001)</td>
</tr>
<tr>
<td>Excited</td>
<td>2,195 (54.5)</td>
<td></td>
</tr>
<tr>
<td>Perform Repetitive Workplace Tasks</td>
<td>1,160 (28.8)</td>
<td>(\chi^2(4) = 448.77)</td>
</tr>
<tr>
<td>Concerned</td>
<td>1,112 (27.6)</td>
<td>(p &lt; 0.001)</td>
</tr>
<tr>
<td>Neutral/no opinion</td>
<td>42 (10)</td>
<td>(\varphi = 0.24)</td>
</tr>
<tr>
<td>Excited</td>
<td>1,752 (43.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value-added Decision Making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Making Important Life Decision</td>
<td>28 (3.7)</td>
<td>(\chi^2(4) = 1136.96)</td>
</tr>
<tr>
<td>Concerned</td>
<td>207 (27.5)</td>
<td>(p &lt; 0.001)</td>
</tr>
<tr>
<td>Neutral/no opinion</td>
<td>517 (66.8)</td>
<td></td>
</tr>
<tr>
<td>Excited</td>
<td>342 (90.7)</td>
<td>(\varphi = 0.47)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnose Medical Problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concerned</td>
<td>636 (34.8)</td>
<td>(\chi^2(4) = 1055.12)</td>
</tr>
<tr>
<td>Neutral/no opinion</td>
<td>507 (27.7)</td>
<td>(p &lt; 0.001)</td>
</tr>
<tr>
<td>Excited</td>
<td>670 (53.2)</td>
<td>(\varphi = 0.45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 1. Crosstabulation of Responses to Towards Roles of AI by Negative/Neutral/Positive Attitude

The results suggest that citizens’ perceptions toward AI system adoption vary depending on the nature of tasks for which AI is utilized. Citizens are more likely to be concerned when AI systems are used for value-added decisions whereas they tend to have a positive attitude when AI systems are utilized for instrumental tasks both in workplace and house settings.

CONCLUSION
The results demonstrate that citizens’ perceptions toward AI system adoption differ based on the nature of tasks turned over to the AI. Citizens are found to be more concerned about AI systems being involved in complex value-added decisions, while they welcome AI systems for performing instrumental tasks on behalf of humans. The
findings of this preliminary study suggest that people may utilize the outputs from AI systems differently depending on their specific needs or purposes. In our future studies, we will investigate factors contributing to these varied attitudes toward AI system adoption, particularly in the context of complex decision-making.

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From Digitization and Images to Text and Content: Transkribus as a Case Study

Prebor, Gila
Bar Ilan University, Israel | Gila.prebor@biu.ac.il

ABSTRACT
This poster explores the potential of using technological tools, specifically the Transkribus platform, for the transcription of Hebrew manuscripts. The digitization of historical resources has made them accessible, but the textual content of the scanned images remains inaccessible. Transkribus, an AI-powered platform, offers tools for text recognition, transcription, and search of historical documents. The poster discusses the process of automatic text recognition (ATR) and the challenges it faces, particularly in handling handwritten texts and Hebrew letters. It provides an overview of the Transkribus platform, its functionalities, and the training process for creating transcription models. The author presents a case study of transcribing a 15th-century Sephardic semi-cursive Hebrew manuscript using the Transkribus platform and evaluates the performance of different models. The poster concludes by discussing the implications and possibilities of using Transkribus for automatic transcription of historical Hebrew manuscripts. While the results show promising improvements in accuracy, further challenges and solutions are also discussed. Overall, Transkribus offers significant potential for the study and transcription of Hebrew manuscripts, revolutionizing the field of Jewish studies and historical research.

KEYWORDS
Hebrew manuscripts; Transkribus; automatic transcription; machine learning; neural networks

INTRODUCTION
In recent decades, libraries and archives have been digitizing their collections, making many resources freely accessible. However, the digital versions usually only provide metadata and images, with the textual content remaining hidden. The National Library of Israel (NLI) is involved in comprehensive digitization projects, including "Ktiv: The International Collection of Digitized Hebrew Manuscripts." These manuscripts hold great cultural significance, but while the originals are scattered worldwide, copies can be found at the NLI. The institute has collected microfilm photographs of approximately 95% of identified Hebrew manuscripts. Extracting information from manuscript metadata is possible, but accessing the textual content remains a challenge. Advancements in automatic reading technologies offer the potential to revolutionize the study of Hebrew manuscripts and Jewish studies. This poster explores the possibilities and potential of using technological tools for Hebrew manuscript transcription. It includes an overview of automatic text recognition and the Transkribus platform, a review of models trained with the Transkribus engine, performance analysis, and a discussion of Transkribus' implications for automatic transcription of historical handwritten Hebrew manuscripts.

AUTOMATIC TEXT RECOGNITION (ATR), HTR AND OCR IN HEBREW LETTERS
The digitization of historical resources involves photographing and scanning them to preserve knowledge in electronic form. However, scanning alone provides only an image, making it necessary to convert the scan into a machine-readable format for searching, copying, and analyzing the text. This process, known as Automatic Text Recognition (ATR), has made significant progress since the mid-1960s. It typically involves layout analysis, character and word recognition, and post-processing with language models. The accuracy of ATR is measured by the Character Error Rate (CER) and Word Error Rate (WER). Handwritten Text Recognition (HTR) and Optical Text Recognition (OCR) are distinguished for handwritten and printed texts, respectively. OCR systems are highly accurate, while HTR software is still under development and faces additional challenges due to variations in handwriting style and other factors. The Hebrew language poses unique difficulties due to its dissimilar letters, right-to-left writing direction, and complex structure. Existing software like Tesseract, Google Docs, and ABBYY work well for printed English text but lack sophistication for transcribing historical handwritten Hebrew manuscripts. Recent approaches using natural language analysis and machine learning, particularly neural networks, have shown promise but require large amounts of labeled data. Several projects, such as eScriptorium and Transkribus, aim to build web-based infrastructure for the successful conversion of manuscripts with different writing systems.

THE TRANSKRIBUS PLATFORM
Transkribus is a comprehensive platform that enables the digitization, AI-powered text recognition, transcription, and search of historical documents. It was launched in 2015 as part of the tranScriptorium Project and allows users to download and organize documents within a private collection. Using layout analysis tools, Transkribus segments images into blocks, lines, and words, enabling transcription into any language with chosen character fonts. Transcribed documents can be exported in various formats. While automatic text detection models require credits, other functions like layout analysis, transcription, and search remain free. Users contribute "ground truth" data for
machine learning by training the system with sufficient data for a specific script, allowing the creation of models applicable to large volumes of similar material. Transkribus provides public models, including the DiJeSt model adapted to Hebrew languages, facilitating collaboration and saving time for users.

**TRANSCRIPTION OF A SEPHARDIC SEMI-CURSIVE 15TH-CENTURY SCRIPT**

This study explores the transcription of a Sephardic semi-cursive 15th-century handwritten script using the Transkribus software. The chosen manuscript, Sefer ha-Iqqarim by Joseph Albo, posed challenges due to the lack of an appropriate model for ancient Hebrew scripts in Transkribus. Despite using the DiJeSt model, which was not specifically trained on Hebrew handwritten texts, the initial transcription showed high error rates. To improve the model, the researcher manually transcribed five pages of the manuscript and trained a new model called the BNF 740 model. The results improved significantly, demonstrating the potential of manual transcription to enhance the accuracy of the model. Further training using more pages led to the development of the Heb_Sefaradic_Semi_Cursive_15 model, which achieved impressive accuracy rates. However, challenges remain, such as handling extra letters at the end of lines and identifying various phenomena in the text, including deletions, footnotes, and headings. Overall, this study highlights the power of Transkribus in transcribing historical Hebrew manuscripts and identifies areas for future improvement and refinement.

**A GENERIC MODEL?**

This study investigates the use of the Heb_Sefaradic_Semi_Cursive_15 model, trained on a specific manuscript, as a generic model for transcribing other manuscripts of the same script type. The manuscript Oxford, BL Poc. 393, containing the commentary on the Pentateuch by Abraham ibn Ezra, was selected for testing. Using the Heb_Sefaradic_Semi_Cursive_15 model, the transcription yielded reasonable accuracy, with a percentage of errors of 2.29% CER and 11.21% WER for fol. 11r. Further testing on additional pages showed similar results, with an average of 3.31% CER and 14.79% WER. To improve the transcription accuracy, a new model named Oxford_393 was trained using a limited number of pages. The results showed significant improvement, with a percentage of errors of 1.27% CER and 5.97% WER. This demonstrates the potential for refining the transcription model to achieve higher accuracy for specific manuscripts. Further research is needed to explore methods for enhancing generic models to accurately transcribe a broader range of manuscripts in the Sephardic semi-cursive script from the 15th century.

**CONCLUSION**

In conclusion, this poster highlights the potential of using technological tools for transcribing Hebrew manuscripts. The analysis demonstrates that handwriting recognition models, trained with the Transkribus engine, can produce usable results for Sephardic semi-cursive 15th-century manuscripts. While manual correction is still required, the initial draft generated by the computer significantly reduces the time and cost involved in transcription. Our findings reveal that relatively good results can be achieved with a modest investment. Although the recommended amount of ground truth data for training a model is substantial, our experiments show that even with a smaller amount, satisfactory outcomes can be obtained. This opens up possibilities for the mass digitization of unpublished manuscripts and wider utilization of these texts for future research. The integration of technology in transcription processes offers promising opportunities for scholars and researchers working with ancient manuscripts. It enhances efficiency, accessibility, and the preservation of valuable cultural heritage. As technology continues to advance, further improvements in transcription accuracy and automation can be anticipated, revolutionizing the field of manuscript studies.

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Scientific Knowledge Production and Artificial Intelligence for Healthcare: A Scientometric View

Qin, Hongyi  
Zhejiang University, People's Republic of China | zoeqhy@zju.edu.cn
Cai, Xiaojing  
Yangzhou University, People's Republic of China | caixiaojing@yzu.edu.cn
Yuan, Weikang  
Zhejiang University, People's Republic of China | yuanwk@zju.edu.cn
Huang, Cui  
Zhejiang University, People's Republic of China | huangcui@zju.edu.cn
Luo, Siqi  
Zhejiang University, People's Republic of China | siqi_luo@zju.edu.cn

ABSTRACT
This study employs a scientometric approach to shed light on the evolving intellectual structure of AI in healthcare (AIH) research. The results substantiate the multi-layered nature of knowledge production within the AIH domain, comprising the foundation, technology, and application layers. The application layer has witnessed a notable expansion in both its scope and depth, encompassing diverse areas including medical image analysis, data analysis and mining, decision support systems, and intelligence assistance. Additionally, a significant shift has occurred in its knowledge production process, wherein the conventional reliance on empiricism has been augmented by the incorporation of datafied innovation. This process of datafication has enriched the empirical underpinnings of AIH research, fostering a more comprehensive and evidence-based approach to knowledge production.

KEYWORDS
Artificial intelligence (AI); healthcare; scientific knowledge production; scientometric analysis

INTRODUCTION
In recent years, the healthcare industry has undergone a remarkable revolution by incorporating AI technologies, resulting in enhanced flexibility in healthcare delivery, heightened precision in diagnostics, more customized treatment strategies, and better patient results (Kumar, Sharma, & Dutot, 2023). Healthcare researchers and practitioners have gained access to powerful tools capable of analyzing vast amounts of data, identifying intricate patterns, and deriving meaningful insights that have further enriched the field of healthcare research and practice (Chin-Yee & Upshur, 2019). Traditionally, healthcare relied heavily on the expertise of physicians. However, the advent of digital technology has introduced not only human doctors but also impersonal AI “doctors” (Zhuang, Wu, Chen, & Pan, 2017). These shifts are reshaping the field by introducing intelligent technologies, leading to the emergence of novel forms of knowledge that challenge the existing frameworks of the AIH discipline (Di Vaio, et al., 2022). The purpose of this article is to delve into the utilization of AI in the healthcare sector, seeking a comprehensive understanding of its impact and potential to shape the future of healthcare, with a particular emphasis on rendering knowledge production more evident and accessible.

To this end, this study seeks to elucidate the existing intellectual structure of scientific and practical outcomes on a global scale and address the following research questions: (1) What are the emerging scientific focal points of AIH research and how are they evolving? (2) What is the nature of the knowledge production process in AIH research?

METHODS
Publications pertaining to AIH were collected from the Clarivate Web of Science (WoS) Core Collection, with a restriction to document types of Article and Proceedings Paper indexed in Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index, Conference Proceedings Citation Index – Science, and Conference Proceedings Citation Index – Social Sciences & Humanities. A total of 90,792 papers were initially retrieved in November 2022, and further refined to 89,034 papers after eliminating irrelevant records.

A document-term matrix was derived from the corpus of titles and abstracts of papers by employing word separation processing techniques, including the exclusion of stopwords, punctuations, and unmeaningful words based on a Natural Language Toolkit. Subsequently, the Latent Dirichlet Allocation (LDA) algorithm was utilized to identify latent topics embedded in the corpus based on the document-term matrix (Wu, Yi, & Li, 2021).

PRELIMINARY RESULTS
The annual number of scientific papers is illustrated in Figure 1(a), showing a consistent upward trend since the mid-1990s and experiencing exponential growth after 2010. Figure 1(b) presents the high-frequency words in the abstracts and titles of papers across three stages. The figure demonstrates a notable inclination for computer science terms like network, neural, and computer to be prevalent in papers before the mid-1990s. However, after the mid-1990s, there was a noticeable shift where words related to patients and their clinical nature became more prominent.

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LDA was employed to analyze topic distribution and evolution across various time intervals, as presented in Figure 1(c). The optimal number of topics was 6 before 1995, 8 from 1996-2010, and 12 from 2011 to present. The evolution of AIH research can be categorized into three layers: foundation, technology, and application. The foundation layer revolves around data and databases, crucial for AIH advancement. The technology layer involves algorithmic models and technologies for AIH development. The application layer predominantly focuses on four key areas: (1) medical image processing, involving tasks such as image reconstruction, edge detection, reconstruction, registration, segmentation, lesion identification and labeling, brain scanning, automatic target delineation, and adaptive radiotherapy; (2) data analysis and mining applications, concentrating on drug discovery and infectious disease prevention and control; (3) decision-making support applications, encompassing tasks like disease risk assessment and prediction, EEG analysis, and personalized medicine; and (4) medical assistance applications, involving surgical robots and electronic health records.

The development of IT infrastructures, algorithms, and technologies are closely intertwined with real-world contexts. As these advance, AI applications broaden beyond image processing to include data analysis and mining, medical assistance, and clinical decision support. This expansion consolidates scientific research in the fundamental and technical layers.

In the AIH domain, empirical methods persist while big data analytics gains importance. Leveraging AI technologies, big data analytics unveils latent patterns, enhancing the efficacy, and quality of knowledge production in AIH research. Medical image processing, specifically for lung nodule screening, exemplifies one of the prototypical applications. AI enables quick and accurate nodule identification, compared to relying solely on physicians. Moreover, as technology and algorithms continue to progress, the physician-centered knowledge production model faces new vulnerabilities. In drug development, generative algorithms enable rational protocols and shift focus to innovation-oriented paradigms.

CONCLUSION

The emergence of AI and its consequential influence on knowledge production has brought about substantial transformations in the healthcare domain. The content of knowledge production has expanded both in terms of breadth and depth, encompassing a wider range of topics and delving into more intricate aspects. Simultaneously, the knowledge production process has undergone a notable evolution, transitioning from its conventional reliance on empirical evidence to incorporating the datafication.
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A FAIR Data Ecosystem for Science of Science

Qin, Jian  
Syracuse University, USA | jqin@syr.edu

Bratt, Sarah  
University of Arizona, USA | sebratt@arizona.edu

Hemsley, Jeff  
Syracuse University, USA | jjhemsle@syr.edu

Smith, Alexander  
Syracuse University, USA | aosmith@syr.edu

Liu, Qiaoyi  
Syracuse University, USA | qliu11@syr.edu

ABSTRACT
This poster discusses Automated Research Workflows (ARWs) in the context of a FAIR data ecosystem for the science of science research. We offer a conceptual discussion from the point of view of information science and technology using several cases of “data problems” in the science of science research to illustrate the characteristics and expectations for designers and developers of a FAIR data ecosystem. Drawing from a 10-year data science project developing GenBank metadata workflows, we incorporate the ideas of ARWs into the FAIR data ecosystem discussion to set a broader context and increase generalizability. Researchers can use these as a guide for their data science projects to automate research workflows in the science of science domain and beyond.

KEYWORDS
Data ecosystem, Science of science research, Knowledge graphs, FAIR principles

INTRODUCTION
The fast growth of data and advances in computational tools have been loudly “revolutionizing” science (Atkins, 2011; Fortunato et al. 2018), but at the same time quietly changing the way research is conducted by expanding expectations of systems that service the needs for data findability, accessibility, interoperability, and reusability (FAIR) (Wilkinson et al, 2018). The term Automated Research Workflow (ARW) refers to the tools and techniques developed to support scientific investigations in meeting the demands for a FAIR data ecosystem and ensuring research reproducibility, replicability, and trustworthiness (NAS, 2022). ARWs “integrate computation, laboratory automation, and tools from AI in the performance of tasks that make up the research process such as designing experiments, observations, and simulations; collecting and analyzing data and learning from the results to inform further experiments, observations, and simulations” (NAS, 2022, p. 1). Although ARWs have accelerated scientific discoveries and yielded benefits to society (e.g., the rapid development of COVID-19 vaccines), the wider application and adoption of ARWs remains riddled with technical, social, cultural, educational, and policy-related challenges.

Science of science research has become increasingly computational, enabled in part by the explosion in trace data from the scientific enterprise and the sophistication and accessibility of AI/machine learning tools (Wang and Barabasi, 2021). However, before science of science data can be analyzed and run through computational workflows, the varied formats and structures of data from various publication and data repositories and the lack of linking between data requires a large amount of time and effort to acquire and process (Wilder-James, 2016; Qin et al., 2023). While the issues and questions raised in the NAS 2022 report are for all disciplines and at a more general level, this poster is going to discuss ARWs in the context of a FAIR data ecosystem for the science of science research.

The concept of a FAIR data ecosystem has been gaining attention from government funding agencies and research communities in the last decade (Wilkinson et al., 2016). The National Institutes of Health (NIH) strategic plan for data science defines a data ecosystem as “a distributed, adaptive, open system with properties of self-organization, scalability, and sustainability inspired by natural ecosystems” (NIH, 2018, p. 29). In this environment “data and resources become seamlessly integrated such that different data types and information about different organisms or diseases can be used easily together rather than existing in separate data ‘silos’ with only local utility” (NIH, 2018, p. 12). The National Science Foundation (NSF) has also strengthened the funding for building research data ecosystems in recent years (NSF, 2022). While funding agencies provide a wish list of essential characteristics of data ecosystems, many questions remain to be answered in specific disciplinary fields: what should a data ecosystem look like? What barriers exist for its implementation and use? What social and cultural impact may result from this transformed data environment for researchers? How do we (the information science and technology society) prepare workforces and reform educational programs for the ARW-driven data ecosystem? Clearly, different disciplinary fields have special sets of questions to address the ARW and data ecosystem challenge.

This poster offers a conceptual discussion from the point of view of information science and technology and in the science of science research as a case to illustrate the characteristics and expectations of a FAIR data ecosystem. We incorporate the ideas of ARWs into the FAIR data ecosystem discussion to set a broader context and increase generalizability. In this poster, we present the conceptual architecture of FAIR data ecosystems, introducing the
concepts of research entities, artifacts, and a preliminary definition of data ecosystem in the context of science of science research. We then describe a proposed prototype of an ARW implemented for science of science in the biomedical context using GenBank metadata. We identify several pressing social, cultural, and educational challenges to implementing the vision of an automated research workflows to implement a FAIR data ecosystem for science of science research.

THE CONCEPTUAL ARCHITECTURE OF FAIR DATA ECOSYSTEMS

There are concepts important for the architecture of FAIR data ecosystems:

Research entities: refers to authors and their affiliations, publications, datasets, patents, and grant awards – the primary objects and interests of science of science research. Research entities are often relatively stable and required to be consistent and identified globally uniquely. The metadata for these research entities are recorded as structured data and identified by a standard or local identifier. For example, authors can be globally uniquely identified by the Open Researcher and Contributor Identifier (ORCID), publications and datasets by Digital Object Identifier (DOI) and/or PMID (used for publications in PubMed), and NIH grants by project number. The entity representation promotes linking by relations, such as the OpenAlex entity graph (Priem et al., 2022).

Artifacts: refers to the input, computational codes, workflows, models, pipelines, and output that are used in/generated from a research lifecycle. Unlike research entities, artifacts are much more dynamic as they are constantly being revised/tuned to achieve the optimal performance or outcome. Metadata about these artifacts including version control is critical for provenance, verification, and reusability, which are significant properties of trustworthy computational analysis (Wing, 2021).

Data ecosystem: refers to an architecture for acquiring, organizing, linking, and sharing research entities and associated artifacts in databases by using automatic methods. The data ecosystem is built on the cloud/virtual infrastructure in which research entities and artifacts are represented by heterogeneous graphs for data discovery, selection, extraction, and other operations for researchers to obtain analysis-friendly datasets. The entity and artifact graphs are developed through an ontology that represents the knowledge networks of collaborations, communities, and innovations.

A FAIR DATA ECOSYSTEM PROTOTYPE USING GENBANK

The GenBank metadata analytics project (Bratt et al., 2017, Qin et al., 2022) has accumulated diverse trace data sources for molecular sequence submissions and associated publications, grants, and patents. Using this data collection, we aim to seamlessly integrate and link metadata for research entities and artifacts to create graphs not only for more effective discovery and use of data and knowledge, but also for tracking data and workflows used in research to ensure reproducibility and transparency.

The prototype will follow the FAIR principles and emphasize integration and linking of key research entities for use with metadata analytics. As the data sources already exist in distributed data systems, e.g., authors in ORCID, publications in PubMed and Microsoft’s Academic Graph, this prototype will focus on linking mechanisms for connecting research entities and resources in the data and knowledge spaces of the data ecosystem. As a data ecosystem, algorithms and tools will be important for optimizing the automation of data ingestion, processing, transformation, and representation, so that the data in this system stay up to date. A requirement for a FAIR data ecosystem is that not only must the data be FAIR but also the artifacts generated from data design and creation process be FAIR. Standardized notes, annotations, workflows, code files would need to be integrated for data and code provenance purposes. Ontology models will represent the conceptual architecture of this prototype for research entities, artifacts, as well as their relations. This area of work will be guided by three core principles: express knowledge in a sufficiently precise notation, the knowledge representation scheme meets the criteria of adequacy and expressiveness, and reasoning and problem solving are based on the facts represented by the schemes (Qin, 2020). The prototype data ecosystem will include not only baseline functions of findability, accessibility, interoperability, and reusability for data and artifacts but also advanced functions such as knowledge representation using “a formal, accessible, shared, and broadly applicable language” (Wilkinson et al., 2016, p. 4).

CONCLUSION

A data ecosystem is a new way to view the vast digital data and has increasingly become a new wave in the organization, management, and services for digital data. There have been many lessons learned from the digital library initiative almost 30 years ago. In this round of revolutionary changes, some lessons from the digital library initiative are still valid, e.g., community building and outreach, but many more are new and different from 30 years ago as we discussed earlier in this text. We hope this poster will stir up discussion and rethinking on the implications of data ecosystems among the ASIST community members and beyond.
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Community Validation as a Method to Establish Trustworthiness in Qualitative LIS Research

Salzano, Rachel
Edinburgh Napier University, UK | r.salzano@napier.ac.uk

Hall, Hazel
Edinburgh Napier University, UK | h.hall@napier.ac.uk

Webster, Gemma
Edinburgh Napier University, UK | g.webster@napier.ac.uk

Brazier, David
Edinburgh Napier University, UK | d.brazier@napier.ac.uk

ABSTRACT
A core aspect of the scientific process is the verification of the credibility of findings. In research with a qualitative and mixed methods approach, there is ongoing discussion on the most effective method to validate results. Discussed in this poster is the efficacy of community validation as a novel method to determine trustworthiness of research findings. This involved research with ‘not-yet-participants’ to explore the accuracy of researcher findings from analysis of interview data collected in an earlier exercise from a different, but related, community of informants. The use of community validation here resulted in increased interpretive power of initial results, and of new results to develop understanding of the topic. It is concluded that community validation expands upon current methods of determining trustworthiness in research with a qualitative approach. It is particularly useful for research with participants who are not the population of direct interest, but informants who supply data based on their own observations of the members of the target population, such as Library and Information Science (LIS) practitioners.

KEYWORDS
research methods; validation; qualitative research; library and information science

INTRODUCTION
Validity in research can be understood as a measure of the trustworthiness of reported findings (Candela, 2019). The ways in which validity is determined differ across quantitative, qualitative, and mixed methods research (e.g., Pickard, 2013 p. 20). In qualitative and mixed methods research, there is ongoing debate on the best ways to establish trustworthiness of results (e.g., Morse, 2015). While strategies such as systematic approaches to data collection and analysis (e.g., Patton, 2015), triangulation (e.g., Flick, 2018a), and member checks (e.g., Candela, 2019), are readily deployed, whether such validation techniques adequately address trustworthiness is still questioned. The poster evaluates a novel form of determining trustworthiness for qualitative and mixed methods research with reference to a study into the adoption and use of public library services by forced migrants completed in 2022 (Salzano et al., 2022a; Salzano et al., 2022b; Salzano, 2023 [forthcoming]). This is ‘community validation’—a technique that combines the benefits of two existing approaches: triangulation and member checks.

LITERATURE REVIEW
In a critical analysis of multiple strategies utilized in qualitative research to demonstrate trustworthiness, Morse (2015 p. 1219) concludes that strategies often cited as indicators of validation are not all appropriate for the task. Despite wide use, two common methods—triangulation and member checks—are insufficient (pp. 1215-1216).

Triangulation is the use of multiple methods to explore the same research question to gain a more complete understanding of phenomena (Flick, 2018a). It is frequently used in Library and Information Science (LIS) research (e.g., Rene, 2022). First conceptualized as a distinct method by Denzin in the 1970s (Flick, 2018b p. 444), triangulation is criticized for the implicit assumption that there is a single truth to be uncovered through the implementation of multiple methods (Flick, 2018a). Morse (2015 p. 1216) and Torrance (2012 p. 114) have also identified that the use of multiple methods, or data, to answer a single question may result in conflicting results. In such situations researchers need to decide the allocation of precedence to the research methods deployed. Member checks utilize participant feedback to ensure credibility of researcher conclusions (Thomas, 2017 pp. 23-24). They are often used in LIS research on public library use (e.g. Detlor et al., 2022). Member checks are also criticized as a technique for determining trustworthiness. For example, Hallet (2013 p. 29) notes that they are often conducted without consideration of the theory behind the method. This may result in inaccurate claims of trustworthiness (Hallet, 2013 pp. 33-34). In addition, and as in the case for triangulation, where disagreement is identified, a decision is required on the narrative assigned precedence (Morse, 2015 p. 1216).

The limitations of these methods indicates that they are not entirely fit for purpose and cannot be regarded as equivalent to those for the determination of validity in quantitative research. Indeed, Morse (2015 p. 1220) argues that there is a need for the development of new practices to determine trustworthiness in qualitative research.
METHOD
The community validation method undertaken in this case included components of triangulation and member checks. Three data sets were assembled: 141 government documents that held information on services for forced migrants; and semi-structured interview data from two populations: 30 information gatekeepers for forced migrants and 6 forced migrants. Data collection was conducted sequentially so that members of the forced migrant community could respond to the findings from the gatekeeper interviews about perceptions of adoption and use of public library services by forced migrants. The sequential data collection, and the specific purpose of the second set of interviews, differentiates the community validation method as a validity check. This recruitment of ‘not-yet-participants’ to determine the accuracy of initial researcher conclusions drawn from the analysis of the earlier data set is a novel method of establishing trustworthiness.

A purposive, snowball sampling method was utilized to recruit participants for the community validation exercise. The interview schedule related to themes from findings generated from the gatekeeper interviews. Each theme took the form of a sentence on which forced migrants were asked to reflect. Before sentences were shared with participants, it was explained that they were based on findings from the gatekeeper interviews. Four interviews were conducted via Microsoft Teams, and two in-person. Interviews lasted 17-67 minutes (average 50). The data were manually coded using paper notes and copies of interview transcripts. Inductive thematic analysis (Braun & Clarke, 2013 p. 175) followed. Codes were data-derived to capture participant perspectives (p. 207), with complete coding to allow for deep analysis. Relevance to the confirmed themes of the gatekeeper interviews was important in this coding process. A total of 24 codes generated 21 initial candidate themes, which were further refined to 15.

RESULTS
The analysis demonstrated that the forced migrants had views in line with seven gatekeeper themes, with additional nuance in three cases. This indicated the trustworthiness of the research findings. The additional information provided by participants acted as a form of triangulation and shone additional light on the previously identified themes that would otherwise have been left uncovered. However, for eight themes, the views expressed by the two populations were in opposition to one another. At interview, when participants expressed views that contradicted the gatekeeper themes, they often discussed the reasons for this. In these cases, as the participants undertook additional self-reflection, the interpretive power of the research was increased. Contradictions not only resulted in the identification of differences of opinion between related populations (which is of value to future policy related to the delivery of services for forced migrants), but—as a form of community validation—led directly to the identification of areas of future research that might otherwise not have been revealed.

DISCUSSION
Both triangulation and member checks face criticism as methods for determining the trustworthiness of research findings. This is due to possible discrepancies in results generated through the deployment of different methods, or in opinions of participants and researchers (Morse, 2015 p. 1216; Torrance, 2012 p. 114). The community validation method deployed here uncovered both agreements and disagreements between two participant populations. However, the purpose of community validation in this case was not simply to confirm the accuracy of the findings derived from the analysis of gatekeeper interview data. It was also meant to illuminate areas of disagreement to gain a more nuanced understanding of the multiple contexts at play, a focus that differentiates this particular method from triangulation and member checks. Community validation, therefore, can be considered an expansion of current methods to determine trustworthiness by highlighting both results that are confirmed by participants, and areas that require additional investigation. This establishes credibility through the generation of nuance to initial results. Community validation is a reliable approach since it addresses the criticisms of triangulation and member checks, and enhances the interpretability of research findings. In addition, it is an inclusive method that allows communities that are ‘spoken about’ to contribute their perspectives to the phenomena under investigation.

CONCLUSION
The community validation method combines aspects of triangulation and member checks through the use of not-yet-participants to verify the accuracy of findings. This combination is not found in extant LIS research, nor in the broader qualitative literature, and provides a novel form of credibility to the results. Through the illumination of agreements and disagreements, the method generates deeper understandings of phenomena and identifies topics that need further exploration. In future, researchers should consider the use of community validation for qualitative research, particularly in cases when participants are not the main population of interest, but informants on that population. Community validation may be especially useful for research with practitioners as it allows for inclusivity of the perspectives of the communities that are served by the professional group in question.

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Knowledge Organisation Systems in the Humanities—Semantic Interoperability in Practice

Scharnhorst, Andrea  
DANS-KNAW, The Netherlands | andrea.scharnhorst@dans.knaw.nl

Flohr, Pascal  
DANS-KNAW, The Netherlands | pascal.flohr@dans.knaw.nl

Tykhonov, Vyacheslav  
DANS-KNAW, The Netherlands | vyacheslav.tykhonov@dans.knaw.nl

De Vries, Jerry  
DANS-KNAW, The Netherlands | jerry.de.vries@dans.knaw.nl

Hollander, Hella  
DANS-KNAW, The Netherlands | hella.hollander@dans.knaw.nl

Touber, Jetze  
DANS-KNAW, The Netherlands | jetze.touber@dans.knaw.nl

Hugo, Wim  
DANS-KNAW, The Netherlands | wim.hugo@dans.knaw.nl

Smiraglia, Richard  
IKOS, US | richard.smiraglia@knoworg.org

Le Franc, Yann  
Esciencefactory, France | ylefranc@esciencefactory.com

Siebes, Ronald  
VU Amsterdam, The Netherlands | r.m.siebes@vu.nl

Meijers, Enno  
Royal Library, The Netherlands | Enno.Meijers@KB.nl

ABSTRACT
We observe a growing universe of machine-readable knowledge organisation systems (KOS) or even wider ‘knowledge organisation systems’ or even wider ‘knowledge systems’ or even wider ‘knowledge artefacts’ (from metadata schema to any kind of in-depth indexing) to be published as semantic artifacts, defined as a machine-actionable and -readable formalisation of a conceptualisation, enabling sharing and reuse by humans and machines. These artifacts may have a broad range of formalisation, from loose sets of terms, taxonomies, thesauri to higher-order logics. Moreover, semantic artefacts are serialised using a variety of digital representation formats, e.g., RDF Turtle, and OWL, using XML (RDF) and JSON-LD. The poster reflects how newest research on semantic interoperability informs current practice for research data repositories and registry service providers. We focus on the domain of humanities and cultural heritage, using different examples from Europe and the Netherlands: The European Archaeological Data Infrastructure Ariadne, services of the Dutch Cultural Heritage Network and two Data Stations (for Archaeology and for SSH) hosted at DANS-KNAW. For those cases we report on current efforts to include ‘semantic artifacts’, together with opportunities and challenges. This poster is a practice report combined with an invitation to reflect about the context of semantic interoperability itself.

KEYWORDS
Humanities, Knowledge Organisation Systems (KOS), ontologies, interoperability, data archiving

INTRODUCTION: Knowledge Organisation Systems and Semantic Interoperability
Knowledge Organisation Systems encompass a wide range of tools and approaches to organize information and to structure our thinking (Scharnhorst, Smiraglia 2021), including thesauri, classification schemes and ontologies (Mazzocchi, 2018). With the increasing role of FAIR data (FAIR stands for Findable, Accessible, Interoperable and Reusable) (Wilkinson et al, 2016) and the unbroken thrust of technological innovation, documenting and processing data are lifted to a level where the creation of meaning on an unprecedented scale - aided by machines - seems possible. One key ingredient of such a scaling up is semantic interoperability, defined as “the ability of computer systems to transmit data with unambiguous, shared meaning.” (Corcho et al. 2021). This requires any annotation of data (from metadata schema to any kind of in-depth indexing) to be published as semantic artifacts, defined as a machine-actionable and -readable formalisation of a conceptualisation, enabling sharing and reuse by humans and machines. These artifacts may have a broad range of formalisation, from loose sets of terms, taxonomies, thesauri to higher-order logics. Moreover, semantic artefacts are serialised using a variety of digital representation formats, e.g., RDF Turtle, and OWL, using XML (RDF) and JSON-LD.” (Le Franc et al., 2022). Currently, we see a wealth of research on semantic interoperability, on its introduction into the research landscape through best practices and principles, and on its governance in networks of distributed service providers to ensure sustainability (see for one example Corcho et al. 2023). We further zoom into the domain of Humanities, with an emphasis on Humanities and Cultural Heritage data.

USE CASE: Specificity of the domain of cultural heritage and humanities research
Interestingly, disciplines of humanities (and even Social Science and Humanities, SSH) are often addressed as one large domain. That may be due to the modest amount, both of researchers and of funding available in those disciplines. But regarding epistemic diversity, the fields in which SSH researchers work are as differentiated as comparable fields in Sciences, Technology, Engineering and Medicine (STEM). When it comes to data, each of the many (digital) humanities fields has special requirements for information. In short, by no means are SSH data on cultural phenomena less complex than data on natural phenomena. The trade-off between standardization and specificity is felt especially acutely in the Humanities. Where many researchers shy away from the concept of datafication in the first place, the relevance of shared conceptual standards is quite contested. However, the need for data-centric research is growing. In spite of the fact that the data of the SSH could be described as part of the ‘long tail of data’, with a large number of relatively small collections rather than a few large data flagships, the volume of the data is significantly growing. Increasing variation in data formats and structures, and harmonisation and...
standardisation are occurring simultaneously. An example for the latter, is the semantic representation of cultural heritage data as standardized in CIDOC CRM, an ontology to describe, connect and integrate concepts. Still, researchers use widely varying metadata schemas, vocabularies and thesauri which are often not even accessible to other humans let alone machine-readable, so that in practice the data is interoperable only with extensive mapping exercises. The situation is exacerbated by the lack of definition of essential variables, which drives semantic data interoperability in several other domains (Reyers et al. 2017; Magagna et al. 2022).

APPROACHES: Technological possibilities and challenges

In the following, we will briefly present some examples of the recent achievements in data harmonisation and FAIRification in the domain of humanities and cultural heritage data in the Netherlands. We describe the emergence of platforms for a specific domain (ARIADNE in Archaeology), across Cultural Heritage providers (Dutch Digital Heritage Network), and for a research data archive (DANS Data stations). At the end, we point to technological principles which enable further interoperability in all those cases.

The ARIADNEplus portal (https://portal.ariadne-infrastructure.eu/) provides access to almost 4 million archaeological data sources. In order to address the complexity of archaeological data integration, ARIADNE used CIDOC CRM as the backbone of its data model. Datasets of project partners coming from different European countries were mapped to this model and enriched with dating information via PeriodO and subject terms via the Getty AAT thesaurus. Partners needed to map from their local terms and thesauri first. Each dataset was then mapped and transformed as Linked Open Data and included in the ARIADNEplus Knowledge Base (Bardi et al., 2023). GraphDB (https://ariadne.d4science.org/web/ariadneplus_lab/) allows researchers to explore this Knowledge Base with an interface or through queries. The Dutch Digital Heritage Network defines itself as a network of networks with the ambition to enable public access to digitised cultural heritage. One of its main platforms is a registry of cultural heritage data collections (see https://datasetregister.netwerkdigitaal erfgoed.nl/faq-beheerders.php?lang=en). This is built on Linked Data principles and connects to Dublin Core (DC), the Europeana Data Model (EDM), and schema.org. At its heart there is a ‘network of terms’ to which content providers can equally contribute, and which is published and made accessible through an API (Van Muijden, 2023).

The DANS Data Station is a domain-specific trusted digital repository for research data serving the needs of specific scientific communities. For example, archaeological data can be deposited in the Data Station Archaeology and historical data in the Data Station Social Sciences and Humanities (SSH). Data is archived for the long-term and is made available for reuse. The DANS Data Stations use the Dataverse platform [dataverse.org]. Metadata of the datasets can be exported in different formats, such as Dublin Core, DDI (Data Documentation Initiative https://ddialliance.org/learn/what-is-ddi), DataCite, JSON and Schema.org. The Data Station Archaeology allows linking of five parts of the Dutch national cultural heritage thesaurus (the ABR + thesaurus): Temporal, Subject, Artefact, Methods of Recovery and Report (ABR stands for Archeology Basis Registry, and belongs to Dutch standards in the field of archeology. About its integration into another mentioned service see here: https://netwerkdigitaal erfgoed.nl/nieuws/termennetwerk-uitgebreid-met-het-archeologisch-basisregister/). This extension results in enrichment of the metadata and search options. The generic metadata fields in the SSH Data Station are almost identical to those used in the Data Station Archaeology, and are based on Dublin Core. As in the Data Station Archaeology, the Data Station SSH provides additional, domain-specific metadata fields and vocabularies. Currently these are DDI and CESSDA’s ELSST, which are heavily tilted towards the Social Sciences (CESSDA is a European Research Infrastructure Consortium in the Social Sciences, and ELSST stands for European Language Social Science Thesaurus, a KOS service provided by CESSDA - https://elsst.cessda.eu). One challenge is to determine which metadata schemas and controlled vocabularies (e.g., the mapping to Getty’s AAT) are broadly usable for the methodologically more fragmented Humanities. Controlled vocabularies are accessed through SKOSMOS, where they can be maintained and updated without loss of information or broken links in the metadata of data deposits.

For all of the above cases, there exist technological achievements which
- crosswalks across schemes using SKOSMOS: Skosmos protocol for the Netwerk Digitaal Erfgoed and the distributed registry of controlled vocabularies and interfaces for querying distributed terminology sources (https://github.com/Dans-labs/semantic-enrichment), and
- the creation of indexing on the fly: development of an annotation pipeline with the AI/ML SpaCy framework, and use of the pipeline within different projects and in multilingual settings to train different Machine Learning models (https://github.com/Dans-labs/spacy-dans).
CONCLUSION: Implementing semantic interoperability

This paper reports concrete examples of how to enhance semantic interoperability in the domain of humanities and cultural heritage data. Although all different, the examples show the importance of the reuse of generic standards. But, each of them also comes with specific vocabularies, or serves communities which use specific KOS. The creation of specific KOS is intrinsically connected to the innovativeness of new systems of thought in research and inherently non-interoperable. For service providers supporting humanities research and providing access to cultural heritage data the challenge lies in a balance between accommodating specific communities and their needs and fostering data exchange across communities. Part of this balance is realized via an emerging network of connected services. This problem is actually shared by all knowledge domains, and not specific to the humanities. What is needed to further foster the implementation of semantic interoperability is to explicitly discuss the context in which it is introduced, including its main target (findability, accessibility, or re-use), its function for research and beyond, and levels of maturity and sustainability when it comes to new technological solutions.

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Knowledge Work Activities of a Systematic Review Task

Segura-Rodas, Stephanie  
The University of Sheffield, UK | scsegurarodas1@sheffield.ac.uk
Griffin, Martyn  
The University of Sheffield, UK | m.a.griffin@sheffield.ac.uk
Simpson, Andrew  
The University of Sheffield, UK | andrew.simpson@sheffield.ac.uk
Toms, Elaine  
The University of Sheffield, UK | e.toms@sheffield.ac.uk

ABSTRACT
Most workers' activities in the workplace can be classed as knowledge work (KW). Previous research has described workers' tasks very broadly, making it difficult to know the actual work. We hypothesise that deconstructing what goes on inside a task could reveal many subtasks and activities at levels that are, as yet, unexamined and in need of deeper understanding. To explore this further, a data set collected from research fellows who described a specific task was examined. The task was broken down into many subtasks and activities, showing that one single task contains many levels of tasks. This understanding may allow for the development of tools to support the worker.

KEYWORDS
Task analysis, knowledge work, systematic review

INTRODUCTION
Most knowledge workers develop multiple and intertwined tasks and activities during their job process. For instance, a researcher who writes research proposals could also make calls, send emails, schedule meetings, read journals, etc. While the development of the work is mostly done with the help of an information system, it is difficult to know what tasks are performed to complete the job. We might be able to get the worker's interactions with the system, but are we considering all the activities aimed at achieving a work goal? This paper examines a single task to identify its subtasks and activities and the specific processes that occur within them. A typical KW task, in this case, a systematic review that usually has four main activities, may contain more activities and actions that until now were not explored. Extracting these could increase our understanding of what knowledge workers do and hence how they can be supported.

LITERATURE REVIEW
What does Knowledge Worker mean to workplaces?
Knowledge work entails objects of work requiring knowledge as an essential ingredient of its output (Iivari & Linger, 2000). Thus, Knowledge workers' activities could be characterised as tasks that use data, information to develop products and services (Acsente, 2010; Reich, 1991). The developments in computing technologies have further advanced knowledge and skill-intensive work (Felten et al., 2021; Zuboff, 1998), which makes Knowledge workers represent the organisation's main assets (Khaksar et al., 2023).

What do we understand about a task?
Sometimes a task is explained by description (Byström & Hansen, 2005), behavioural actions (Gwizdka & Spence, 2006) or workflow involving a process and sequence of steps to complete the task (Al-Hakim, 2008; Krovi et al., 2003; Nissen, 2002). Studies have categorised tasks as discussion and problem-solving (Hackman, 1969), decision-making, judgment, problems (Campbell, 1988), production, discussion and problem-solving(Gersick & Hackman, 1990), instructional, constraints-based (Vicente, 1999), managing, advising, negotiation and problem-solving (Wildman et al., 2011), and intellectual and social (Fernández-Macias & Bisello, 2022). These representations provide many ways of examining or describing tasks but rarely identify each task's key goal or activities.

What do we understand by a systematic review task?
A systematic review (SR) commonly follows a standard procedure involving searching, selecting and identifying studies (Rethlefsen et al., 2021). Even though most SRs follow guidelines such as Prisma (Moher et al., 2009), the literature differs about the number of tasks required to complete an SR task. Cooper (1988) indicates there are six, while Kelly & Sugimoto (2013) says five and Moher et al., (2009) mention four tasks. The four tasks of identification, screening, eligibility and inclusion (Moher et al., 2009) are presented as broad descriptions that do not provide details of the activities contained within these tasks.

Without a complete understanding of work, that is, knowing the tasks and activities a worker does for an assigned job, information systems cannot be appropriately created to tackle the work demand. Describing a task in sufficient detail could help identify potentially engineerable processes. This research focuses on this research question: What tasks do knowledge workers do to accomplish a determined task?

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METHOD
Fifteen researcher fellows agreed to participate in this research. They are part of the National Institute for Health and Care Research (NIHR) group. In semi-structured interviews, participants were asked to recall and describe a task in detail. The interviews took 29 to 60 minutes. All were recorded and transcribed. Five task features discovered in a previously unpublished systematic review were employed to identify the tasks. These are: a task has a goal and a process, has a beginning and end, uses resources, can be assigned or self-generated and has constraints. These were coded in a spreadsheet. For each participant’s answer, a code was assigned. Qualitative task analyses (Saunders et al., 2019) were employed to identify the procedures and steps to complete each task, resulting in a workflow map. The examination consisted of identifying activities that follow from one to another, which results in various sublevels of subtasks or activities. Thus, the identified subtasks or activities were written in columns indicating from left to right the process.

FINDING AND DISCUSSION
Five participants identified a specific task, screening papers, which is one of the main tasks of a Systematic Review as identified above by Moher et al., (2009). Using experience and knowledge, participants identified the steps and process of the task's development, resulting in multiple and different tasks and activity levels. Most subtasks were broken down into multiple activities, some executed in parallel or sequences, and these generate a document, e.g. a report or briefing note as the outcome, which depends on what triggered the task and the receiver of the document.

Two typical subtasks were found: Searching for information to find unknown words while a participant reads abstracts and titles. To illustrate, one participant said it: "if there's some clinical terms that I'm not sure of, the first thing I do is Google them to see if actually there's a simple explanation or something that will demystify it a little bit". Moreover, the Searching for information to find papers that meet the eligibility criteria, as one participant said: "So we go back to the literature and do a targeted search to see if there are other studies out there that have related quality of life information". Another subtask was Reporting results, which is found at the end of any subtask. One participant commented: "In a report put whether yes or no the study is included ". The common subtask, cross-reference, was the most executed to check participants' choices on their selected articles for further examination. This single subtask was broken down into five levels, which may be fundamental tasks; these include retrieving the list of selected papers, arranging meetings, making decisions about the selection of paper, discussing discrepancies if there are any conflicts and consulting with an expert.

The literature has shown that a systematic review could consist of six (Cooper, 1988), five (Kelly & Sugimoto, 2013) or even four major tasks (Moher et al., 2009). These fail to indicate the activities involved in each main task. To illustrate, Moher et al.,(2009) indicate that the study selection part consists of the process of screening and eligibility but does not mention the activities involved. Our findings indicate that participants' study selection or screening tasks involve reading and analysing, searching, distributing work, setting up their tools, cross-referencing and discussing their disagreements before making a final decision about a paper.

We can see that what is presented in the literature as a single knowledge work task, screening, can be broken down into various levels of subtasks, some of which may be fundamental being present in more than one subtask. We note that although different tasks taxonomies were proposed for teams (Wildman et al., 2011) or assessing tasks which could be undertaken by new technologies (Fernández-Macias & Bisello, 2022), none of them clearly describe or mention what activities or subtasks are involved in these tasks. Our findings suggest that the screening task involves seven activities or subtasks before making a final decision about a paper. Understanding how tasks could be deconstructed on different levels by focusing on the task goal would be essential to understand what is inside the knowledge worker tasks and therefore we can get a better idea of what is needed to support those tasks.

CONCLUSIONS
Previous research has broadly conceptualised the main tasks of a systematic review, but none gives sufficient details about their activities. Our research shows that inside those tasks exists a plethora of activities on a different level resulting from workers' knowledge. Understanding how knowledge work is done, including its objective, the processes that needs to be undertaken, its constraints and its outcome, will help identify what is happening at work and could increase efficiency over time as technologies are developed to support these activities. This could have the benefit of increasing the productivity of these knowledge workers.

This research aims to explain how a main task could have various activities and break down multiple levels. Previous research has shown that tasks are mainly grouped or categorised broadly and specific activities are not given. Understating what is involved in a task could lead to the development of appropriate information systems to support the job. Our findings show that a task can be deconstructed into five levels and executed in parallel or sequences rather than the generic task typologies of previous research. Further work is needed to obtain information on what knowledge workers do on each of the systematic review's main tasks and identify the fundamental tasks that might be applicable across multiple KW domains.
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Putting the User in the Loop: Developing a Research Infrastructure for Social Sciences and Humanities Research

Sendra, Anna  
Tampere University, Finland  |  anna.sendratoset@tuni.fi
Late, Elina  
Tampere University, Finland  |  elina.late@tuni.fi
Kumpulainen, Sanna  
Tampere University, Finland  |  sanna.kumpulainen@tuni.fi

ABSTRACT
The development of research infrastructures (RIs) for social sciences and humanities (SSH) research is still incipient. Few of the existing facilities face several challenges that complicate researchers’ interactions with RIs and its digital tools and materials. This study explores the creation of an information service for conducting data-intensive SSH research by placing the end-user at the center. Particularly, the study investigated what factors affect the development of the RI and if this process is integrating all the information needs of end-users, putting a special focus on how these facilities should be evaluated. A qualitative analysis of 13 semi-structured interviews with SSH scholars and computer/data scientists revealed three themes: developing a RI, needs and expectations of the RI, relationship with user feedback and user interactions. Based on our findings, we were able to raise several design implications to create more successful and sustainable information services for supporting SSH research processes.

KEYWORDS
social sciences; humanities; research infrastructure; information need; information behavior

INTRODUCTION
Digital humanities (DH) and computational social sciences (CSS) are fields of study that approach social sciences and humanities (SSH) research through using digital tools and materials (Nelimarkka, 2023; Salmi, 2021). Thanks to these resources, scholars nowadays can conduct SSH research more efficiently (Nelimarkka, 2023). At the same time, when brought together, these digital tools and materials can form a research infrastructure (RI). The problem remains that the creation of these facilities is still too centered on its technological aspects (Late and Kumpulainen, 2022). Understanding the information needs (Wilson, 1981) of the people who will use the resources of these RIs will allow to create more structured and sustainable information services (Late and Kumpulainen, 2022).

To fully support research processes, there is a need to set the aims of these RIs and the criteria that determine its success. The extent to which this kind of facility reaches its goals also needs rigorous investigation. In this research, we examine what the researchers expect a RI for the DH and CSS offers, particularly in terms of digital tools and materials, and to which direction they wish it will be steered. Moreover, we explore the role of user feedback and user interactions in the development of these information services. Specifically, the study raises the following research questions (RQs): What elements impact the development of a RI for the DH and CSS? (RQ1); Are there any common information needs within the users of the RI? (RQ2); How should the RI be evaluated? (RQ3).

RESEARCH SETTING
The case study examined is DARIAH-FI, the Finnish RI for the DH and CSS. Our work within the facility consists of generating opportunities for exchanging ideas on the information needs of different end-users regarding the RI, thus revealing the critical development points for successfully creating the information service. A first step towards revealing these critical development points involved conducting semi-structured interviews with service developers, including both SSH scholars and computer/data scientists. A total of 13 semi-structured interviews were conducted via Microsoft Teams between 7–27 September 2022. Informed consent was obtained from all participants. An interview guide developed by the research team was used to support the interviews. The interviews were video recorded and lasted approximately from 40 to 100 minutes. A professional service transcribed verbatim the video recordings into 13 files, which were later cross checked by the research team for consistency. The transcripts were also pseudonymized to protect the privacy and confidentiality of the participants. Data collected was analyzed through an inductive (reflexive) thematic analysis following the steps explained by Braun and Clarke (2006, 2021).

FINDINGS
The inductive (reflexive) thematic analysis revealed a total of 3 themes and 16 sub-themes (Figure 1). The themes include developing a RI (i.e., elements that impact the development of the facility); needs and expectations of the RI (i.e., expectations regarding the information service and the main needs to achieve the development goals); and relationship with user feedback and user interactions (i.e., the role of feedback and interactions in the development of the solutions). Each of the subthemes is supported by 8-10 extracts from the interviews.
With respect to RQ1, findings mainly revolve around the long-term maintainability of the facility. While the creation of the RI is still in progress, many participants showed concern in relation to what will happen to the information service once the current funding period of the RI is over, both at the technical and the non-technical level. Regarding RQ2, findings are mostly focused on the question of support. While the concept of RI has many definitions (Caliari et al., 2020), it is often the case that these facilities are only described in relation to the digital materials and tools they provide (e.g., see Kaltenbrunner, 2017). Instead, our results show that a RI is something more than a place to find these solutions. Many participants, particularly those with a non-technical profile, expect that the information service will also provide resources to help them use the solutions being developed and find potential collaborators for their research projects. Concerning RQ3, findings mainly revolve around the concept of uncertainty. While understanding the information behaviors is a key aspect for participants both at the technical and the non-technical level, most WPs do not have plans to involve the end-users during the development of the facility.

**DISCUSSION**

Overall, results confirm that developing a RI for the DH and CSS is a complex task (Craig, 2015; Foka et al., 2018) that is depending on a lot of intertwined factors. While some information needs remain the same, such as the necessity of developing user-friendly and flexible resources (Bermúdez-Sabel et al., 2022; Waters, 2022), new requirements that consider the academic differences between SSH scholars and computer/data scientists are also recognized. Consequently, the (common) critical development points to push the development of the facility further that better meet the information needs of its end-users are identified (e.g., expansion of educational materials).

Likewise, recommendations of what means to be a good RI for the DH and CSS can be summarized in four points. First, a good RI for the DH and CSS one that considers all types of end-users, no matter their background or expertise. This condition applies not only in relation to the usability of the information service, but also in terms of its development, where all perspectives need to be contemplated since early creation stages. Second, a good RI for the DH and CSS is one that is accessible. Along with maintainability, findings highlight this requirement as one of the most important for this kind of facility. This result reflects that of Matres et al. (2018, p. 40), who found that the DH community in Finland “considered better accessibility to resources the most important requirement for doing research in the digital age”. Third, a good RI for the DH and CSS is one that provides regular support to its community. According to our findings, this support is expected in various forms (e.g., guidance, documentation). Fourth, a good RI for the DH and CSS is one that promotes collaboration between the stakeholders of the RI, especially in terms of finding partners and ideas for conducting DH and CSS research. Fostering this type of alliances from the information service could be a way of lowering the barrier for those who remain uncertain about the use of computational approaches in the fields of SSH (Craig, 2015; Matres et al., 2018).

**CONCLUSION**

This research has explored the problem space (Sharp et al., 2019) related to the design of a RI for the DH and CSS from a new approach. Unlike most previous research in these disciplines (Oberbichler et al., 2022), the discussion involved stakeholders with technical and non-technical backgrounds. This allowed us to highlight from early stages the (common) critical development points for reducing the uncertainty that usually surrounds the creation of these facilities (Matres et al., 2018) and developing the RI in the most successful way possible. However, many of these information needs have been recurrently identified over time (Star and Ruhleder, 1994), problematic that may respond to the fact that the focus is usually placed on technical concerns without considering the distinct scholarly practices between SSH scholars and computer/data scientists. Likewise, some of these requirements (e.g., the ones related to RI evaluation) will not be achieved unless the information service receives continuous funding, something that is not always the case in RIs (Buddenbohm et al., 2017).

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How Do Open Patents Affect Follow-On Innovation? Evidence from Tesla

Shi, Jing  
School of Information Management, Nanjing University, China | shijing11@smail.nju.edu.cn
Kang, Lele  
School of Information Management, Nanjing University, China | lelekang@nju.edu.cn
Chen, Ye  
School of Information Management, Nanjing University, China | chenyeye@nju.edu.cn
Sun, Jianjun  
School of Information Management, Nanjing University, China | sjj@nju.edu.cn

ABSTRACT
In the past, high-tech enterprises aimed to apply for patents to protect their innovation and obtain a competitive advantage. However, Open Innovation models encourage enterprises to open and exchange knowledge to accelerate technology development because of higher innovation complexity. Nonetheless, the impacts of open knowledge on follow-on innovation are unclear. Tesla’s patent openness event provides a better opportunity to observe a causal relationship between open knowledge and follow-on innovation as it is an exogenous shock for the whole Electric Vehicle (EV) field. Against this backdrop, this poster uses patent data of Tesla and EVs before and after the open-patent events from Derwent Innovations Index (DII) between 2003 and 2020. The difference-in-difference regression results show that patent openness has an inhibition effect on follow-on patents and patentees and the high-value open patents will strengthen this inhibition effect. Surprisingly, once technologies were shocked by openness, more open patents would stimulate them to boost in the future.

KEYWORDS
Open innovation; EV technology; Patents analysis

INTRODUCTION
The patent system protects inventors at the expense of hindering technological development by excluding others from granted inventions. Patent policy traditionally aims to balance the benefits and costs as a trade-off in the innovation ecosystem (Nordhaus, 1969). However, the Open Innovation theory proposes organizations should leverage both internal and external knowledge to create and profit in intense market competition (Chesbrough, 2003). Intense marketing competition forces high-tech enterprises to exploit their knowledge resource by transferring intellectual property to external actors, called outbound OI strategy (Chesbrough, 2007, 2003). In 2014, Tesla opened all patents to the public which is a shock for the EV market and triggered a series of reactions. Tesla’s patents openness strategy supports strengthening its technological capabilities, improving cooperative modes, and cultivating competitive advantage of itself (Moritz, et al., 2015; Alexy et al., 2018; Wang et al., 2021).

However, it is inconclusive how patent openness influences the follow-on innovation of relevant technologies. Sampat et, al. found that gene patents had no quantitatively important effect on follow-on scientific research and product development using patent applications submitted to the US Patent and Trademark Office (Sampat et al., 2019). Alberto concluded that patent rights blocked downstream innovation in computers, electronics, and medical instruments, but not in drugs, chemicals, or mechanical technologies by patent citations (Alberto and Mark, 2015). Prior studies focus on the success or unsucuss of patent protection which is mainly a passive judgment from examiners. But patent openness is an active strategy by technology actors. On the other hand, the impacts of patent openness should be multi-dimensions and multi-levels in the whole field, while previous studies observed them indiscriminately. Complementing this debate on patent openness and follow-on innovation, this poster investigates a famous case, Tesla’s patent openness, through which we can evaluate how patent openness influences follow-on innovation.

STUDY DESIGN
Data collection
In this study, we used a 17-year panel of patents data of Electric Vehicle (EV) spanning the years 2003 and 2019 from DII. This panel data yields sufficient observations of years before and after Tesla’s patents openness event in 2014 since Tesla founded in 2003. Firstly, we searched patents using search strategy from Borgstedt et al. (2017) which has been applied widely in various studies (Aaldering et al., 2019; Yuan & Li, 2020; Yuan & Cai, 2021). Secondly, company names are extracted using “Standard Codes” of patentees in DII which assigns the same 4-digit codes to parent and subsidiary companies. And we identified Tesla’s patents using “TESL”. Finally, the dataset is 122,355 patents in EV field and 868 of them are Tesla’s patents.

Variables measurement
The main independent variable is whether technologies were shocked by open patents or not. We aggregate all patents into 474 technologies (using 4-digit IPC), and technologies including Tesla’s patents were set as 1, otherwise 0. That is to say, those technology categories same as Tesla’s open patents were shocked and others didn’t. Finally,
181 technologies went through the openness shock and 293 didn’t. We measure the dependent variables, and impacts on follow-on innovation, from two facets: Patent quantity and Patentee quantity. Patent quantity is the number of patents application of focus technologies in focus year and Patentee quantity is the number of patentees of focus IPC_4 in focus year. Open patents quantity is the number of Tesla’s open patents of focus technologies. Open patents quality is the number of PCT (Paten Cooperation Treaty) patents applications in the focus IPC category. Technological field (Tech_field) and application year (Appln_year) are included as control variables.

**Regression model**

To observe the net effect of patent openness, we use the patent openness event of Tesla in 2014 as a natural experiment to compare the follow-on innovation evolution between open and non-open patents before and after the opening shock by using a time-varying Difference-in-Differences model. The regression model can be written:

\[ Y = \alpha + b_1 S + b_2 P + b_{int}(S \cdot P) + b_3 C_1 + \cdots + b_d C_d + \varepsilon \]

where \( Y \) is the follow-on patents quantity and patentee quantity; \( S \) is a technology dummy variable coded 1 for the treatment technologies and 0 otherwise; \( P \) is a year dummy variable equal to 1 if in the post-openness period and 0 if in pre-openness. \( S \cdot P \) is an interaction term between technology and year dummy variables. \( C_1 \) through \( C_d \) are control variables and \( \varepsilon \) is the error term.

**FINDINGS**

Table 1 shows the regression results of the impact of open patents on follow-on innovation. The coefficients suggest that, under the effect of openness, the follow-on innovation of affected technologies decreases by 53.7% in patents application and 58.7% in patentees. The significant inhibit effects are stronger on patentees than on patents. Considering those affected technologies, more patents are opened, and more follow-on patents and patentees occur. That means that, once technologies were shocked by openness, more open patents would stimulate them to boost instead of inhibition. While the influence of open patents quality is opposite with quantity, higher-value patents are opened, and less follow-on innovation occurs. The inhibition effect of openness is strengthened by open patent quality. However, both the stimulating effect of open patents quantity and the inhibition effect of open patents quality are stronger on follow-on patents than follow-on patentees.

![Table 1. Difference-in-Differences Estimates](image)

**CONCLUSION**

This poster used Tesla’s case to analyze the incidence of patent openness on follow-on innovation. We search Tesla’s and EV patents data from DII from 2003 to 2020 to estimate the net causal effect. Our results confirm the view that open resource has complex impacts on follow-on innovation. On one hand, patent openness inhibits follow-on innovation including innovation productivity and actors. On the other hand, if technologies have been influenced by openness, the more open patents the more follow-on productivity and actors. Thus, the open strategy might be an opportunity for emerging technologies in a niche market.

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Analysis of UK Science Data Ethics Policy: Structure, Content and Governance Network

Si, Li  
School of Information Management and Centre for Studies of Information Resources, Wuhan University, China | lsi@whu.edu.cn

Liu, Xianrui  
School of Information Management, Wuhan University, China | darui552@whu.edu.cn

ABSTRACT
This study uses the UK as an example to explore the structure, content and governance network of scientific data ethics policies. Adopting grounded theory (GT) and Social Network Analysis (SNA), Nvivo12 is used to analyze and summarize the structure and content of scientific data ethics policy, and Ucinet and Netdraw are used to map governance network reflected in policy. Results indicate that the structure covers governance context, subject and measure. The content of governance context contains context description and data ethics issues analysis. Governance subject consists of defining subjects and facilitating their collaboration. Governance measure includes governance guidance and ethics governance initiatives in the data lifecycle. Governance network indicates that research institution plays a central role in ethics governance and the core of the governance content are ethics governance initiatives and governance guidance.

KEYWORDS
Scientific data ethics; Data ethics; Data governance; Research ethics; Ethics governance

INTRODUCTION
Scientific data refers to the data generated through basic research, applied research, experimental development, etc. (General Office of the State Council of China, 2018). Scientific data ethics governance is implemented to regulate data storing, repurposing and harvesting (Clark et al., 2019). It is a branch of ethics that evaluates data practices with the potential to adversely impact on people and society – in data collection, sharing and use (Open Data Institute, 2020). Policies and documents are issued to promote data ethics governance, such as Statement on COVID-19: ethical considerations from a global perspective, Data Ethics Framework, etc. However, research shows that the lack of common rules and standards among different governance subjects hinders cross-institutional and interdisciplinary research regulation (Favaretto et al., 2020). A common policy standard or model needs to be constructed (Gold and Krinke, 2022). Therefore, this study explores the structure, content and governance network of UK policy, which can inform the standardization of policies.

RESEARCH METHOD
The research process mainly involves data collection, analysis and theory construction (see Figure 1). GT is adopted to summarize the structure and content of the UK scientific data ethics policy. Based on proceduralised grounded theory (Corbin& Strauss, 2008), this study uses Nvivo12 to analyze text through open, axial, and selective coding. The coding process is dynamic and iterative, involving constant discussion and comparison. 8 samples (T07, F09, F20, R7, R18, L12, G02 and D02) are randomly selected for theoretical saturation test, and no new concepts or categories are found. Based on coding results SNA are conducted by using Ucinet and Netdraw to map governance network in policy.

UK was chosen because of its relatively comprehensive data governance system and valuing data ethics (The Royal Society, 2020). Policy in this study includes scientific data governance policies, documents, guidelines and reports published by stakeholders. These stakeholders are government, university, research institution, funding agency, publisher, database, library, and other third-party organization. In order to ensure the relevance, representativity, reliability, authority and accessibility of samples, when identifying institutions, indicators containing institutional reputation, recognition, policy accessibility, and policy relevance were combined to screen out organizations who publish ethics policies. In the end, 78 policies were obtained (last updated at 24 February 2023). These samples distribute between 2003 and 2023. 64% of them were published between 2018 and 2023, 19% of them were published before 2018, and 17% of samples did not indicate the publication date (see Appendix A).
RESULTS
The policy structure covers scientific data ethics governance context, subject and measure (see Figure 2). Governance context includes governance context description and data ethics issues analysis. Governance context consists of applicable subject, applicable field, concept definition and related policies. Related policies are invoked in policies to support regulations on data privacy, data ownership, informed consent, data copyright, etc. Data ethics issues analysis contains the dilemma of data ethics governance so as to propose corresponding measures. Governance subject includes defining subjects and facilitating collaboration. Governance subjects are defined as the competent authority, sub-department and supporting cooperator. Collaboration can be facilitated by identifying partners, reaching governance consensus, creating communication channels and so on. Data governance measure includes governance guidance and ethics governance initiatives in the data lifecycle. The guidance consists of governance aims, principles, FAQs (frequently asked questions) and reference resources. Governance initiatives cover the whole data lifecycle during research, from planning and designing to reusing and citing (JISC, 2021).

Based on the coding results, the governance network was mapped using Ucinet and Netdraw. In Figure 3, Square nodes represent the governance subject, triangular nodes represent policy content, and the number represents coded references (number of times this content appears in the policy), with more references indicating that the subject attaches more importance to this content, e.g., the content of the applicable field has 12 references in funding agency’s policy. Overall, research institution plays a central governance role (806), followed by third-party organization (475), funding agency (339) and library (331). The core of governance content in policy is governance initiatives in data lifecycle (919) and governance guidance (528).

CONCLUSION
This study reveals the typical structure, content and governance network of scientific data ethics policy, and serves as a reference for formulating policy in terms of standard framework, core content and multi-subject governance role allocation. Results indicate that the UK does have a relatively comprehensive governance system, but its governance measures are mostly instructive and lack mandatory, particularly in penalties. The structure and content of policy should revolve around ethics governance context assessment, ethics governance subject identification and ethics governance measure formulation. Ethics governance should take research institution as the central role, with a focus on ethical risk prevention in the planning and design phase of research project and governance context description.

This research advances previous studies in 3 aspects. First, policies are used as samples to draw conclusions from an integrative perspective consisting of theory (Hadziselimovic et al., 2017; Paxton, 2020) and practice (Franzke et al., 2021). Second, this study conforms and completes the content of scientific data ethics governance, which is in line with the existing data governance model (Lee, 2014; Jia, 2020). Third, the inclusion of multi-subject and cross-sectoral cooperation in governance in this research is in line with the trend of collaborative data governance (Abraham et al., 2019; Stewart& Lyons, 2021). This study elaborates on refined collaboration measures, governance role, and focus of each subject through constructing governance network in policy. This can be a supplementary to data ethics collaborative governance theory. This study also has limitations. UK policies are used as the sample to draw conclusions that may not have global applicability. The structure and content of policies need to be improved and comply with national context, disciplinary requirements and research paradigm. In the future, policies, theories and practical cases of multiple countries should be compared to explore effective strategies for improving scientific data ethics governance capacity.
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Public Library Innovation Inside Out

Sinn, Donghee  
University at Albany, USA | dsinn@albany.edu

Kim, Sujin  
University of Kentucky, USA | sujinkim@uky.edu

Syn, Sue Yeon  
Catholic University of America, USA | syn@cua.edu

ABSTRACT
This poster presents public library innovations during the Covid-19 pandemic. Many public libraries quickly adapted to the pandemic environment, changing and improving their operations and services to meet the new challenges and demands from their users. We collected two datasets to investigate these innovations: the first dataset comprised 751 tweets from the 12 largest public libraries in the U.S., and the second dataset included 72 articles from 3 major professional magazines. These datasets were analyzed to identify innovative services provided between 2020 and 2021. A rigorous content analysis involving multiple coders was conducted. The findings from both datasets highlight that public libraries quickly changed their service delivery modes and implemented diverse innovative services to bridge the digital divide, support health and technology literacy, and help with unemployment and career development. Libraries made efforts to reach out to their communities during lockdowns and also served as community education centers during difficult times, combating with misinformation and focusing on assisting marginalized populations. Additionally, the magazine articles introduced innovative services that pertained not only to user services but also to internal operations within public libraries.

KEYWORDS
Public libraries, Innovation, Covid-19, Twitter Messages, Professional Magazine Articles, Content Analysis

INTRODUCTION
During the Covid-19 pandemic, public libraries have actively engaged in innovative services to cater to diverse needs of patrons, making valuable contributions to their communities. To investigate public library innovations, we collected two distinct datasets. The first from Twitter messages from large U.S. public libraries (Syn et al., 2023) which provide insights into promotional aspects of library innovations. However, it does not offer information on libraries’ internal implementation. The other dataset is from three professional magazines targeting public librarians, offering a comprehensive understanding of innovations in libraries of various sizes. This study aims to present a holistic view of public library innovations from these two datasets during the early stage of the pandemic, identifying specific innovative services and programs.

LITERATURE REVIEW
Innovation & the Covid-19 Pandemic: During the Covid-19 pandemic, public libraries enhanced innovation in their operations to provide essential services. They implemented remote work arrangements, digital collaboration tools, and virtual meetings (Azizi et al., 2021). Leveraging technology, libraries maintained administrative functions like cataloging and interlibrary loans (Alajmi et al., 2021; Koulouris, 2020), and introduced innovative approaches for managing physical collections, including contactless pick-up services and enhanced sanitization protocols (Nageswari et al., 2021; McMenemy, 2023). Libraries offered virtual learning resources, workshops, and e-learning materials (Cone et al., 2022). Collaborations with external organizations ensured equitable access to resources and bridged the digital divide (Eruchalu, 2020; Wilson, 2021). Public libraries also promoted community engagement through expanded digital collections and virtual events (Cleave et al., 2020; Morse, 2020). These efforts fostered social connections and enriched the lives of library users (Lu et al., 2023; Lukovska, 2021; Aleksandra, 2021).

Multiple Datasets for Content Analysis: During the Covid-19 pandemic, Twitter has been widely utilized to analyze real-time trends in public library services, including user services, internal operations, and community engagement (Rufai et al., 2020; Dadhe et al., 2020; Choi & Kim, 2021). Library websites have also been widely used to understand Covid-19-related library services (Majhi, 2020). Additionally, professional magazines provide a broader perspective and in-depth analysis, specifically focusing on internal library operations and human resource management, capturing the needs of public library professionals (Ladan, 2022). In fact, professional journals have covered a wide range of topics related to libraries and their response to the pandemic. Thus, content analysis of magazines will be an effective approach for understanding Covid-19-related innovative services in public libraries.

METHODOLOGY
We defined innovation in a broad sense to include any actions that libraries have taken to improve the quality of services (Wójcik, 2019) as well as any efforts to address the challenges due to COVID-19. Under this definition, we included services and approaches that are novel as well as repurposed or newly emphasized during the pandemic. Twitter messages: The Twitter data were collected from 12 largest public libraries in the U.S. during two time periods: April 1 to 14, 2020 and September 1 to 14 in 2021. Top 12 largest libraries were selected from library statistics that ALA published in 2019 (ALA, 2019). All 12 libraries used Twitter. A total of 751 tweets were analyzed, and among them, 583 included innovative services. Our recent publication (Syn et al. 2023), which

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utilized this dataset, presented an expanded typology of library innovation based on the work of Winberry and Potmes (2021). In this poster, combined with the newly collected data from professional magazines, we intend to present a whole landscape of public library innovation, without being limited to any existing typology.

**Magazine articles**: To complement the Twitter data, we examined three major professional library magazines: *American Libraries, Public Libraries,* and *Library Journal* covering the period from 2020 to 2021, which aligns with the timeframe of the Twitter data. In conducting a systematic literature review, we used the search phrases of (“public library” OR “public libraries”) AND (“covid-19”). The search resulted in 119 articles: 58 articles from *American Libraries,* 36 from *Public Libraries,* and 25 from *Library Journal.* As search phrases were broad, we reviewed the articles and removed irrelevant articles. A total of 72 articles were finally selected: 26 articles from *American Libraries,* 30 from *Public Libraries,* and 16 from *Library Journal.* Content analysis was conducted by adding tags to phrases in articles that feature innovative services. To ensure the intercoder reliability, a two-step coding process was employed, involving two coders for the initial coding, followed by another coder who reviewed the entire dataset. The third coder is the one of the coders who previously coded the Twitter data. With the coding process, we identified 358 phrases for innovative services and operations.

**FINDINGS**

These two datasets demonstrated a diverse range of public library services. The most prominent innovation identified was the transition of existing services into virtual formats. Public libraries, being educational hubs for the community, typically offer a wide array of services: story times, book talks, technology classes, workshops with diverse topics, and resources recommendations. Despite the challenges posed by the pandemic, many public libraries promptly adapted by transitioning these conventional services to virtual platforms, utilizing technologies like Zoom, social media live streaming, YouTube, podcasting, curated music playlists, etc. Ensuring uninterrupted service delivery through virtual channels was their primary focus.

In the early stage of the pandemic, Covid-19 was still unknown and the misinformation of the virus became public health threats. The misinformation was often combined with racism. Public libraries apparently made efforts to combat misinformation and racism. They actively sought the most current information about the virus from authoritative sources, created information web pages (e.g. banners, signs, boards, social media posts), hosted virtual events for panel discussions, workshops, and interviews with experts, and created recommended reading lists. During the pandemic, public libraries have emerged as a crucial community center. They used their creativity to serve their community, especially those who have been marginalized or impacted significantly by Covid-19. A lot of public libraries tried to address the digital divide in various ways: lending hotspots and digital devices, providing Wi-Fi services 24/7, working with companies to offer free broadband services, sending vans for Wi-Fi, and providing mobile printing services. They offered their spaces as vaccine clinics, Covid-19 home-test kit distribution sites, food bag distribution sites, daycare centers for essential workers, and temporary housing for those who went through homelessness. Some offered their space for telehealth visits and this includes the instruction for telehealth technology. Some conducted community surveys to assess the impacts by Covid-19 and redesigned their programs according to findings. Libraries’ endeavors to reach out to their communities were stellar innovations, making marketing and outreach were the areas where innovations frequently witnessed. There was a varied list of partners identified in these datasets that public libraries collaborated with for ingenious and helpful services for their community.

Not surprisingly, there are differences in findings between the datasets. Twitter was an effective marketing tool itself to spread word out. Thus, it includes a large amount of data to promote digital resources, virtual programs, and other library events. Twitter was also used to increase the sense of community by making quizzes or trivia events among users, social media challenges, and posting local history related information/digital images. The Magazine data showed a wider range of services, including innovations related to internal and general library operations. It provided more detailed information on how libraries operate with innovative ideas. Many public libraries took proactive steps to enhance staff training, including Covid-19 response playbook and offering webinars for staff to improve community service. They adopted workflows and improved remote working procedures by utilizing technology such as a phone forwarding system and flexible communication through virtual and hybrid meetings. Some libraries prioritized staff morale and well-being. They showed flexibility in budget management to maximize virtual services.

**CONCLUSION**

Two datasets in this study have effectively demonstrated an extensive range of innovative services by public libraries in the U.S. The Twitter data exhibits promotional messages about library services and programs, and the magazine data further illustrated internal innovations related to library operations, including human resources, budgets, and creative ideas for community programs and events. The study examines the innovation trends in public libraries and contributes to offer potential insights for libraries considering innovative services. In this research, we
focused on innovations, but there may be drawbacks that could be involved with innovation implementation. While this was not the scope of the current study, it would be an important aspect to explore in future research.

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**Automated Metadata Enhancement for Physical Sample Record Aggregation in the iSamples Project**

Song, Hyunju  
University of Arizona, USA | hyunjusong@arizona.edu  
Cui, Hong  
University of Arizona, USA | hongcui@arizona.edu  
Vieglais, Dave  
University of Kansas, USA | vieglais@ku.edu  
Mandel, Danny  
University of Arizona, USA | dmandel@arizona.edu  
Thomer, Andrea K.  
University of Arizona, USA | athomer@arizona.edu

**ABSTRACT**

Large amounts of samples have been collected and stored by different institutions and collections across the world. However, even the most carefully curated collections can appear incomplete when aggregated. To solve this problem and support the increasing multidisciplinary science conducted on these samples, we propose a method to support the FAIRness of the aggregation by augmenting the metadata of source records. Using a pipeline that is a combination of rule-based and machine learning-based procedures, we predict the missing values of the metadata fields of 4,388,514 samples. We use these inferred fields in our user interface to improve the reusability.

**KEYWORDS**

digital archive; samples; metadata; automated metadata generation

**INTRODUCTION**

Physical samples – for example, a chip from a geologic outcrop – play a key part in scientific research and form a fundamental unit of data that represents nature and the environment. Just as research data must be made findable, accessible, interoperable, and reusable (FAIR; Wilkinson et al., 2016), so must physical samples and their metadata.

This poster describes work from the Internet of Samples (iSamples) project, which aims to aggregate diverse physical sample databases from the earth sciences, biosciences, and archaeology via consistent metadata and links (Davies et al., 2021). iSamples developed a high-level metadata schema that can be applied to multiple sample-collecting domains. However, when aggregating records into a single digital infrastructure, we found many incomplete sample records with missing fields such as “material” and “specimen type”. Missing metadata is a crucial problem as it impacts the quality of the aggregation and limits the usability of individual records. To address this issue, we developed a procedure that uses rules and machine learning-based predictions.

**METHOD: COMBINING RULES-BASED AND MACHINE LEARNING-BASED APPROACHES**

Given an incomplete record that has a missing value in the material or specimen type field, we first check if it falls into any of the rules that were curated based on expert domain knowledge (Figure 1). If it does not correspond to any rules, we apply the machine learning model to predict the missing metadata field.

![Figure 1. Pipeline of procedure](image)

**Rule-based approach**

After test runs and expert evaluations on the machine learning model’s prediction results, we observed that some of the existing metadata fields of a record could be used to predict the missing values. Dedicating part of the prediction task to rule-based approach can embed the collection-specific knowledge that was not picked up by the machine learning model and help improve system efficiency. The rules were created by the collection curator after reviewing a random subsample of the records (Figure 2).

| IF collection="SESAR" and metadata field="sample type" and value="CTP", THEN material = "Liquids" |
| IF collection="Open Context" and metadata field="item category" and value="Animal bone", THEN material = "Biogenic non-organic material" |

![Figure 2. Example of curated rules. Based on the metadata field value, determines the missing material value](image)

**Machine learning approach**

As the sample records have rich textual descriptions, we used BERT, a transformer-based architecture that was developed to solve natural language processing tasks. After experiments, we decided to use BERT-E (Koirala et al., 2023).
2021), an earth science-focused language model that is trained on a similar domain of dataset for our task. We developed a multiclass model that is fine-tuned on the records we have for each collection.

We integrated the models into our curation pipeline. SESAR had 3,565,478 (78%) earth sample records that were missing the material field. 3,534,384 records were rule-assigned, and 31,094 records were machine assigned. Open Context had 790,375 (96%) records missing the material field, and 793,751 (97%) records missing the specimen type. The material field of 520,632 records were rule-assigned, and 269,743 records were machine assigned. The specimen type field of 349,556 records were rule-assigned and 444,195 were machine assigned.

<table>
<thead>
<tr>
<th>Collection-Field</th>
<th>Label</th>
<th>Precision</th>
<th>Recall</th>
<th>F1</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>SESAR-Material</td>
<td>Biology</td>
<td>0.998</td>
<td>0.999</td>
<td>0.999</td>
<td>198192</td>
</tr>
<tr>
<td></td>
<td>Earth Material</td>
<td>1.000</td>
<td>0.494</td>
<td>0.662</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Gas</td>
<td>0.662</td>
<td>0.891</td>
<td>0.760</td>
<td>546</td>
</tr>
<tr>
<td></td>
<td>Liquid</td>
<td>0.996</td>
<td>0.989</td>
<td>0.992</td>
<td>25131</td>
</tr>
<tr>
<td></td>
<td>Mineral</td>
<td>0.993</td>
<td>0.995</td>
<td>0.994</td>
<td>244422</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>0.971</td>
<td>0.892</td>
<td>0.930</td>
<td>16932</td>
</tr>
<tr>
<td></td>
<td>Particulate</td>
<td>1.000</td>
<td>0.95</td>
<td>0.974</td>
<td>123</td>
</tr>
<tr>
<td></td>
<td>Rock</td>
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<td>0.996</td>
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<tr>
<td></td>
<td>Sediment</td>
<td>0.998</td>
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<td>0.997</td>
<td>78976</td>
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<td></td>
<td>Soil</td>
<td>0.990</td>
<td>9.995</td>
<td>0.993</td>
<td>14790</td>
</tr>
<tr>
<td></td>
<td>Experimental Material</td>
<td>0.943</td>
<td>0.985</td>
<td>0.964</td>
<td>300</td>
</tr>
<tr>
<td>OpenContext-Material</td>
<td>Anthropogenic</td>
<td>0.980</td>
<td>0.942</td>
<td>0.962</td>
<td>21945</td>
</tr>
<tr>
<td></td>
<td>Anthropogenic Metal</td>
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<td>0.784</td>
<td>3297</td>
</tr>
<tr>
<td></td>
<td>Biogenic Non-Organic</td>
<td>0.680</td>
<td>0.712</td>
<td>0.680</td>
<td>2294</td>
</tr>
<tr>
<td></td>
<td>Mineral</td>
<td>0.802</td>
<td>0.746</td>
<td>0.700</td>
<td>433</td>
</tr>
<tr>
<td></td>
<td>Natural Solid Material</td>
<td>0.418</td>
<td>0.340</td>
<td>0.300</td>
<td>1326</td>
</tr>
<tr>
<td></td>
<td>Organic Material</td>
<td>0.396</td>
<td>0.498</td>
<td>0.426</td>
<td>306</td>
</tr>
<tr>
<td>OpenContext-Specimen</td>
<td>Artifact</td>
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<td>0.992</td>
<td>0.996</td>
<td>23164</td>
</tr>
<tr>
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<td>Organism Part</td>
<td>0.858</td>
<td>1.000</td>
<td>0.908</td>
<td>613</td>
</tr>
<tr>
<td></td>
<td>Organism Product</td>
<td>0.650</td>
<td>1.000</td>
<td>0.746</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 1. Performance by class on test set. Evaluation results by average scores of stratified 5-fold cross validation. Macro F1 score was used to evaluate the imbalanced data. Count represents the number of records. We do not predict the specimen type of the SESAR as there were none that had missing values in this field.

Application
Using this augmented metadata, we developed a faceted search interface for iSamples (Figure 3). This allows users to locate samples via the augmented metadata fields, which we hope will improve the discoverability of samples.

CONCLUSION
In this poster, we presented an automated metadata enhancement procedure to create a more complete, higher-quality metadata aggregation that improves the FAIRness of the physical samples in the iSamples project. Our approach is broadly applicable to numerous other domains and collections that grapple with “lossy” metadata aggregation resulting in incomplete records. We utilize the large amount of textual data that is available in the earth science and archaeological records for the fine-tuning process. We find that developing and utilizing domain-specific language models may be a solution for automatic metadata generation of digital libraries even beyond the area of natural science. In our future research, we plan to conduct a comprehensive user study to both test the accuracy of our predicted labels, and to understand how best to flag predicted metadata values (vs verbatim legacy values) in records, and thereby increase trust in and usability of the aggregated collection.
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Investigating Scientific Misinformation Originating from Retracted Publications and Their Perception

Stiller, Juliane  
Grenzenlos Digital e. V. Germany | juliane@grenzenlos-digital.org
Terner, Senta  
Uppsala University | senta.terner@idehist.uu.se
Trkulja, Violeta  
Grenzenlos Digital e. V. Germany | violeta@grenzenlos-digital.org

ABSTRACT

Scientific retractions can be an indicator that misinformation is present in a research paper. Retractions are therefore an interesting research object to explore news coverage of misleading scientific information. This poster presents how problematic research (before and after retraction) is portrayed in news outlets, the impact of the retraction on these reports and the relationship of retracted scientific results and the spread of false information. Starting from a list of 270 retracted COVID-19 papers from the Retraction Watch blog (https://retractionwatch.com), we analysed news articles of 16 retracted publications, that were immensely discussed in journalistic formats. By presenting three different use cases, we show how misinformation emanates from retractions, how problematic research is presented in media and what factors influence the message of the article. Our research contributes to a better understanding of how retractions are used and perceived in propagating scientific misinformation on one hand and in mitigating it on the other.

KEYWORDS

Scientific misinformation, retractions, science disinformation, scholarly communication

INTRODUCTION

The scientific community is built on the principles of transparency and accountability, where published research is subject to scrutiny and open to re-evaluation. One of the mechanisms by which the scientific record is corrected is through retractions (Wray & Anderson, 2018), which signal to the scientific community that a published article contains significant flaws or errors and results cannot be relied upon (COPE, 2019). As retracted papers are often related to erroneous research, we use these to learn more about the relationship between scientific publication and false information and the spread of false information in the media. This research primarily examines scientific misinformation, which encompasses various types of false information originating from scientific literature or appearing to be scientific. When such misinformation is intentionally created and disseminated, it falls under the category of science disinformation (ALLEA, 2021). For Southwell et al. (2022), scientific misinformation is “publicly available information that is misleading or deceptive relative to the best available scientific evidence or expertise” (p. 109). We distinguish between four different causes of scientific misinformation: 1) information that originally met scientific criteria but is now considered outdated, 2) information produced by scientists either intentionally or due to unintentional errors, 3) information that appears scientific but lacks a scientific basis (pseudoscience), and 4) information that meets scientific criteria but is distorted or falsified in its reception. Retractions are a crucial mechanism to flag problematic research in publications and can be attributed to various reasons such as genuine errors, scientific misconduct or editorial mistakes (Bar-Ilan & Halevi, 2018). Although the scientific community should not rely on retracted research, retracted papers continue to get positive citations despite issued retraction notices from the publishers (Bar-Ilan & Halewi, 2017). This is worrisome as retracted papers are more likely to have false information in them that gets further distributed with each citation. Another way of introducing false information stemming from scientific research is through distortions in press releases and news articles (Leßmöllmann, 2020). Journalistic presentations of scientific articles can also generate perplexity through linguistic components like spins (Boutron et al., 2019), framing, supposed contextualization, or omissions. Consequently, the gradual alteration during the transfer process across different communities and media formats can transform information into misinformation.

METHOD

We leveraged an expanding list of retracted scientific publications related to the COVID-19 pandemic curated by the blog Retraction Watch (https://retractionwatch.com). Altmetrics data from Plumx and Altmetrics for 105 articles of this list gives us insights into spread and inclusion of these articles in public media. These 105 articles garnered significant attention from both traditional and social media sources. 16 articles were further examined as they were mentioned more than ten times in news outlets. The articles addressed various subjects, including the effectiveness of face masks, diverse treatments and remedies for COVID-19, and search queries conducted on Google during the pandemic. We employed an open coding method to conduct an analysis of the 180 news outlet articles pertaining to one of these 16 specific retractions or scientific articles across three distinct dimensions: 1) “Type of Coverage”: identify patterns of coverage and different objects of coverage, 2) “Perceived Accuracy and Reliability of Claims”: analyse the perceived validity of claims presented in scientific articles as seen by news articles as well as how
studies are perceived once they are retracted, 3) “Distance from Original Research”: determine how deeply the news article engages with the original scientific paper or retraction. Figure 1 shows a flow diagram of the research design. Additionally, we identified three distinct use cases that illustrate the diversity of reception and the underlying relationships between scientific content and misinformation. These use cases span across different aspects of the dimensions and provide insight into the various forms of scientific misinformation and how they are received.

**USE CASES ANALYSIS**

In early April 2020, an article was published that evaluated the efficacy of surgical and cotton masks in filtering and blocking the SARS-CoV-2 virus (Use Case A: DOI: 10.7326/M20-1342). For this use case, we analysed 8 news items. This use case underscores the significance of scrutinising bold claims put forth in scientific literature and specifically in conclusions. This paper's conclusion contains a frequently cited phrase that propagated widely and lent support to numerous articles that contended masks are ineffective in preventing infection. However, the study also illustrates the diversity of interpretations that can arise based on the community reporting on it: the original publication may be used as evidence that masks are ineffective, or its retraction may be cited as proof that masks are effective, depending on the intentions of the authors producing journalistic or blog content. During the early stages of the COVID-19 pandemic, studies suggested that smoking may confer some degree of protection against the SARS-CoV-2 virus. One such study (Use Case B: DOI: 10.1183/13993003.02144-2020) claimed that cigarette smokers were less likely to contract COVID-19. We analysed 9 news outlet articles. This use case exemplifies that the motivations of scientists may be influenced by external factors that deviate from the drive to seek knowledge with unbiased inquiry – an idealised view of science. The potential impact of various external pressures, such as financial incentives, lobbying, or professional recognition, on the scientific decision-making process and the creation of false information in scientific papers due to these pressures is not studied extensively. On October 13, 2021, an article by Jiang and Mei (Use Case C: DOI: 10.3390/v13102056) concluded that the so-called spike proteins could be responsible for inhibiting the adaptive immunity. Most news outlet articles (out of 22 analysed) use reference to the study to support their claims or even promote conspiracy myths. The majority of the examined news articles use the study as evidence that the COVID-19 vaccine is dangerous, connected with the call for not getting vaccinated. Other news articles make the argument that retractions are used to silence people who are critical of vaccination. Most news articles only superficially mention study details and commonly misinterpret the results. The fact that the study is difficult to read for people who are not familiar with DNA or the function of spike proteins makes it all the more suitable for being used in this way.

**DISCUSSION**

The three identified use cases demonstrate the dissemination of scientific misinformation in the public domain. Our investigation specifically focused on scientific misinformation originating from article retractions and how these retractions are perceived and discussed in news outlet articles. We identified four key factors that influence the portrayal of retracted articles and the information presented in these news outlets: 1) the object of reception determines whether the article itself or its retraction is discussed within the news outlets, 2) the characteristics of news articles determines the depth and extent to which information about the retraction is integrated into the news articles, 3) the community of reception pertains to the intended readership or audience of the news article, and 4) the characteristics of the publication deals with the potential motives or intentions of the authors behind the publication. Our investigation provides a foundation for further analysis and advances our understanding of how dubious scientific publications are perceived and how scientific misinformation spreads.
ACKNOWLEDGEMENTS
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Chinese-Tibetan Bilingual Knowledge Organization in the Cultural Heritage Domain: A Practice for Traditional Tibetan Festivals

Sun, Guoye  Wuhan University, People's Republic of China | sunguoye@foxmail.com
Deng, Yuyang  Wuhan University, People's Republic of China | sparklingdeng@whu.edu.cn
Liang, Shaobo  Wuhan University, People's Republic of China | liangshaobo@whu.edu.cn
Wu, Dan  Wuhan University, People's Republic of China | woodan@whu.edu.cn

ABSTRACT
The trend of multilingualism in the web environment has put new demands on the digitization of cultural heritage. However, minority languages in cultural heritage have received little attention in China. This study selects traditional Tibetan festivals, a representative minority cultural heritage in China. Based on constructing a Chinese-Tibetan bilingual ontology, the cultural and tourism data of Tibet are linked. By further constructing a knowledge graph, a Chinese-Tibetan Bilingual Tibetan cultural service platform with traditional Tibetan festivals as the core is established.

KEYWORDS
Cultural Heritage; Knowledge Organization; Chinese-Tibetan Bilingualism; Traditional Tibetan Festivals

INTRODUCTION
The semanticization of information resources and the multilingualization of users are becoming increasingly evident. Knowledge organization techniques, such as ontologies, are applied to the cultural heritage domain. In order to preserve cultural heritage (Pramartha, 2016), researchers have organized cultural heritage resources at a semantic level, taking into account the characteristics of regional cultural heritage (Noardo, 2015). Compared to the trend of semanticization, multilingualism has received less attention in digitizing cultural heritage. It is not conducive to disseminating ethnic cultural resources in China, where there is a wide variety of minority languages.

Therefore, this study selects Tibetan, a minority language with a large number of speakers in China. We build a Chinese-Tibetan bilingual Tibetan cultural service platform with traditional Tibetan festivals as the core. It enables cultural heritage resources to be better used by bilingual Chinese-Tibetan users and provides a reference for the subsequent multilingual knowledge organization of cultural heritage.

RESEARCH DESIGN
Festivals from the representative lists of Chinese national and provincial intangible cultural heritage in five Tibetan-inhabited provinces, namely Tibet, Qinghai, Gansu, Sichuan, and Yunnan, were selected for this study. In turn, a Chinese-Tibetan bilingual ontology, a knowledge graph, and a Tibetan cultural service platform were constructed. The flow of this study is shown on the left side of Figure 1, and the constructed ontology is shown on the right side.

CHINESE-TIBETAN BILINGUAL ONTOLOGY
Referring to previous studies (Hu, 2014), this study reused the classical ontology model CIDOC CRM in the cultural heritage domain. Five categories of actor, thing, event, place, and timespan were identified to construct the ontology model of the traditional festival domain. Subsequently, festival data were obtained from the web, and the terms of the five categories in the ontology were extracted and labeled by a combination of manual and machine methods.

Figure 1. Research Flow and Constructed Ontology
In the ontology translation stage, this study constructed Chinese-Tibetan bilingual word pairs based on a translation from multiple data sources. The multiple data sources mainly include two major categories. One category is web resources, including Wikipedia, the List of Tibetan Intangible Cultural Heritage Items, and the Tibetan Language and Script Network. The other category is book resources, including the General Theory of Tibetan Culture, the Chinese-Tibetan Dictionary, and the Encyclopedia of Tibetan Traditional Culture.

Book resources are the key to translating actors, things, and events. Wikipedia is the translation source for noun entities. The Tibetan Language and Script Network provides a cross-reference book to supplement the translation of places. The list of intangible cultural heritage items is the translation source of festival names. After completing the translation, this study used Protégé to construct a bilingual Chinese-Tibetan ontology for traditional Tibetan festivals. The consistency and logic of the ontology were examined through ontology reasoning and visualization.

CHINESE-TIBETAN BILINGUAL KNOWLEDGE GRAPH
The knowledge graph was constructed based on ontology by adding external cultural and tourism data. The external data corresponding to the festivals were collected online. Specifically, we crawled the data of attractions and hotels through Ctrip, cuisines and cultural venues through Meituan, cultural activities through the official cultural websites of Tibetan areas, and books through the National Library of China. Ctrip and Meituan are each well-known travel and lifestyle group-buying websites in China.

Combining the Sunshine Chinese-Tibetan translation tool developed by Tibet University with Microsoft Bing’s API, the collected data was translated. The ontology was linked with the translated external knowledge using Python. The linked knowledge was stored in the commonly used graph database Neo4j to construct a Chinese-Tibetan bilingual knowledge graph of cultural and tourism resources related to traditional Tibetan festivals.

CHINESE-TIBETAN BILINGUAL TIBETAN CULTURAL SERVICE PLATFORM
Based on the deployment of Chinese-Tibetan pre-training language model, this study developed a Chinese-Tibetan bilingual Tibetan traditional festival named entity identification system. Combining it with the knowledge graph, a Chinese-Tibetan bilingual Tibetan cultural service platform (http://hctfc.whu.edu.cn/) was constructed.

The platform realizes knowledge navigation of cultural and tourism resources related to traditional Tibetan festivals based on semantic fusion. It also supports visual interaction, unified discovery, bilingual search, and recommendation. In addition, the platform provides a geographical perspective for presenting of Tibetan cultural and tourism resources. It marks Tibetan cultural and tourism resource locations and generates dynamic maps and routes.

The developed named entity recognition system can help the platform realize the function of cultural term recognition of festivals. The platform supports further Chinese-Tibetan bilingual search based on cultural term extraction.

The search results of specific festivals or regions are provided as word collections. The search result page will also recommend related cultural and tourism resources through a knowledge graph. Figure 2 shows partial interfaces of the search results, corresponding from left to right to Chinese search in the Chinese interface, Tibetan search in the Chinese interface, Tibetan search in the Tibetan interface, and Chinese search in the Tibetan interface.

![Figure 2. Partial Interfaces of the Platform’s Bilingual Search Results](image)

CONCLUSION
This study is oriented to traditional Tibetan festivals, an important cultural heritage of Chinese minorities. With it as the core, a bilingual semantic organization of Tibetan cultural and tourism knowledge is carried out. In the long run, this study is beneficial to promote the further dissemination and development of Tibetan cultural heritage. In addition, the knowledge organization method of this study can also be applied to other languages or fields.
ACKNOWLEDGMENTS
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Supporting Early Literacy in Public Libraries: A Meta-ethnography of Qualitative Studies

Sung, Hui-Yun  
National Chung Hsing University, Taiwan | hsung@dragon.nchu.edu.tw
Tsai, Tien-I  
National Taiwan University, Taiwan | titsai@ntu.edu.tw

ABSTRACT
This study reviewed qualitative studies that focused on library practices for supporting early literacy development. A meta-ethnography approach was used to locate, evaluate, and synthesize the findings of these studies. Based on a search in the Web of Science and a nationwide database developed by the National Central Library, 16 articles were included in the synthesis. Drawing upon Bronfenbrenner’s ecological systems theory, the findings identified five key themes (i.e., diverse collections, innovative activities, proactive intermediary role of librarians, print-full environment, and community partnership) related to library practices that support early literacy. By interpreting the findings of the review, suggestions and implications were discussed for library services supporting early literacy.

KEYWORDS
Early literacy, public libraries, meta-ethnography, ecological systems theory

INTRODUCTION
Storytimes are an established and trusted feature of public library services (Albright et al., 2009; Sung, 2017). Recent research has been directed towards the impact of library storytimes on early literacy development (Campana et al., 2016). This study aims to review qualitative studies regarding library practices for supporting early literacy development. Such a review enables a holistic view of the situation and helps offer recommendations for policy and practice. Specifically, this study asked: what positive impacts do library practices make on early literacy development?

Public library storytimes have been one of the important early literacy programs since the 1940s in the United States (Albright et al., 2009), which were later introduced to other countries around the world. Library storytimes are well received by children and their caregivers in terms of supporting child learning and development (Cahill et al., 2020; Hunt, 2020). Research has also shown library storytimes have a positive impact on supporting children’s early literacy skills (Goulding et al., 2017). A well-recognized set of early literacy skills were organized by the first edition of Every Child Ready to Read® (ECRR), which include: print motivation, phonological awareness, vocabulary, narrative skills, print awareness and letter knowledge (Ghoting & Martin-Diaz, 2006). Bronfenbrenner’s (1979, 1994) ecological systems theory examines interactions and relationships between individuals and their surroundings during human development. The current study applied this framework to investigate how public libraries support early literacy.

METHOD
This study used a meta-ethnography approach proposed by Noblit & Hare (1988) to analyze 16 journal articles based on Bronfenbrenner’s (1979, 1994) ecological systems theory. Following Noblit & Hare’s procedure, the researchers used theoretical sampling while scrutinizing peer-review journal articles derived from the Web of Science and a local database developed by the National Central Library using the following search strategy: "early literacy" and public librar* in all fields. As Noblit & Hare (1988) suggested, a meta-ethnography approach emphasizes in-depth discussion based on qualitative studies, and thus tends to set strict article inclusion criteria. The current study excluded three articles not published in an SSCI (Social Sciences Citation Index) or TSSCI (Taiwan Social Sciences Citation Index) journal, nine articles that were not qualitative research articles, and one that was not written in English. A total of 16 sample articles from SSCI or TSSCI journals were included. The sample articles were conducted in seven different countries: six were from the United States, two from Canada, one from New Zealand, two from Australia, one from Sweden, two from China, and two from Taiwan. Most of the studies adopted interviews and/or observations, with a few drawing upon design-based research and secondary data. The data collected in the sample articles were consolidated from librarians, storytime providers, children, caregivers, and print environments in the community.

FINDINGS AND DISCUSSION
The synthesis findings demonstrate five key entities frequently mentioned in the context of library practices that support early literacy. Figure 1 depicts five key entities in the ecological system in bold as well as other entities mentioned in the sample articles based on the ecological systems framework according to Bronfenbrenner’s (1979, 1994) ecological systems theory.
Bronfenbrenner’s (1979, 1994) definitions. Discrepancies during data analysis process were resolved through discussions among the researchers. All entities in the microsystem directly interact with the child, and the entities in the exosystem connect with entities in the microsystem and interact with the child in a subtle way. The five key themes identified (i.e., diverse collections, innovative activities, proactive intermediary role of librarians, print-full environment, and community partnership) were further reviewed and discussed as follows:

**Diverse Collections Encourage Literacy-related Behaviors and Enhance Parent-Child Reading**

Nine out of sixteen studies mentioned the importance of library collections for supporting early literacy development. Libraries offer a variety of books (especially picture books and board books) for babies, toddlers, and preschoolers to use, and therefore literacy-related behaviors often occur, such as biting books (Hedemark & Lindberg, 2018), parent-child shared reading (Barratt-Pugh et al., 2013; Hedemark & Lindberg, 2018), and children reading independently (Neuman & Knapczyk, 2022; Wang, Xu, Sturm, et al., 2022). Additionally, research has shown a strong link between play and early literacy. To this end, Ralli and Payne (2016) found U.S. libraries provide various toys to satisfy different needs, including open-ended play, sensory toys, and a quiet space. Literature also highlighted the importance of reflecting users’ backgrounds (e.g., multilingual collections) and diversity (e.g. topics and toy types) in the collections.

**Innovative Activities Help Early Literacy Development and School Readiness**

Thirteen studies mentioned the importance of library activities for supporting early literacy. Paynter, Simpson, and O’Leary (2020) observed that the focus of library storytimes has shifted from offering performance to supporting early literacy and school readiness, including various aspects such as mathematics (Campana, 2020; Neuman & Knapczyk, 2022), language development (Neuman & Knapczyk, 2022; Prendergast & Sharkey, 2021), subject knowledge (Kociubuk & Campana, 2020; Wang et al., 2022), and reading literacy (Paynter, Simpson, & O’Leary, 2020).

**Proactive Intermediary Role of Librarians Facilitate Interactions among Entities within and across Systems**

Thirteen studies mentioned the importance of librarians for supporting early literacy. Librarians play various roles, such as intermediaries, leaders, and emotion supporters. As intermediaries, librarians connect collections, caregivers, and children in order to support caregivers and children gaining access to related resources (Cheng & Sung, 2020; Wang et al., 2022), informing caregivers about children’s services (Hedemark & Lindberg, 2018), incorporating books in low-income neighborhoods (Neuman & Knapczyk, 2022), and modelling play for caregivers and children (Ralli & Payne, 2016). As leaders, librarians plan, organize, and deliver storytimes. For children from low-income families, Neuman and Knapczyk (2022) showed that librarians offered emotional support. Research has shown that the commitment, passion, and a proactive attitude of librarians are key factors that affect activity effectiveness and sustainability (Barratt-Pugh, Anderson, & North, 2013; Goulding, Dickie, & Shuker, 2017).

**Public Libraries Play an Important Role on Cultivating Print-full Environment**

Eleven studies mentioned that the library provides a print-full environment to support early literacy development. Additionally, the library is an informal learning environment. Campana (2020) considered that in libraries, learning is interesting and pleasant. Neuman and Knapczyk (2022) also emphasized that an informal learning environment provides a flexible and child-centred pedagogy. The library offers a public space, resources, and opportunities for socialization (Cheng & Sung, 2020; Ralli & Payne, 2016). Hedemark and Lindberg (2018) found that libraries forge touch and bonds, such as caregivers cuddling, swinging, raising, entertaining, and feeding babies.

**Community Partnership Fosters Cross-system Interactions and Expand the Scope**

Four studies mentioned the importance of community partnership for supporting early literacy development. Conversations between different organizations and disciplines help form the foundation of partnerships (Ralli & Payne, 2016; Hedemark & Lindberg, 2018). Barratt-Pugh, Anderson and North (2013) took Better Beginnings as an example to explain approaches to partnership, including: librarians working with medical personnel; librarians working with community organizations to develop a harmonious relationship for supporting early literacy.

**CONCLUSION**

Overall, the findings echo ECRR’s (Ghoting & Martin-Diaz, 2006) main idea—various early literacy skills were evidenced in the library practices. This study also finds that emerging research revealed evidence related to positive effects on school readiness (e.g., Kociubuk & Campana, 2020) and family relationship (e.g., Funge, Sullivan, & Tarter, 2017; Hedemark & Lindberg, 2018). Mapping entities mentioned in the sample articles, we find that public libraries can help connect a wide variety of entities in children’s ecological system when supporting early literacy development. Based on the above discussion, if public libraries can connect diverse collections, innovative activities, and proactive librarians in the microsystem, and reach out to the exosystem that cultivate print-full environment and build community partnership, a sustainable ecological system that well supports early literacy development for all children may help disadvantaged children make a difference. In order to facilitate sustainable early childhood library services, the government or national library can help public libraries develop an early
literacy library services best practice guideline to build long-term community partnerships and engage with families from diverse socioeconomic backgrounds and take this important role to promote information equity.

ACKNOWLEDGMENT
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Result Assessment Tool: A Software Toolkit for Conducting Studies Based on Search Results

Sünkler, Sebastian  
HAW Hamburg, Germany | sebastian.suenkler@haw-hamburg.de

Yagci, Nurce  
HAW Hamburg, Germany | nurce.yagci@haw-hamburg.de

Sygulla, Daniela  
HAW Hamburg, Germany | daniela.sygulla@haw-hamburg.de

von Mach, Sonja  
HAW Hamburg, Germany | sonja.vonmach@haw-hamburg.de

Schultheiß, Sebastian  
HAW Hamburg, Germany | sebastian.schultheiss@haw-hamburg.de

Lewandowski, Dirk  
University of Duisburg-Essen, HAW Hamburg, Germany | dirk.lewandowski@haw-hamburg.de

ABSTRACT

The Result Assessment Tool (RAT) is a software toolkit for conducting research using results from commercial search engines and other information retrieval (IR) systems. This software combines modules used for the design and management of studies, the automatic collection of search results through web scraping, and the assessment of search results by jurors using different scales in an assessment interface. Due to the flexibility of RAT, several types of studies can be implemented, for example, classification studies and qualitative content analyses in addition to classic retrieval tests. Therefore, RAT is a versatile tool and useful in various disciplines.

KEYWORDS:
search engines; web scraping; retrieval tests; research software

INTRODUCTION

Studies that rely on results from commercial search engines and other IR systems usually require manual work in designing the test, collecting the search results, finding jurors, gathering their ratings, and analyzing the test results, making it challenging to conduct such studies on a large scale. Jurors are individuals who evaluate collected search results at various levels, e.g., assessing their relevance to a particular search task or performing classification tasks. For instance, a researcher interested in comparing the sources and relevance of the results from Google and Bing on a particular topic would need to design a test, then use the queries to search for results in both search engines, copy the URLs from the result pages, randomize the URL lists, distribute the URLs to the jurors for evaluation, make a list of all domains found in the results and compare them between the two engines. Finally, the researcher must collect and analyze the juror’s scores. It is obvious that the described process is cumbersome and cannot be applied on a large scale. These problems have been evident for years, and some software solutions have been developed. However, these are tools primarily designed for one-time use in studies (e.g., Bar-Ilan & Levene, 2011; Tawileh et al., 2010; Trielli & Diakopoulos, 2020), prototypes that have not been further developed (Lingnau et al., 2010; Renaud & Azzopardi, 2012), and software for test collections (Dussin & Ferro, 2008; Koopman, 2014; Ogilvie & Callan, 2001) or for narrowly limited use cases (The Digital Methods Initiative, 2022; Thelwall, 2009).

To integrate all steps of the testing process into a complete and sustainable solution, we develop the Result Assessment Tool (RAT). RAT is a software toolkit that enables researchers to conduct large-scale studies based on results from search engines and other IR systems. The software toolkit is unique due to the offered flexibility, automation of tasks such as the scraping of commercial search engines, and the possibility of using the integrated platform to evaluate search results. In addition, RAT provides functions for automatically analyzing the jurors’ ratings and determining statistics, such as the overlap of search results between different search services. These features will support the quantitative evaluation of search results to assist manual interpretation by researchers in subsequent studies. In the following, the Result Assessment Tool is presented with all the components currently available.

FUNCTIONALITY

RAT is a flexible web-based software toolkit developed in Python using the database PostgreSQL and Selenium testing suite for web scraping. Researchers can access a web interface to design studies, while participants can simultaneously use this interface to evaluate search results for predefined questions. The toolkit is unique due to the offered flexibility, allowing nearly all kinds of studies based on search results to be carried out; in addition to classic studies on IR, classification studies, data analyses, and even qualitative content analyses are possible.

RAT consists of the following six modules:

1. Test design: The test design module is the basic module that researchers use to define the type of study, the result type for the assessment (search results or snippets from search result pages, or both) and the type of access to the assessment interface. Access options include using a single access code (same code for all participants), personal access codes (each participant gets their own code), or group codes (used for group comparisons).
2. Result scraper: This module is used to define search tasks with search queries and select the search engines to be scraped. For instance, a researcher might write their own task descriptions (e.g., "You are searching for information on nuclear energy. How relevant is the following result?"), define a set of queries for their study ("nuclear power", "nuclear energy", "atomic energy", and so on), and define the search engines from which results should be collected (e.g., Google and Bing). Alternatively, lists of URLs can be uploaded to be made available for assessment. The content of the search results or URLs are scraped, and the source code and screenshots are stored in the database. As copies of the results and result documents are generated, all results will be available to jurors in the version when they were scraped; i.e., jurors will not experience any 404 errors or see documents updated in the meantime.

3. Definition of questions: RAT is very flexible in the design of questions. Question types include open-ended questions, Likert scales, sliders, and multiple-choice questions.

4. Assessment interface: In the assessment interface, jurors click through the copies of the results and answer predefined questions (e.g., "How relevant is the result shown here?", "Would you see this result as coming from a reputable source?", "Is this text well-written?").

5. Analysis module: The analysis module offers options for automatically analyzing the scraped results. Examples of such analyses include calculating the overlap of search results (Yagci et al., 2022) or measuring the application of search engine optimization (SEO) on web pages (Lewandowski et al., 2021).

6. Results export: Researchers can download the search results, juror scores, and the results of the analysis modules as tables at any time, enabling further use of all the collected and created data.

Figure 1 shows the overview page for a study in RAT. This view displays the status of the study, and it offers a glance into the search engines, search queries, questions, tasks, and number of participants so far. The study summary provides an overview of all the options specified in the test design process. It shows the study type (e.g., relevance assessment or classification study); result types to be assessed (e.g., organic results or search result snippets); search engines used in the study; and the search queries entered. "Analysis" provides access to the results of the automatic analysis, and "Export" opens a module to download the results in tabular form for further processing. Figure 2 shows an example of an assessment in the assessment interface of the Result Assessment Tool. The jurors see all predefined questions on the left side and a screenshot of a result to be evaluated on the right side.

All collected results and assessments can be processed by automatic processes in the analysis module of RAT. The automated analysis for a study in the Result Assessment Tool computes and reports statistics about the study. These statistics provide an overview of the number of search queries, search results to be collected per query, and expected and collected results. These are standard statistics for any study; it is possible to calculate and display other statistics, for instance, the probability of using SEO on a search result or the calculation of the overlap of search results between the search engines used in a study. Both examples already show the potential of automated analyses since no further effort was required for the overlaps and the classification. We designed the analysis module so that researchers can extend it easily. In the future, we will extend this module with standard measures for information retrieval and readability scores, among others.

**AVAILABILITY OF SOFTWARE DEMO, SOURCE, AND RESEARCH DATA**

To adhere to the Findability, Accessibility, Interoperability, and Reusability (FAIR) principle (Wilkinson et al., 2016), we make the research data on the studies we conducted with RAT (Lewandowski et al., 2023a) and the source code (Lewandowski et al., 2023b) available. The demo is available at [https://rat-software.org](https://rat-software.org).
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Comparative Analysis of AI Applications in Libraries: A Systematic Literature Review

Tang, Zhenyi
Department of Information Management, Peking University, Beijing, China | tangzhenyi@pku.edu.cn
Zhang, Pengyi
Department of Information Management, Peking University, Beijing, China | pengyi@pku.edu.cn

ABSTRACT
The application of AI (artificial intelligence) in libraries is not only the result of the development of technology, but also the choice of libraries to improve their service. However, how to better integrate libraries and AI still needs further exploration, and libraries also need guidance in implementing AI technology. This study uses a systematic literature review method to analyze the literature on the application of AI in libraries published before 2023. Based on sorting out the application of AI in libraries, this paper summarizes and analyzes the practice and attitudes of applying AI in libraries. We find that there is a broad prospect of AI applications in libraries, but the current application is scattered and lacks a comprehensive view. There are different attitudes towards the application of AI in libraries and it is important to learn about different views.

KEYWORDS
Artificial intelligence, Library, Systematic literature review

INTRODUCTION
There is currently no unified definition of Artificial intelligence (AI) and its scope is relatively broad, but the ultimate goal of AI is to create computer systems that are comparable to human intelligence. AI-related applications in autonomous driving, speech recognition, and other fields have greatly improved the quality of people's life and work efficiency (Gul & Bano, 2019). While the library undertakes the function of providing public cultural services, it has been actively trying to serve the readers with various information technologies, such as the intelligent agents (Herron, 2017) and chatbots (Allison, 2012). Most studies hold an open attitude that with the help of AI technology, libraries can provide readers with better personal services (Mao, 2018). However, some studies hold that the application of AI would destroy the "library spirit" and affect people's knowledge acquisition (Jiao & Liu, 2021). Some studies also believe that the application of AI will also bring concerns about privacy security, algorithm discrimination, and other aspects, and even exacerbate social inequality (Smith, 2022), some librarians also express concern about the substitution of artificial intelligence (Calvert, 2017).

Although many researchers express their attitudes and views on the application of AI in libraries, there is no systematic study and summary of the relationship between AI and libraries. Therefore, this study attempts to answer the following research questions through a systematic literature review: 1) What are the main applications of AI in libraries? 2) What are scholars' different attitudes toward the application of AI in libraries?

By analyzing the application and researchers’ attitudes toward AI in libraries, we can find the research hotspots and help us view the AI application in libraries more objectively and rationally.

METHOD
Using a systematic literature review method, this study selected CNKI academic journal database to search Chinese journals, and Library, Information Science & Technology Abstracts (LISTA) database to search English journals. The search terms both were SU library AND SU (artificial intelligence or ai), and the search time was up until December 31, 2022. After removing duplicates, 496 Chinese and 144 English articles were obtained.

![Flowchart showing the literature selection process]

This study formulated the literature inclusion criteria to select and evaluate literature: 1) the topic must include library and AI. 2) to ensure quality, the document type must be the research paper. 3) the article's length should be

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more than two pages (including two pages). After several rounds of selection, 91 Chinese and 48 English articles were retained. The specific process is shown in Figure 1.

**FINDING**
Through statistical analysis, the Chinese literature first discussed the relationship between libraries and AI in 1992, while the English literature was in 1995, and most of the articles were published after 2017 (n (Chinese) =89, n (English) =40). Source journals include both library management (such as *Journal of Library Administration*) and technology applications (such as *Information Technology and Libraries*). There are also journals that explore comprehensive fields (such as *Library Hi Tech*).

According to different research contents, the articles in this study were divided into three categories: theory, application, and ethics. The specific distribution is as follows:

<table>
<thead>
<tr>
<th>Country</th>
<th>China</th>
<th>USA</th>
<th>European countries</th>
<th>American countries (except USA)</th>
<th>Asian countries (except China)</th>
<th>African countries</th>
<th>Oceanian countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td>52</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethics</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>38</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>16</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

*Table 1. The Distribution of Articles*

It can be seen that most English literature focus on the specific application of AI in libraries, studying specific technologies such as automatic cataloging technology, intelligence agent, or specific applications such as reference service, while Chinese literature focuses more on the construction of macro theories, such as the framework study of AI application in libraries. At the same time, the English literature discusses more ethical issues.

**Application**
After reading and analyzing the content of the articles, the application of AI in libraries was divided into three dimensions: service, resources, and space. The service dimension generally includes reference service, reading service, and social education. Chinese literature also discusses reading promotion. The resource dimension includes library resource management, resource retrieval, knowledge organization, and book order, while the space dimension includes virtual space construction and real space management. While most of the Chinese and English literature covers these topics, English literature focuses more on specific applications, from development to testing, and Chinese literature focuses more on the construction of macro theories, such as the framework study of AI applications in libraries.

**Attitude: positive and cautious**

*Positive attitudes.* It is believed in both Chinese and English literature that AI can provide readers with better services, improve the working efficiency of librarians and the utilization rate of information resources, and facilitate space management and information system design. But Chinese literature expresses a more positive attitude and believes that AI is conducive to the development of library theory and the industry.

*Cautious attitudes.* It has been mentioned in both Chinese and English literature that the application of AI may pose a certain threat to the employment of library staff, as well as problems such as user information security and privacy ethics. However, the English literature expresses more concerns in the aspects of ethical privacy, algorithmic discrimination, and bias, which are explained in more detail. The Chinese literature specifically mentions the imperfect development of theories and the lack of relevant laws and regulations.

**CONCLUSION**
Artificial intelligence has a broad application prospect in libraries, but its current application is scattered. Although it is mainly concentrated on the three dimensions of service, space, and resources, the practical practice is still in the exploration stage, lacking a comprehensive view. There are different attitudes toward AI applications, but the Chinese attitude is more positive. Different countries should learn from and communicate with each other to better promote the integration of AI and libraries.

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Exploring Data Justice in Citizen Humanities: Case Studies from Memory Institutions

Ting, Yu-Ning  
National Taiwan University, Taiwan | r10126032@g.ntu.edu.tw  
Jeng, Wei  
National Taiwan University and National Institute of Cyber Security, Taiwan | wjeng@ntu.edu.tw

ABSTRACT

Today, while one sector can effortlessly gain access to data provided by another, there may also be instances of injustice between data producers and decision-makers. This study applies Heeks and Shekhar's framework of data justice to analyze two humanities and citizen science projects in Taiwan: the collection of old photos by the Taipei Public Library and the citizen archivist project of the National Archives Administration. The study explores data justice issues within libraries and archives and examines the applicability of the data justice framework to citizen humanities projects. The research findings indicate that although there are unequal power dynamics between institutions and citizen scientists regarding data, the selected cases involve relatively straightforward task contexts and individuals, resulting in minimal violation of data rights for citizen scientists. Consequently, these two projects have limited observable instances of data injustice.

KEYWORDS

data justice; citizen science; citizen humanities

INTRODUCTION

In the data-intensive era, the ease of collecting and utilizing vast data brings concurrent power imbalances and injustices concerning global data rights. According to Heeks & Renken (2016), data justice is an interdisciplinary field grappling with the increasing concerns rooted in the power dynamics of data collection, processing, and utilization, especially focusing on issues like surveillance, monopolization, and privacy. Heeks and Shekhar (2019) further dissect data justice into five dimensions: 1) procedural data justice, focusing on fairness and participation throughout the information value chain; 2) instrumental data justice, addressing fairness in data utilization; 3) rights-based data justice, emphasizing basic rights related to data representation, privacy, access, and ownership; 4) structural data justice, considering the role of power dynamics in achieving equitable outcomes; and 5) distributive data justice, encompassing the overall handling, processing, and benefits distribution of data across stakeholders.

Libraries and archives have historically played vital roles in promoting social justice: Libraries focus on citizen participation, information literacy, and information justice (Mathiesen, 2015), whereas archives preserve records of social justice activities (Caswell & Punzalan, 2016). As libraries and archives increasingly engage in citizen science projects involving data, it is crucial to ensure social justice and address potential exploitation or inequality among participants. This study analyzes data justice in two humanities citizen science projects conducted by libraries and archives, using Heeks and Shekhar's data justice framework, to explore its applicability in these projects.

METHODOLOGY

This study utilized a mixed-methods approach comprising secondary data analysis and semi-structured interviews, both focusing on two projects: the “Taipei Old Photos Collection” (TOPC) campaign by the Taipei Public Library, and the “Citizen Archivist Project” (CAP) by the National Archives Administration. TOPC involves citizens’ photo submissions selected by the library, with contributors receiving an authorization fee and their photos used for digital preservation and public exhibitions. CAP involves citizen assistance in transcribing and describing archives, with the top three contributors receiving monetary rewards and public recognition through an award ceremony. Our data of the secondary data analysis primarily used official records from TOPC and CAP, including relevant official websites, event websites, databases, promotional documents, collection systems, and citizens' LINE communication groups. The analysis of this secondary data allowed the research to understand the scope of the projects, their public reception, and institutional strategies. Semi-structured interviews with purposive sampling were also conducted to explore data workflows of the institutions. The participants were institutions involved in citizen science projects, specifically those governed by central authorities or acting as main branches of local libraries. The interviews centered on the experiences and perspectives of the institutions involved in the TOPC and CAP projects.

RESULTS

In this section, we apply Heeks and Shekhar's data justice framework to analyze the TOPC and CAP projects across five dimensions: procedural, instrumental, rights-based, structural, and distributive data justice. A detailed side-by-side comparison of the two projects can be found in the Appendix table on OSF at https://osf.io/6btvj.

Procedural data justice. TOPC participants contribute photos without involvement in data processing or utilization, focusing on the initial stage of the information value chain. Selected participants receive authorization fees and a sense of achievement. On the other hand, those in the CAP project transcribe or describe publicly available archives,
positioning them in the midstream of the information value chain and facilitating the acquisition of historical knowledge and improved retrieval efficiency.

Instrumental data justice. TOPC utilizes participant-provided photos primarily for digital preservation and exhibitions, but participants might not frequently access the digitized photos themselves, resulting in less noticeable benefits in terms of data utilization for the participants themselves. Comparatively, in CAP, participant collaboration improves the retrieval efficiency of national archives. Nevertheless, the participants in the Citizen Archivist Project may not be direct users of the archives, and the benefits they gain from their involvement may be less apparent.

Rights-based data justice. TOPC participants retain photo ownership but grant a CC BY 3.0 license to Taipei Public Library. They can freely access digitized photos in the collection system. As old public photos often lack clear individual identification, privacy concerns are minimal. CAP focuses on processing government-produced historical archives, reducing privacy and representativeness worries. While individual contributions are recorded, data ownership rests with the National Archives Administration. Caution is needed to avoid misrepresentation and misunderstanding of historical facts if archive context isn't clarified.

Structural data justice. Structural data justice in TOPC follows selection criteria like historical significance, landmarks, rarity, and composition, set by the review committee. Not all submitted photos are chosen, and Taipei Public Library has the final say in their usage. Similarly, CAP limits collaboration based on National Archives Administration's full-text image availability and legal constraints. While participants may have limited influence on institutional decisions, these projects hold societal significance. Participants contributing old photos for digital preservation and exhibitions can shape local urban memory and cultural awareness. The Citizen Archivist Project, involving citizen scientists, enhances public archive access and deepens national memory understanding.

Distributive data justice. TOPC rewards participants with achievement and licensing fees upon host selection, fulfilling their desire to share their personal collections. This enriches the library's collection and its cultural role in the community. Other users benefit from accessing valuable research materials and discovering insights into local heritage. In the CAP, citizen scientists gain a sense of achievement, rewards, and new knowledge through digitization contributions, saving time and resources for the institution and enhancing archive accessibility for users.

DISCUSSIONS AND FUTURE WORK
Applying Heeks and Shekhar's (2019) data justice framework, this study dissects the TOPC and CAP, two humanities-focused citizen science projects in Taiwan. While these projects engage citizen scientists in a section of the information value chain, the power over data processing and decision-making remains largely with the institutions. Despite mutual benefits, a distinct power imbalance lingers. This imbalance is pronounced in rights-based data justice, where unclear archival context may breed misinterpretation and misrepresentation, a critical point for the Citizen Archivist Project.

Regarding applying the data justice framework to humanities-focused citizen science projects, there's overlap in Heeks and Shekhar's proposed dimensions, especially in rights-based data justice, which is intertwined with procedural, instrumental, and structural data justice. Drawing clear boundaries between the five dimensions proves challenging. Comparing to Christine and Thinyane's (2021) analysis of citizen science projects in natural science domains, the stakeholder dynamics in this study's cases are relatively straightforward, with less pronounced issues of vulnerability and exploitation. Thus, it is inappropriate to label a project as unjust solely based on a lower degree of participant benefit in a specific dimension.

Discussing data justice in TOPC and CAP projects also reveals an important characteristic of citizen science in Taiwan's public sectors - decision-making power often leans heavily towards the public sector side. This dynamic stands in contrast to traditional citizen science projects, where participants are generally volunteers who freely contribute their time and resources. Here, the institutions not only set the project parameters but also offer monetary incentives for participation. This arrangement introduces complexities that standard theories may find difficult to accommodate. Another point to consider is that the monetary rewards for citizen participation can complicate our understanding of voluntary engagement in citizen science projects. In traditional citizen science, volunteers are typically driven by a sense of personal satisfaction, curiosity, or a desire to contribute to a broader cause. The introduction of monetary rewards in the TOPC and CAP projects raises questions about the nature of participation.

In this study, interviews were solely conducted with institutional personnel, shedding light on inequalities faced by citizen scientists from an institutional standpoint. While the secondary data analysis includes some insights from participants, like the citizen's LINE group in CAP, the amount of data is limited. Therefore, it is recommended to incorporate the perspectives of users in future research to uncover additional considerations for libraries and archives in addressing data justice. Furthermore, for future analysis using the data justice framework, it is suggested to select cases involving multiple stakeholders and tasks directly related to addressing the concerns of marginalized communities. Such cases may better highlight the various data justice issues present in the selected context.
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Who Communicates Well with Data: Examining Data Literacy among Pre-service Secondary Teachers

Tsai, Tien-I  National Taiwan University, Taiwan | titsai@ntu.edu.tw
Lee, San  National Central University Library, Taiwan | r06126016@ntu.edu.tw

ABSTRACT
The current study developed a data literacy instrument with 20 contextual questions and conducted a multi-mode survey with 232 pre-service secondary teachers in a university system. Three-way ANOVA was used to test whether pre-service teachers with different characteristics (i.e., field of study, library use, and Internet use) performed differently on data literacy. Pre-service teachers got a decent overall percentage score. They performed better in “identifying problems” and “analyzing data” than in “transforming data” and “collecting data.” While pre-service teachers in humanities and social sciences performed better in “identifying problems,” those in sciences performed better in “analyzing data.” Humanities pre-service teachers with high Internet use scored significantly lower; social science pre-service teachers with high Internet use and low library use scored significantly lower; science pre-service teachers with low library use scored higher. Implications for future data literacy education and instrument design are discussed based on the preliminary findings.

KEYWORDS
Data literacy; college students; pre-service teachers.

INTRODUCTION
Pre-service teachers are college students in teacher education programs and would be potential future school teachers who are influential to the future generation. Teacher education has long been promoting information technology integration and recently highlighted the importance of data decision-making (Mandinach & Gummer, 2016a, 2016b). In order to ensure future school teachers possess the ability to adapt to various tools/technologies and utilize data properly, it is crucial to investigate pre-service teachers’ data literacy for teaching. Libraries and information professionals can thus provide appropriate data-literacy-relevant services based on the current state.

Data literacy has drawn attention in education research for about two decades, but relatively few studies discuss relevant issues from the perspective of library and information science (LIS) or with a focus on pre-service teachers. Research in LIS tended to be exploratory in nature and focused on teenagers (e.g., Bowler et al., 2017; Chi et al., 2018; Bowler et al., 2022). Empirical studies (e.g., Ebbeler et al., 2016; Kippers et al., 2018; Beck & Nunnaley, 2021) using the framework of data literacy for teaching proposed by Mandinach and Gummer (2016a) typically focus on educators’ data literacy in four different aspects—identify problems, collect data, analyze data, and transform data. It remains unclear how pre-service teachers perform in data literacy. Other empirical studies found that school teachers and pre-service teachers in different fields of study exhibit differently on information technology integration, and pre-service teachers with science backgrounds tended to perform better (Liao et al., 2018). Additionally, the information environment has been proven to be one of the important factors in individuals’ information behavior and information literacy (Sin, 2009, 2011). The current study further examines if there are discrepancies in individuals’ data literacy.

While Mandinach and Gummer’s (2016a) framework provides a solid foundation to discuss data literacy for teaching, the lack of a ready-to-use data literacy survey instrument drives the current study to develop a data literacy assessment instrument that can be applied to the contexts of pre-service secondary teachers. The current study aims to develop an instrument to understand the current state of data literacy among pre-service teachers. The research questions include: (1) How do pre-service secondary teachers perform in data literacy? (2) Do pre-service teachers with different characteristics (i.e., field of study, library use, and Internet use) perform differently in data literacy?

METHOD
A multi-mode survey was used in this study. Print surveys were distributed in classroom settings with permission from the instructor of 8 different teacher education required courses; the web survey was distributed through three teacher education program offices and student associations. The questionnaire consists of two major parts: 20 contextual questions assessing pre-service teachers’ data literacy and nine background questions, including demographics, their field of study, frequencies of library use, and internet use (hours per day). Data literacy questions were designed based on the data knowledge scale by Sikorski (2016) and other teaching assessment tools (Thorndike & Thorndike-Christ, 2010). All questions have been redesigned to fit the current study contexts in order to assess the aforementioned four aspects of data literacy. The survey instrument has been revised in two major rounds based on the review comments provided by two LIS experts and four education experts.
Two hundred and thirty-two pre-service teachers at a national university system consisting of three elite universities participated in the current study. They started teacher education programs for one to two years. Almost all have full access to a computer (97.4%). Most use the Internet for more than 3 hours per day (84%), and nearly half use the Internet for more than 5 hours per day (45.2%). Most of the participants visit the library at least twice a month (81.9%).

The Kuder-Richardson 20 (KR-20) reliability reached 0.602 after removing seven items. Although the reliability can be further improved, the KR-20 score is within the range that is acceptable, according to Thorndike and Thorndike-Christ (2010). Principle components analysis was also used to examine the factor loading. Varimax was used with fixed factor extraction 1 and factor loading below 0.2, as suggested by Sikorski (2016), to determine which item should be excluded. Item discrimination successfully grouped high-score and low-score groups using the 27th percentile and the 73rd percentile, which means the data literacy scale is valid.

FINDINGS

Overview of pre-service teachers’ data literacy

The accuracy rates were calculated in percentage for each construct and for overall data literacy performance according to Sikorski’s (2016) method. Pre-service teachers got a decent percentage score on overall data literacy performance (80.92%) and especially performed better in identifying problems (88.93%) and analyzing data (87.21%). The average score in transforming data was only 77.37%, and pre-service teachers tend not to do well when it comes to collecting data (71.55%). Among them, science students (81.21%) performed slightly better than social sciences (79.27%) and humanities students (78.05%). However, according to Figure 1, pre-service teachers in humanities and social sciences performed better in “identifying problems” (89.19% and 92.33%, respectively) than those in sciences (83.67%). And those in social sciences and sciences performed better in “analyzing data” (89.12% and 88.89%, respectively) than the humanities counterparts (83.33%).

Data literacy of pre-service teachers with different characteristics

To investigate the data literacy of pre-service teachers with different characteristics, participants were regrouped according to their frequency of library use and Internet use. Three-way ANOVA (Analysis of Variance) results are shown in Figure 2. The bar charts in different quadrants show how pre-service teachers with different information use experiences performed differently in data literacy. The first quadrant (top-right) represents those with relatively high frequencies in both library visits and Internet use; the third quadrant (lower-left) represents those with relatively low frequencies in both library visits and Internet use. Students with different information use experiences performed differently in overall data literacy scores ($F(1, 220)= 5.081, p<.05$). Nevertheless, regardless of library and Internet use, science students perform similarly across different quadrants. Social science students with high Internet use and low library use scored significantly lower than others. Humanities students with high Internet use scored significantly lower than their low Internet use counterparts. Science students with low library use scored higher than others.

CONCLUSION

Overall, pre-service teachers performed better in identifying problems and analyzing data than in collecting data and transforming data into decisions/actions. This highlights the importance of reinforcing how to transform data analysis into decisions/actions in future teacher education. Moreover, the large standard deviations in many items and discrepancies in different fields of study reflect that pre-service teachers may somewhat lack systematic training regarding data literacy in the context of teacher education. Academic libraries can design customized instructional materials for students in different fields of study. And teacher education programs can further incorporate data literacy contents in current curriculum and instruction training. Finally, due to the lack of an assessment tool for data literacy, the current study developed a survey instrument to assess pre-service teachers’ data literacy for teaching.
with 20 contextual questions. However, this new tool needs to be further tested and validated in broader contexts. Future research can further develop the tool in order to further apply it to a wider pre-service teacher population.

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Shifting Roles of Citizen Scientists Accelerates High-Quality Data Collection for Climate Change Research

Van Hyning, Victoria  
University of Maryland, USA  |  vvh@umd.edu
Bibeault, Britney  
University of Maryland, USA  |  bbibeaul@umd.edu
Purves, Michael  
Old Weather LibreOffice Calc, Canada  |  mapurves@hotmail.com
Heikes, Randi  
Old Weather LibreOffice Calc, USA  |  randi.heikes.g@gmail.com

ABSTRACT
We are a team of citizen science volunteers and academics presenting a case study about how long-serving Old Weather (OW) project volunteers left the leading citizen science platform, Zooniverse.org, and created their own opensource transcription tool to capture meteorological data from historic ship logbooks, for climate science. This project, built in LibreOffice Calc (hereafter LOC-OW) marks a transition from a hierarchical model of crowdsourcing to a co-productive model in which the roles of the volunteers and the original project owners shifted, the volunteers gained expertise and developed a sense of ownership over the data production tools and process.

KEYWORDS
Crowdsourcing; climate science; citizen science; transcription; opensource

INTRODUCTION
The value of a hierarchical model of crowdsourcing, whereby an organization creates a project and invites volunteers to perform defined tasks, is well-established (Brabham, 2013; Estellés-Arolas and González-Ladrón-de-Guevara, 2012), as is the value of co-productive models between organizations and volunteers (Hedges and Dunn, 2018; Ridge et al, 2021). Information about how crowdsourcing projects evolve from hierarchical to co-productive models, and how volunteers create tools as part of such a transformation, is less well-known. This case study details how OW volunteers created the LOC-OW tool, when they felt Zooniverse was no longer meeting their needs as a community of experienced transcribers.

Zooniverse is an online crowdsourcing platform hosting hundreds of research projects and >2.5 million registered volunteers. Most projects consist of short tasks performed by multiple volunteers independently, whose assessments are later aggregated (i.e. Swanson et al, 2016). Launched in 2010, Old Weather (hereafter Z-OW) was the first transcription project on Zooniverse, and one of the longest-running online citizen science projects in the world (Eveleigh et al., 2013; Blaser, 2014; Allen et al., 2021). Z-OW was a collaboration between climate scientists, naval historians, cultural heritage organizations, Zooniverse, and thousands of volunteers who have transcribed millions of weather observations from nineteenth- and twentieth-century ship logbooks.

From 2016 to 2022, <100 LOC-OW volunteers have provided >5.5 million weather record observations from >1.08 million lines of transcription in 209 log books (numbers supplied by Purves and Heikes). This is approximately 1.1 million more observations than those produced on Z-OW from 2010 to 2016, where 4,730 volunteers extracted 4 million observations from > 480,000 transcribed pages (Brohan, 2016). The data from both source-streams contribute to models of Arctic sea-ice coverage and climate retrospective analysis (Slivinski et al., 2019; Schweiger et al., 2019; Allan et al., 2021).

CHALLENGES
Text is a highly dimensional type of data that is open to interpretation: independent transcriptions vary and are hard to aggregate (Blickhan et al 2019; Van Hyning 2019). The question of whether volunteers should transcribe a whole page or extract specific values such as latitude,longitude added to these complexities in Z-OW from 2010-2016. OW PI Philip Brohan summarized these challenges: “The base problem is that the logbooks are written for human reading, not for machine analysis, so they don’t stick rigidly to the fixed and regular structure that we need to easily convert them to observational database records” (Email to the authors, 2015, quoted with permission).

Despite these challenges, participation in Z-OW from 2010-2016 was significant. Volunteers were motivated by the historical content of the logbooks, and the value of the data to climate science (Blaser, 2014; Marshall, 2019). Between 2010 and 2017, 4,821 volunteers completed >4.4 million weather observations from 189,124 pages of logbooks (Brohan, 2017a). These were quality checked by high-contributing volunteers or members of the science team, and fed into the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) model to improve climate reanalysis (Brohan, 2017b; Wood, 2020). Concerns about data aggregation, data quality, and some volunteers’ dissatisfaction with significant changes to Z-OW in 2015, led PI Kevin Wood and several long-serving volunteers to explore alternative transcription methods. Their goal was to reduce the number of transcribers required per logbook page from three to one, and to increase the pace and quality of data extraction.

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**VOLUNTEER-GENERATED SOLUTIONS**

In 2016, OW volunteers created a transcription interface for logbooks in the opensource tool LibreOffice Calc, (hereafter LOC-OW), which allows transcribers to overlay a customized transcription grid on an image of a logbook page downloaded from the National Archives in the USA. Volunteers alpha- and beta-tested versions with fellow volunteers, and the science team, who approved the method for use.

![Affordances of LibreOffice Calc (LOC-OW) version compared to Zooniverse OW (Z-OW)](https://catalog.archives.gov/id/167185355.; Figure 1. LOC-OW transcription interface overlaid on an image of a manuscript page from USS Lakawanna, 1/1867, https://catalog.archives.gov/id/167185355.;)

1. **Configurable images and transcription areas:** LOC-OW volunteers can rotate, crop, zoom, switch from color to grayscale, adjust brightness, contrast, and gamma variables, and align the weather grid overlay manually. Until 2021, Zooniverse did not support most of these functions for text, and does not support grid overlays.  

2. **Accommodate variation of logbook formats:** LOC-OW has custom templates to accommodate a wide variety of logbook formats. When new formats arise in the archival record, the volunteers who maintain LOC-OW can make changes quickly and release new versions faster than Zooniverse, which must balance the needs and infrastructure of hundreds of project teams, and millions of volunteers;  

3. **Autofill recurring data:** Because many entries repeat information, such as latitude and longitude when a ship is moored, LOC-OW volunteers created a shortcut key to allow users to autofill values. This can reduce errors by reducing keying;  

4. **Support narrative immersion:** LOC-OW volunteers can reserve parts of logbooks and enjoy the narrative and sense of progress of a single ship and crew, whereas Z-OW volunteers see pages in a random order and cannot go back to make changes, check spellings, etc.;  

5. **OW Forum:** LOC-OW is not the only Zooniverse spin-off project. Volunteers from LOC-OW and two other OW spin-off projects clubbed together to set up a new OW Forum. A similar forum was originally provided by Zooniverse to connect volunteers and researchers. Lead volunteers pay for this new forum subscription themselves, and have full responsibility for maintaining the forum. Macros in the LOC-OW spreadsheet enable volunteers to access dedicated help pages in the new OW Forum;  

6. **Automated data verification and visualization** Before the data are saved, an automated verification process checks for a valid date, location, and at least one entry in the PM weather column of LOC-OW pages. If any of the checks fail, a warning message is displayed, and the transcriber can remedy any errors, if they are able to do so based on the information they have. Two pages in the spreadsheet help transcribers visualize their work. One is a table of their weather entries, and the other is a graph of their pressure and temperature data. Automated data checking compensates for the use of only one volunteer in the transcription process, instead of three.

**FINDINGS**

These features increase transcription accuracy because volunteers can configure their workflow for each log page layout, and run basic data input checks before submission. The increased data accuracy led the PIs to waive the Z-OW requirement for three separate transcriptions per data point, and rely instead on one LOC-OW transcription. The customizability and affordances of LOC-OW have tradeoffs, however. Learning the system requires more time and effort than participating in the average Zooniverse project, which are all browser-based: LOC-OW volunteers must able to implement LOC-OW on their personal computers.

**IMPLICATIONS**

Long-serving volunteers develop needs and insights that cannot always be met by larger crowdsourcing platforms that must balance the needs of different projects, data types, teams, and volunteers, while managing technical debt. With the support of domain experts, volunteers may be better placed than anyone to create alternative systems that satisfy their own working preferences, and produce high-quality data for their expert partners. This process can be iterative, collaborative, mutually beneficial, and, in the case of LOC-OW, create a project that can withstand fluctuations in grant funding, and the passing of several key volunteers and science-team members. Though still serving the needs of researchers through their data collection work, the volunteers transitioned from using a hierarchical model created by Zooniverse and the research team, to a collaborative model in which they became the chief architects of their own transcription methods, forum space, and workflows.

**ACKNOWLEDGMENTS**

OW in all its forms has benefited from the passion and expertise of many people: volunteers, researchers, and Zooniverse staff. We dedicate this work to the memory of those we have lost, most recently PI Kevin Wood, and...
stalwart volunteer Joan McArthur, aka @AvastMeHearties, who was highly active in the OW forum, and various OW iterations, including a separate volunteer-generated project not discussed in this paper.

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Which Information Behavior Concepts Bridge the Gap from Research to Reference Practice?

VanScoy, Amy  University at Buffalo, USA  |  vanscoy@buffalo.edu
Merčun, Tanja  University of Ljubljana, Slovenia  |  Tanja.MercunKariz@ff.uni-lj.si
Hands, Africa  University at Buffalo, USA  |  africaha@buffalo.edu
Švab, Katarina  University of Ljubljana, Slovenia  |  Katarina.Svab@ff.uni-lj.si
Kuhar, Maja  University of Ljubljana, Slovenia  |  maja.kuhar@ff.uni-lj.si

ABSTRACT
Although there is much discussion of the theory/practice gap in library and information science, there is little research about how librarians use formal theory in their practice. Using a card sort and interviews, we explore the extent to which public librarians encounter or use theoretical concepts and models from information behavior in their reference practice. Results from our pilot study show that our procedures, including plain language descriptions of theoretical concepts and models printed on cards, are effective for eliciting examples of theory in practice. Librarians are clear about which concepts are relevant to their practice and can easily provide examples of real-world application. Results of the study will suggest which theoretical concepts might be most important for instructors to teach to students in reference courses and which translate best from the research to the practice environment. In addition, the examples provided by librarians of how they use the concepts in their practice will be useful for instructors as they try to engage students in learning.

KEYWORDS
Theory to practice; information behavior; reference work.

INTRODUCTION
The disconnect between theory and practice has been discussed for many applied academic disciplines, including information science (Bawden, 2008; Haddow & Klobas, 2004). Research in different areas of library and information science has, for example, shown that professional standards of practice do not value theoretical knowledge (Hicks & VanScoy, 2019), that papers written by librarians typically do not include theory (e.g., Julien & O’Brien, 2014), and that practitioners often view theory as distant from their practical work and of limited relevance to them (e.g., Wakeling et al., 2019). However, there is little research that examines the extent to which specific theoretical concepts and models are being used in practice. Wakeling et al. (2019) suggest that even if librarians do not see theory as relevant to their practical work, they might be using it implicitly to structure their existing knowledge or as a “silent and essential foundation” to practical work. Similarly, Bawden and Robinson (2022) argue that theory may contribute to the formation of librarians’ professional knowledge and that even when it is used in practice, practitioners may not regard it as such. Our research aims to explore this “silent foundation” by identifying which theoretical concepts and models are relevant to and used by librarians in their information service work.

PREVIOUS WORK
Although there is much discussion of the theory/practice gap in library and information science (e.g., Crowley, 2005; Kern, 2014), few studies have explored how librarians use formal theory in their practice. Using a survey, Schroeder and Hollister (2014) investigated American librarians’ familiarity with and use of critical theory. About two-thirds of the participants stated that they were knowledgeable about critical theory. These participants were to provide an example of how they used critical theory in their work. Participants were also asked about particular theorists and school of thought. The authors did not discuss whether the participants’ examples accurately applied critical theory.

Using interviews, Pinfield et al. (2020) studied whether open access theory was relevant to practice. Among other questions, they asked participants if theory “had informed their understanding of OA” and “how theory and informed their practical work”. They did not examine use of any particular theory, and by theory meant “research incorporating theory”. Their study included 36 participants from several countries.

Outside of library and information science, there are a few examples of studies in this area that use different methodologies from those in LIS. For example, Tsangaridou and O’Sullivan (2003) used observation of lessons, interviews, and discussions of scenarios to study the extent to which education theories guide the practice of physical education teachers. Kwenda, Adendorff, and Mosito (2017) used a guided reflection framework (formal, structured reflection with the aid of a facilitator) during focus groups to study student teachers’ use of theory in their teaching. Guided reflection and written narratives of a critical incident were used to study nursing students’ use of theory (De Swardt, Du Toit & Botha, 2012).

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The aim of this project is to explore the extent to which theoretical concepts and models are used or encountered in library practice. By analysing and comparing practices of librarians from Slovenia and the United States, it also seeks to get a broader perspective on the use of theory in different environments. As there are many theoretical concepts and models that exist in the field of library and information science, this study focuses on information behaviour concepts and models used by public librarians in their reference work and addresses the following questions:

- Which information behaviour concepts and models do public librarians see as relevant to their information service? How do they use or encounter them in practice?
- How does familiarity with and use of information behaviour concepts and models differ by country?

METHODS

This study uses a card sort technique and interviews to explore participants’ use of information behavior concepts and models in their reference practice. We selected 12 theories, models, or concepts from previous research on the topic (Lund, 2019; McKechnie, et al., 2005; VanScoy, Julien, & Harding, in press). We described each theory in one or two sentences using language accessible to librarians. A panel of four experts in the discipline reviewed the descriptions for accuracy and made suggestions for revision. The revised descriptions were printed onto cards for use during the interviews.

Participants for the study will be public librarians who have reference service responsibilities. They will be recruited using convenience and snowball sampling. At the time of this proposal, a pilot study has been conducted with five librarians, three from Slovenia and two from the United States. The pilot study confirmed that the procedures were effective but resulted in several additional revisions to the plain language descriptions. By the time of the conference, all data will have been collected and some preliminary analyses will be reported. This proposal reports procedures and results from the pilot study.

We met with participants for 30-60 minutes at a location convenient to them or online. We explained the study procedures and then asked participants to sort the cards according to the prompt: “Which of these concepts are relevant to your reference work?” For those that were relevant, participants were asked to provide an example from practice. After these questions, the participants were invited to turn the cards over to see the theory names if they were interested. If they recognized any of the theories or theorists, they were asked if they remembered how they learned about them. Participants were also asked to sort the relevant cards into like groups to show us how they perceived their similarities and differences. The interviews were audio recorded and transcribed and analyzed to determine whether the procedures were effective for answering the research questions.

PRELIMINARY RESULTS AND DISCUSSION

All of the participants in the pilot stated that Simon’s bounded rationality (1955) or “satisficing” was relevant to their practice, as was Belkin’s anomalous states of knowledge (1982) and Gross’ imposed query (1995). We are curious whether these three theories will be the most frequently mentioned in the actual study. All of the theories were considered relevant by at least two of the five participants in the pilot. This finding from the pilot suggests that the theories we selected for the study are effective.

Participants were able to sort the cards based on relevance to their practice. They easily provided examples of how the concepts surfaced in their practice for those that were relevant. This bodes well for upcoming data collection during the summer. We look forward to collecting examples of how these concepts bridge the theory/practice gap; a finding which will be useful for instructors as they try to make discussion of theory more relevant in the reference classroom. Most of the participants did not recollect the names of the theories or the theorists. However, some participants in the pilot study identified the concepts as something they had heard about during their studies. When presented with the names, some were also able to connect the names with a specific course where they had heard about the concept or model. For librarians who attended the same study program in Slovenia, their familiarity with the theories differed. Also, an American librarian who we know encountered some of these concepts in her reference coursework, did not recognize any of the theories or theorists. This finding suggests that relevant theories are likely to be used only implicitly even if they are introduced during a librarian’s coursework.

CONCLUSION

Results of the pilot study suggest that librarians use some information behavior concepts and models in their practice, but this use may be implicit. Identifying which theories are most commonly used in practice will suggest which might be most important for instructors to teach to LIS students in reference courses. It may also reveal which concepts translate best from the research to the practice environment. In addition, the examples provided by librarians of how they use the theories in their practice will be useful for instructors as they try to engage students in learning LIS theory. In addition to hearing out late breaking research results, visitors to the poster will be able to see the full list of theories used in the study, to handle the cards used for the study, and to see dendrograms of how participants sorted the cards.
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Between Realities: Information Sharing Practices of Deepfake Creators

Vera, Nick
University of South Carolina, USA | veraan@email.sc.edu

ABSTRACT
Deepfakes are AI-generated multimedia that convincingly graft or replace one person's likeness onto another, resulting in remarkably realistic yet fabricated content. These sophisticated manipulations challenge users' ability to discern factual visual information as they portray individuals engaging in actions and uttering words that never occurred. This research takes a unique approach by delving into the perspective of deepfake creators through the analysis of 15 tutorial videos on YouTube. By examining creators' information-sharing practices, this study aims to identify creators' motivations for disseminating knowledge on deepfake creation and their understanding or lack of understanding of the ethical implications of sharing such information. Achieving such an understanding can play a vital role in informing the development of regulatory measures. By examining creators' intentions and comprehending their societal impact, patterns, and characteristics, this research can contribute to the creation of effective detection technologies and strengthen content platform guidelines. Analyzing deepfake creation tutorials can facilitate the implementation of targeted and comprehensive regulatory measures, enhancing protection against potential risks and misuse.

KEYWORDS
Deepfakes, Information creation, AI-generated multimedia, YouTube, Ethics

INTRODUCTION
In 2017, deepfakes emerged on the Reddit page r/deepfakes, introducing the combination of artificial intelligence and machine learning to generate convincingly realistic manipulated images of human faces in motion. Created by often manipulating prominent figures, deepfakes have since come to blur the line between fact and fiction (Fallis, 2019; Hancock, 2021). Using neural networks trained on data from images, videos, and language associated with a particular person, deepfakes mimic facial expressions and swap features in images and videos (Westerlund, 2019). The increasing prevalence of deepfakes poses a threat to information consumption, with bad actors exploiting them for divisive propaganda and other nefarious political acts (Chesney & Citron, 2019; Janiesch et al., 2021; Masood et al., 2023; Westerlund, 2019). Not only do deepfakes impact political systems and prominent individuals, but they also manipulate everyday internet users. Interacting with deepfakes on social media leads to the adoption of false beliefs, while their advanced technology and realistic appearance evade detection by computers and humans (Ahmed, 2021; Wagner & Blewer, 2020; Wagner et al., 2023). Sharing deepfakes on social media amplifies the problem as platforms become conduits for their dissemination (Chan, 2016).

Efforts to combat deepfakes often overlook the crucial aspect of their creation. Creation concerning deepfakes can best be understood as either information or knowledge, where both are considered attributes used to describe or regard people, places, or things as being "informative," and in this particular case, instructional to be used in everyday life information practices (Buckland, 1991; Savolainen, 1995). Specifically, information or knowledge shared with others teaches the skills, steps, knowledge, or resources needed to create deepfakes. The creation of deepfakes involves sharing instructional information and knowledge through platforms like YouTube, offering step-by-step tutorials and access to resources such as open-source code and image libraries. However, concerns arise due to the potential misuse of deepfakes by bad actors to deceive or manipulate others (Fallis, 2019). Existing scholarship primarily focuses on the implications of deepfakes, with limited exploration of their creation and sociotechnical underpinnings (Ahmed, 2020; Anderson, 2018; Caramancion, 2020; Chesney & Citron, 2019; Grinberg, 2019; Valenzuela et al., 2019). In response, this research aims to understand the motivations of individuals who promote and share deepfake creations via their tutorials. It also evaluates ethical concerns related to consent, agency, and information surrounding the rapid rise of deepfake technology. Understanding these aspects is crucial for preventing further proliferation and addressing deepfakes within broader sociotechnical discourses (Garrett, 2016; Poché et al., 2017; Snelson, 2018). This ongoing research reports findings on the discursive underpinnings of deepfake tutorial videos, exploring the following questions: 1) How do YouTube deepfake tutorial creators frame, if at all, the ethical issues of disinformation or misinformation within their videos? and 2) What notable relationships exist between the identities of the YouTube deepfake tutorial content creators and how they discuss the ethical impact of deepfakes?

METHODS
Thematic analysis was used to examine deepfake tutorial content on YouTube and gain insights into the process of creating deepfakes as discussed and presented by content creators. The analysis involved identifying, analyzing, and interpreting recurring themes and patterns within the data to understand the central concepts and perspectives...
conveyed by creators in their tutorial content (Braun & Clarke, 2021). Data collection was conducted within a specific period to ensure relevance. To select the dataset for analysis, 73 YouTube videos were identified using phrase searching, including keywords such as "how to make deepfakes," "creating deepfakes," and "deepfake tutorials." These videos were sorted based on relevance and language, specifically English. From the dataset, 15 videos, constituting 20% of the total, were randomly chosen for coding and analysis, following the approach by Hayes and Krippendorff (2007). A constant comparison method, based on Glaser and Strauss (1967), was employed to code the data, facilitating a deeper exploration of emerging patterns within the content. Additionally, axial and focused coding techniques were utilized to condense the codebook and identify new coding patterns and categories, aligning with the scope of the research questions. Data analysis focused mainly on tutorial videos (i.e., video transcript and video descriptions) downloaded for each video. This approach afforded a richer understanding of the process of creating deepfakes, as discussed and demonstrated by content creators in their tutorials. Furthermore, inter-coder reliability (ICR) was ensured by testing with an additional coder familiar with the data, resulting in the production of a final codebook that enhances the study's robustness and consistency (Saldaña, 2021).

**FINDINGS**

**Content Creators:** Most videos featured audible voice narration by mostly masculine-presenting individuals, with some exceptions of feminine-presenting creators. European, Scandinavian, and American creators were more prevalent, but there was unexpected participation from non-Western creators. The visible creators appeared to be in their 20s or early 30s. These observed characteristics of the deepfake creators, including gender presentation, geographic distribution, and age, can be attributed to a combination of societal norms, existing gender imbalances in technology fields, regional technological advancements, accessibility to resources, cultural factors, and the appeal of emerging technologies to younger age groups.

**Deepfake Creation Methods:** Creators used various methods and software in the tutorial videos, including non-deepfake-specific software like Audacity, Photoshop, and Python. Deepfake code repositories like GitHub and GoogleColab were prominent, along with proprietary applications, particularly mobile apps. Pay-to-play deepfake sites were also mentioned, such as Deepfacelab.

**Images Used:** Source images in deepfake tutorials varied in terms of gender, race, and age, with political figures and celebrities commonly used. Tutorials discussing the dangers of deepfakes or personal use tended to focus on female and male individuals. One tutorial used images of an unidentified swimsuit model to demonstrate putting a Canadian social media influencer into compromising situations. The absence of explicit disclosure regarding the source of the image in the tutorial may stem from concerns about legal implications, privacy, and copyright. It can be inferred from the data that some creators prioritize technical aspects over sourcing details, assuming audience familiarity. However, this raises ethical concerns about non-consensual image use.

**Perception of Deepfake Technologies:** Tutorials aimed to show viewers quick and easy ways to create deepfakes, often without requiring coding knowledge. The technology was viewed as innovative and pervasive, normalized for everyday use and humor. Creators emphasized the desire for quick tutorials, suggesting a connection between success as a YouTube content creator and the presence of deepfakes in ICT spaces.

**Perceptions of Ethical Use:** Deepfake tutorial videos lacked ethical considerations, although creators mentioned policies against illegal use in GitHub repositories. The focus on ethics was generally absent, reflecting a perception of deepfakes as fun and novel rather than dangerous or fraudulent. One video addressed ethical concerns but seemed disingenuous in promoting exploitative use.

**CONCLUSION**

Historically, deepfake mitigation has primarily focused on detection and removal, leaving preventative measures addressing the human factor of deepfake creation largely overlooked. This project aimed to comprehensively explore deepfake tutorials on YouTube by examining the motivations and implications behind their creators' actions. Preliminary findings from this ongoing research indicate a concerning absence of ethics awareness among creators, potentially facilitating nefarious uses of deepfake information, such as pornography, blackmail, and disinformation. Additionally, findings highlight a lack of diversity in the creator demographic, with predominantly white presenting males and limited representation of female individuals. Moreover, the prevalence of using celebrities and individuals with extensive social media accounts with images, videos, and stories remain easy targets to be used in deepfake tutorials and deepfakes in general, further raising concerns over user data, privacy, and consent. To gain a deeper understanding, future research plans for this work will include interviewing and surveying content creators while collaborating with HCI experts, information professionals, and industry leaders to develop comprehensive ethical frameworks that can effectively prevent harmful implications of deepfakes. Taking a proactive stance, advocating for robust standards, and holding deepfake creators accountable are essential steps to effectively address this issue and curtail the proliferation of deepfakes in digital media and society.
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Nonsuicidal Self-Injury and Content Moderation on TikTok

Vera, Valerie  
University of South Carolina, USA | lookingv@email.sc.edu

ABSTRACT
Online nonsuicidal self-injury communities commonly create and share information on harm reduction strategies and exchange social support on social media platforms, including the short-form video sharing platform TikTok. While TikTok’s Community Guidelines permit users to share personal experiences with mental health topics, TikTok explicitly bans content depicting, promoting, normalizing, or glorifying activities that could lead to self-harm. As such, TikTok may moderate user-generated content, leading to exclusion and marginalization in this digital space. Through semi-structured interviews with eight TikTok users with a history of nonsuicidal self-injury, this pilot study explores how users experience TikTok’s algorithm to create and engage with content on nonsuicidal self-injury. Findings demonstrate that users understand how to circumnavigate TikTok’s algorithm through algospeak (i.e., codewords or turns of phrases) and signaling to maintain visibility on the platform. Further, findings emphasize that users actively engage in self-surveillance and self-censorship to create a safe online community. In turn, content moderation can ultimately hinder progress toward the destigmatization of nonsuicidal self-injury and restrict social support exchanged within online nonsuicidal self-injury communities.

KEYWORDS
Social media; Nonsuicidal self-injury; Content moderation; TikTok

INTRODUCTION
Individuals who engage in nonsuicidal self-injury (NSSI) commonly turn to social media platforms as a response to stigma in their offline environment (Seko & Lewis, 2018). Here, NSSI is defined as intentionally injuring one’s body tissue through cutting, scratching, burning, or bruising for nonsuicidal purposes (Klonsky et al., 2014). Social media platforms like TikTok have long afforded individuals who engage in NSSI a refuge to engage in discussions of NSSI, exchange social support, experience validation with little fear of stigmatization, and facilitate harm reduction (Dyson et al., 2014). However, TikTok’s algorithm restricts access to NSSI content, including referring users to suicide hotline numbers when they search for NSSI related content due to falsely conflating NSSI with suicidal ideation and spurious connections of NSSI to discredited social contagion claims (Lavis & Winter, 2020). Such content moderation constitutes algorithmic exclusion, which describes how algorithms adversely impact populations who do not engage in participatory norms (Simpson & Semaan, 2020), suggesting that marginalized populations will always need to navigate barriers to access and engage with information on any social media platform. In doing so, TikTok undermines the validity of individuals’ experiences with NSSI, further reifying deficit-based notions that view these individuals as failed bodies. This work reports on a pilot study investigating how TikTok users experience the algorithm to engage with NSSI information and addresses two research questions: 1) What are the motivations for TikTok users to seek, share, use, and create nonsuicidal self-injury information? 2) How do users circumnavigate algorithmic barriers to seek, share, use, and create nonsuicidal self-injury information on TikTok?

METHODS
Participants were recruited through a pre-screening questionnaire distributed on TikTok, Twitter, and Reddit, which confirmed participants were between the ages of 18-29, had a history of NSSI, and resided in the United States. A total of eight semi-structured interviews were conducted over Zoom. All interviews were audio recorded, transcribed verbatim, and returned to participants for member-checking. Data analysis followed an emic/etic approach, in which emergent inductive codes were generated from transcripts and matched to higher-level etic codes deductively applied from prior theoretical and conceptual work (Guba & Lincoln, 1994) on algorithmic exclusion (Simpson & Semaan, 2020) and digital marginalization (Haimson et al., 2021; Thach et al., 2022; Wagner et al., 2022). These codes were then merged into larger thematic categories (Table 1).

<table>
<thead>
<tr>
<th>High-Level Codes</th>
<th>Child Codes</th>
<th>Definition</th>
<th>Sample Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivations</td>
<td>Sense of community</td>
<td>Participant uses TikTok to build or facilitate relationships with other users</td>
<td>“[Nonsuicidal self-injury] content is more about promoting community and care, rather than the act itself.”</td>
</tr>
<tr>
<td>Protective information practices</td>
<td>Awareness of audience</td>
<td>Participant engages in self-surveillance and self-censorship of their content to protect other users</td>
<td>“I'll be telling a story, and it's the type of thing where I'll have a trigger warning at the top so [users] know what I'm talking about.”</td>
</tr>
<tr>
<td>Defensive information practices</td>
<td>Algospeak</td>
<td>Participant uses a code word or turn of phrase to evade content moderation</td>
<td>“Like I know you're not allowed to say kill or murder. You can't say it, so I say unalived.”</td>
</tr>
</tbody>
</table>

Table 1. Selected coding

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FINDINGS

Findings suggest that TikTok users work to destigmatize NSSI through normalizing discussions of NSSI on the platform. Participants noted how NSSI content on TikTok centers on sharing lived experiences, including stories of recovery (e.g., celebrating milestones of abstaining from NSSI) and finding humor in those experiences. Participants expressed how sharing lived experiences works to normalize discussions of NSSI. TikTok affords users a space to converse about these "taboo" topics, where users can create and view content as their way of coping. In addition to destigmatizing NSSI, participants cited community as a significant motivator for engaging with NSSI content on TikTok. Participants expressed that TikTok enables users to find common ground with others and learn they are not alone in their experiences. For participants, stories of lived experience and recovery serve as essential functions for facilitating a sense of community. Recovery stories provide a sense of relatability for participants, in which other users can verbalize something that participants have struggled to verbalize themselves.

Findings also suggest that participants believe the broad nature of TikTok's Community Guidelines shape NSSI content and, by extension, the strategies participants use to circumnavigate algorithmic barriers. Participants shared the belief that TikTok's Community Guidelines were created as "all-encompassing" over potentially harmful content, making the Guidelines feel more like an "umbrella" leading to flagging or removing content without a transparent reason. This lack of contextualization leads participants to carefully consider their content creation strategies, such as engaging in algospeak or signaling. Content is primarily distributed on TikTok through the For You Page, an algorithmically curated feed. Thus, having a following does not necessarily ensure that other users will see content. As such, this has led to a shift in participants’ information practices, namely that participants must tailor videos primarily towards the algorithm rather than a follower base, making abiding by content moderation policies more critical than ever. Thus, to avoid having their content removed or downranked by content moderation systems, participants adopt algospeak (i.e., codewords or turns of phrases) (Lorenz, 2022). Participants commonly referenced examples of algospeak, such as "unalive" (i.e., suicide) or "barcodes" (i.e., NSSI scars). Participants also engage in signaling, enabling them to indicate to other users that they are an insider of the NSSI community without explicitly referencing NSSI or using NSSI terminology. Particularly, participants commonly cited signaling NSSI through clothing, such as long-sleeved shirts, as members of the NSSI community understand that long sleeves are a means to conceal NSSI scars. As TikTok’s Community Guidelines ban content related to NSSI, including NSSI terminology, these strategies enable participants to maintain visibility on the platform. In this sense, participants learned the rules established by TikTok and articulated by its algorithms and formulated tactics accordingly. As such, participants do not violate Community Guidelines but rather play by the rules outlined in the Guidelines, recognizing this as a means of maintaining visibility.

DISCUSSION

Findings suggest that community is central to NSSI community members on TikTok. For participants, TikTok functions as a safe, destigmatized space to engage in discussions of NSSI by satisfying users’ self-targeted (i.e., individual) and socially oriented (i.e., communal) motives (Seko et al., 2015). Previous studies (Staniland et al., 2021) have discredited social contagion claims, which pose that exposure to NSSI content on social media can cause more users to engage in self-injurious behaviors. In fact, the analysis indicated that TikTok users were cognizant of the potential triggering nature of NSSI content and concerned themselves with reducing triggering content to protect themselves and other members of their community. Participants were aware of their triggers and purposely did not engage with content that could cause them distress while simultaneously recognizing that triggering content for them might serve as a coping mechanism for other users. Further, participants noted that community members engaged in self-surveillance and self-censorship to protect others within the community (Lavis & Winter, 2020).

CONCLUSION

This research contributes design recommendations that appreciate the individual impact of technological “solutions,” which conflict with current broad, population-level approaches to mental illness to be categorized as harmful content (Feuston & Piper, 2019). Design affordances, such as content moderation, perpetuate social control structures by focusing on identifying and mitigating information practices associated with NSSI. However, incorporating the subjective experiences of NSSI is an important component of understanding and validating the information produced by users in NSSI communities. By contextualizing the information practices of NSSI communities, product design teams can better understand the “normalcy and disruption for the individual” (Feuston & Piper, 2019, p. 10) and attend to how design for these communities fails. In this sense, product design teams should not obsessively focus on "fixing" NSSI, such as solely providing mental health resources or erasing its existence entirely, but instead should focus on supporting users’ experiences. Product design teams may accomplish this through a co-design process (Lee, 2008). In doing so, product designers can employ a stress case approach to highlight the sociocultural discourses embedded into technologies and account for the marginalizing outcomes produced by technological affordances.
REFERENCES


Beyond Boundaries: Unraveling the Interactions between Science and Technology through Linked Topics

Wang, Jiajie  
Nanjing University, People's Republic of China | 181820236@smail.nju.edu.cn

Hou, Wanfang  
Nanjing University, People's Republic of China | houwf@smail.nju.edu.cn

Wu, Keye  
Nanjing University, People's Republic of China | wky1221@smail.nju.edu.cn

Sun, Jianjun  
Nanjing University, People's Republic of China | sjj@nju.edu.cn

ABSTRACT
Understanding the interactions between science and technology (S&T) is crucial for driving major innovations. Previous studies have typically focused on identifying scientific and technical topics separately and analyzing their association through semantic or citation. In this study, we propose a novel approach to identifying linked topics that directly reflect the interactions within the S&T domain. Our approach integrates semantic characteristics and citation relationships, allowing for a comprehensive analysis of the specific content and structure of these interactions. We test our approach using a dataset of 2,821 patents and 4,626 papers from the field of genetic engineering vaccines, spanning the years 1980 to 2020. The results demonstrate that our approach provides a more direct and detailed understanding of the content and structural characteristics of S&T interactions. This research contributes to the methodology of linked topics identification in the field of S&T, offering new insights and analytical perspectives for related studies.

KEYWORDS
Science and technology linked topics; Graph representation learning; Document representation learning; Citation network; Network fusion

INTRODUCTION
Innovation in science and technology (S&T) interaction is crucial for economic growth and long-term goals. The complex interaction between S&T presents opportunities for major advancements (Chen et al., 2023; Yu & Yan, 2022; Ba & Liang, 2021; Xu et al., 2021). Existing research represents S&T innovation through papers and patents, using various methods to identify scientific and technical topics separately and analyzing their association through semantic (Xu et al., 2019; Ranaei, Suominen, & Dedehayir, 2017) or citation (Du et al., 2019; Ahmadpoor & Jones, 2017). However, these approaches have limitations in detecting deep cross-fertilization within S&T fields (Chen et al., 2023). To address this, the study proposes a novel approach that combines semantic characteristics and citation networks to identify linked topics of S&T, and further facilitates in-depth analysis of content and interaction structure. The approach is tested using 2,821 patents and 4,626 papers in genetic engineering vaccines from 1980 to 2020. The study enriches the methodology of identifying linked topics and interaction patterns in S&T, offering new knowledge units and analytical perspectives. This research promotes the study of cross-information identification of innovation patterns using S&T interactions, expanding the context and object of research in information science.

RESEARCH DESIGN
This study involves four distinct stages in the research process: data preprocessing, document representation learning, citation network construction, and identification of linked topics in S&T. To begin, keywords are extracted and refined from the titles and abstracts of papers and patents using the Doc2vec algorithm (Le & Mikolov, 2014). Following this, direct citation networks are constructed. We fuse the above two networks using Graph Auto Encoder algorithm (Dai et al., 2018). To evaluate the knowledge linkage between these vectors, cosine similarity is calculated. Finally, the Louvain algorithm (Blondel et al., 2008; Yang, Algesheimer, & Tessone, 2016), which is known for its efficiency and performance, is employed for topic identification. Additionally, the percentage of S&T coupling keywords within each identified topic serves as an indicator of the intensity of S&T interactions. These indicators are visualized over time to illustrate the evolution of each topic.

RESULTS
Following the above method, the results of S&T linked topics were obtained. The statistics found that the top 7 topics covered 97.22% of all papers and patents. The number of papers, patents and high frequency keywords within these topics are listed in Table 1. According to Table 1, the linked topics for S&T in the GEV field can be roughly divided into three types: (1) Science-oriented linked topics, such as topics 1, 4, 6, and 7, which involve various research objects in the field of GEV, including peptides, lymphocytes, DNA, bacterial strains, influenza, hepatitis, etc. There are some differences in the key research objects of different topics. (2) Technology-oriented linked topics, such as topic 2, which mainly focuses on inventions related to GEV. (3) Linked topics with relatively balanced

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distribution of S&T, such as topics 3 and 5. topic 3 has more patents and mainly focuses on chimeric antigen receptor, while topic 5 has more papers and mainly focuses on research related to Salmonella typhimurium attenuation and its use as a vaccine vector.

<table>
<thead>
<tr>
<th>ID</th>
<th>Papers</th>
<th>Patents</th>
<th>High frequency keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,249</td>
<td>150</td>
<td>cell, antigen, human, peptide, lymphocyte</td>
</tr>
<tr>
<td>2</td>
<td>134</td>
<td>1,084</td>
<td>vaccine, invention, virus, recombinant</td>
</tr>
<tr>
<td>3</td>
<td>393</td>
<td>685</td>
<td>antigen, cell, chimeric antigen receptor</td>
</tr>
<tr>
<td>4</td>
<td>874</td>
<td>103</td>
<td>vaccine, immune, DNA, antigen, virus</td>
</tr>
<tr>
<td>5</td>
<td>567</td>
<td>309</td>
<td>vaccine, antigen, strain, protein, salmonella</td>
</tr>
<tr>
<td>6</td>
<td>720</td>
<td>144</td>
<td>vaccine, virus, influenza, protection, vaccination</td>
</tr>
<tr>
<td>7</td>
<td>479</td>
<td>182</td>
<td>antigen, gene, expression, hepatitis, antibody</td>
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</tbody>
</table>

Table 1. Descriptive Statistical Analysis of Linked Topics

Differences in the distribution of the number of papers and patents within different topics are due to the pre-existing clusters within scientific and technological systems. The linked topics identified by the methodology of this study are influenced by the clusters within these single systems, resulting in science-biased or technology-biased linked topics. To demonstrate the evolution of the intensity of S&T interactions within the linked topics, we examine the changing trend of interaction intensity across seven linked topics. Figure 1 reveals that the interaction between S&T in the field of GEV can be divided into three distinct periods: 1980-1989, 1990-2009, and 2010-2020.

Figure 1. Time Evolution of Interaction Intensity of Linked Topics

During the initial period, topics 2, 5, and 7 exhibit high interaction intensity. Topic 2 focuses on technology-related research involving pseudorabies virus, adenovirus, and herpes simplex virus. Topic 5 explores strains related to the production of genetic engineering vaccines, such as Salmonella, Escherichia coli, Vibrio cholerae, and Shigella. Topic 7 centers on science-based investigations into hepatitis vaccines, particularly the development of the hepatitis B vaccine in 1981. This period exemplifies the integration of S&T. The second period, spanning from 1990 to 2009, displays fluctuations in the intensity of S&T interaction across topics, with topics 2 and 4 showing a decline while topics 1, 3, and 6 experience an increase. Topic 1 focuses on synthetic peptide vaccines, peaking in interaction intensity between 1995 and 1999. Topic 3 explores recombination vaccines, and topic 6 studies influenza vaccines. Topic 4 centers on HIV research, with a brief increase in interaction intensity around 1995 due to the invention of cocktail therapy. After 2010, the intensity of interaction in each linked topic shows either an upward or downward trend. Topics 1, 3, 4, and 6 exhibit an upward trend, indicating enhanced interaction in the fields of synthetic peptide vaccines, genetic engineering vaccines, influenza vaccines, and HIV research, respectively. However, topics 2 and 7 experience a downward trend, likely due to reduced intersection and interaction between S&T after reaching a certain stage of development. Topic 5 maintains a consistently high level of interaction intensity due to the significant overlap between S&T in this area.

CONCLUSION

This study focuses on identifying linked topics in S&T fields. The proposed method involves constructing knowledge associations within a public knowledge space using semantic characteristics and citation relationships. The study aims to understand the interaction patterns in specific fields. The framework's feasibility is validated using data from genetic engineering vaccines. However, limitations exist, including the network fusion part needs to add comparison experiments to verify the effectiveness of the fused features. Future work aims to enhance accuracy through deep graph neural networks, incorporate additional data sources, and test the method in other highly interactive fields like artificial intelligence and blockchain. At the same time, there is a need to explore the content and structure of related topics from more perspectives.
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Differences in Open Government Information among Departments with Different Responsibilities

Wei, Jingzhu  
Sun Yat-sen University, China | weijzhu@mail.sysu.edu.cn
Zhang, Tongrui*  
Sun Yat-sen University, China | zhangtr3@mail2.sysu.edu.cn (correspondence)

ABSTRACT
Although open government information awareness has enhanced since China implemented the Open Government Information Regulation, the complaints about the information disclosure work also increased. Previous research has ignored the impact of the department’s responsibilities on information disclosure, which are essential as some departments handle information that should not be disclosed. From this standpoint, this paper is the first to analyze the differences in departments’ open government information performance from their annual information openness reports. Variance and correlation analysis show that the potential harm of disclosure to third parties’ legitimate rights and interests, the availability of relevant information, and duplicate requests can explain their differences in government information disclosure on request. Besides, this paper calls for an elastic criterion for openness evaluation and finds that the benchmark effect in previous research does not apply to departments with different responsibilities.

KEYWORDS
Government information disclosure; Open government policy; Government department; Official responsibility

INTRODUCTION
Open government information (OGI) is vital in effective policymaking and stimulating public political participation (Grimmelikhuijsen et al., 2019; Piotrowski et al., 2016). The OGI Regulation of China issued in 2019 has optimized the OGI process and highlighted the departments’ responsibilities of OGI. Although open awareness is enhanced among departments (Dong, 2022; Geng & Zhou, 2020), complaints also increase due to administrative lawsuits instituted yearly. Considering the significance of information openness in guaranteeing the public’s right to know and improving government accountability and transparency, what impacts OGI must be answered first. OGI deterrents in previous research include internal factors such as leadership, openness willingness, politics, and ICT application, and external factors such as benchmark effect, law, media, demographic features, and stakeholders (Birskyte, 2019; Baldissera et al., 2021; Choi, 2018; Guillamón et al., 2016; Kosajan et al., 2018; Muñoz et al., 2017; Porumbescu et al., 2020; Spáč et al., 2018). As secrets and personal privacy are exceptions to OGI in most countries, government departments handling such information may indicate a lower OGI ratio. However, little research has investigated if the department’s responsibilities impact OGI. In this case, this paper first proves the differences in responses to OGI requests from different departments concerning non-disclosure reasons, before analyzing if such differences impact OGI on request through variance, Least-Significant Difference and correlation analysis.

Following the regulation, government information is “information recorded or retained by an administrative agency when performing its administration functions”. As the public can request OGI according to the regulation, government departments receive many OGI requests each year. Besides entirely disclosing the information, they can respond with a partial or non-disclosure decision. The reasons for non-disclosure decisions in the regulation include: “State secrets.” (R1); “Prohibited to be disclosed by laws and regulations.” (R2); “Harm to national, public and economic security & social stability.” (R3); “Harm to third parties’ legitimate rights and interests.” (R4); “About department’s internal affairs.” (R5); “Department’s process information.” (R6); “Administrative law enforcement files.” (R7); “Request should be an administrative inquiry.” (R8); “No relevant information.” (R9); “No ready-made information and the information needs to be made separately.” (R10); “The content is unclear after revision.” (R11); “Duplicate requests.” (R12); “Repeated requests without justified reasons.” (R13); “Information is in publications.” (R14); “Disclosed before.” (R15). The proportions of these circumstances faced by departments are related to their responsibilities, which are defined as the issues they cope with and are reflected by their official names. For instance, the Culture and Tourism Ministry is responsible for cultural and tourism issues, while the Education Ministry handles education-related affairs. The Chinese government has adopted the vertical leadership model in 12 departments (details in Figure 1 or Table 1). The daily issues these departments handle are professional and differ from each other. Thus, they are selected to represent departments with different responsibilities. More importantly, these departments have published formatted annual reports on OGI yearly since 2019, which include their responses to OGI requests. Therefore, data is collected from these annual reports on their official websites.

RESULT
Number of Requests & Proportions of Entire and Partial Disclosure
The number of OGI requests received varies significantly among the 12 departments. People’s Bank and Banking and Insurance Regulatory Commission receive most OGI requests, followed by Taxation Administration and

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Securities Regulatory Commission. Food and Strategic Reserves Administration, Administration of Foreign Exchange, and Tobacco Administration receive no more than 100 OGI requests each year. Variance and the Least-Significant Difference analysis are conducted to analyze the department’s differences in entire disclosure proportions (F=3.344, R=0.003) and partial disclosure proportions (F=3.321, R=0.003). The Meteorological Administration, Civil Aviation Administration, and Administration of Foreign Exchange respond most frequently with entire disclosure decisions. The frequency of partial disclosure from the General Administration of Customs is the highest, as shown in Figure 1.

Figure 1. Proportions of Entire and Partial Disclosure

Reasons for Non-disclosure Decisions
Variance and the Least-Significant Difference analysis indicate that non-disclosure reasons vary significantly among departments. Departments indicate differences in reasons for non-disclosure concerning R1 (F=2.299, sig=0.030), R2 (F=3.087, sig=0.005), R3 (F=2.733, sig=0.011), R4 (F=5.767, sig=0.000), R5 (F=2.277, sig=0.031), R6 (F=2.090, sig=0.047), R9 (F=4.184, sig=0.001) and R10 (F=9.384, R=0.000). No significant differences occur concerning R7, R8, R11, R12, R13, R14 and R15. The results of the Least-Significant Difference analysis are shown in Table 1, in which red indicates significantly higher proportions concerning each reason.

<table>
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<th>R1</th>
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<td>People’s Bank</td>
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<tr>
<td>Admin. of Foreign Exchange</td>
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Table 1. Differences in Reasons for Non-disclosure Decisions

Impact Factors of Government Information Disclosure
Pearson Correlation analysis shows that the entire disclosure proportion is negatively correlated with the frequencies of R4 (r=-0.307, sig=0.034), R9 (r=-0.359, sig=0.012), R12 (r=-0.292, sig=0.044), and R16 (r=-0.299, sig=0.039). However, no reason is correlated with the partial disclosure proportion. In this case, the potential harm of disclosure to the third parties’ legitimate rights and interests, the availability of relevant information to be disclosed and duplicate requests are the barriers to OGI, which can also help explain departments’ differences in OGI on request.

IMPLICATION AND CONCLUSION
With an innovative perspective, this paper enriches theories on OGI by analyzing the differences among departments in information’s entire disclosure, partial disclosure, and reasons for non-disclosure. Barriers and possible explanations of the department’s responsibilities impact on OGI include the potential harm of disclosure to the third parties’ legitimate rights, the availability of relevant information and duplicate requests. In this case, governments should improve citizens’ information literacy so that they can judge the departments that obtain the information and avoid repeated requests. As responsibilities impact OGI, this paper also contributes to the field by holding that government departments should improve OGI by considering their responsibilities rather than simply following others, which is considered a key impact in previous research. Further, the same requirements for OGI ratio and format of the report do not apply to departments with different responsibilities, while an elastic criterion for evaluation is needed.
ACKNOWLEDGMENTS
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New Online Form of Activity Organization in Promoting Cultural Participation: Evidence from Parent-child Activities by Jiading Library

Wei, Jingzhu  
Sun Yat-sen University, China | weijzhu@mail.sysu.edu.cn

Zhang, Tongrui*  
Sun Yat-sen University, China | zhangtr3@mail2.sysu.edu.cn (correspondence)

ABSTRACT
The ICT advancement and people’s increasing cultural needs have stimulated China’s online form of cultural activity organization. With highlights on such a new trend, this paper analyzes the impact of the newly-invented online activity organization form on the participation ratio of parent-child cultural activities, which are vital in China’s public cultural service system. Regression analysis indicates that the online activity organization form reduces the impact of limited available tickets and web browsing. It also relaxes the special time limit for public participation. Such an online form of activity organization deserves further attention considering its flexibility and convenience valued by the public.

KEYWORDS
Cultural activity; Online activity organization; Culture cloud platform; Information and communication technology

INTRODUCTION
The major public health emergencies have changed people’s approaches to satisfying their cultural needs. Although various platforms have been built in China to release public cultural resources and activities online, the emergencies are preventing the public from offline participation. In this case, China’s public cultural institutions have devised a way of organizing public cultural activities online with the application of apps including QQ, Tencent Conference and Ding Talk. As a new trend in public cultural services, the pros and cons of the online form need to be analyzed considering the significance of cultural services on an individual’s subjective well-being (Gotthardt et al., 2023). Although attention has been paid to culture and tourism integration, culture platform construction and COVID-19 (Gotthardt et al., 2023; He, 2018; Hakjun & Shik, 2023; Ma et al., 2018; Wu, 2019), little research has highlighted the online cultural activity organization form and its impact on cultural activity outcomes. As a critical component of reading promotion in public libraries, parent-child cultural activity refers to the cultural activity in which parents and children are invited in pairs to read fairy tale stories, create beautiful handicrafts and attend lectures on popular science knowledge. All these activities are of great educational significance for children to learn about the world and culture outside of school. In this case, this paper narrows the research gap by analyzing the impact of the newly-invented online activity organization form on the participation ratio of parent-child cultural activities. Regression analysis is adopted with ticket number, web browsing times and whether the event is on weekends (found to be the impact factors of cultural activity outcomes in previous research) as independent variables, participation ratio as the dependent variable and activity form as the grouping variable.

“Cultural Jiading Cloud” was built by Shanghai public cultural institutions in 2014 for cultural resource exhibitions and activity announcements. Since its operation, institutions including Jiading Library, Jiading Museum and Jiading Galleries have begun to release cultural activity information and provide ticket booking links through the platform. Besides, the platform has recorded the activity form, web browsing number, ticket number, participant number, activity announcement time and start time of each activity. This paper selected the parent-child cultural activities held by Jiading Library on the platform and collected the activity data held since 2020 with the Octopus Data Collector on February 10, 2023. Missing and repeated activities were deleted before 158 activities were obtained.

DATA ANALYSIS
Descriptive Statistics and Comparisons
Jiading Library regularly holds one offline parent-child activity per week since 2020, except from August 2022 to February 2023 when no offline cultural activities are held, as shown in Figure 1. Significantly more online activities are held during July/August and February, the summer and winter vacation periods in China. Although most activities are held on weekends when most people don’t work and have more free time, the activity form on each day varies significantly. Most activities on Saturdays are online, while only a tiny proportion of activities on Sundays are in the same form. Moreover, online activities account for nearly 1/5 of the weekday activities, as shown in Table 1.
Group Regression and Z Test
Group regression indicates that the online activity organization form has eliminated the impact of whether the activity is held during weekends on its participation ratio, as shown in Figure 2. Z-test also confirms the significant differences in the impact of the ticket number and web browsing number between the online and offline form.

<table>
<thead>
<tr>
<th>Day</th>
<th>Online Percentage</th>
<th>Offline Percentage</th>
<th>Number of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td>3.85%</td>
<td>96.15%</td>
<td>26</td>
</tr>
<tr>
<td>Weekday</td>
<td>21.43%</td>
<td>78.57%</td>
<td>28</td>
</tr>
<tr>
<td>Saturday</td>
<td>88.46%</td>
<td>11.54%</td>
<td>104</td>
</tr>
</tbody>
</table>

Table 1. The Proportion of Parent-child Activities Each Day

DISCUSSION AND CONCLUSION
The ticket number positively impacts the participation ratio of cultural activities. Participants’ probability of successful ticket booking will increase with more available tickets. Such an increase will stimulate their attention to the activity information and active participation in related activities, increasing the participation ratio of each activity. Compared to offline activities, however, online cultural activities are under the assistance of social media apps, making it possible for the organizers to invite more participants. The participants no longer worry about missing activities due to the lack of tickets, which leads to the relaxation of the available activity ticket restrictions on the participation ratio.

Whether the event is held on weekends and announcement advancement also affect the participation ratio of cultural activities. Most parents and children work or go to school from Monday to Friday, making it difficult for them to spare time for cultural activities on weekdays. This also explains why most offline cultural activities are held on weekends. Although people have more free time on weekends, they have much to do besides participate in cultural activities in person. Therefore, the earlier the activity information is announced for offline activities, the easier they feel to arrange the schedule and participate in the activities that interest them, which increases the participation ratio of cultural activities. Compared to offline activities, online cultural activities do not require advanced booking due to sufficient tickets. The public can log in to the platform to inquire about cultural activities and book tickets whenever they are free on weekdays. Moreover, the online form also reduces the time cost to travel to and from public cultural venues, making it possible for the participants to attend a lecture or book-sharing program to satisfy their cultural needs if they have limited free time. Therefore, whether the event is held on weekends has a significantly reduced impact on the online cultural activity participation ratio than that of offline activities, and this online form of cultural activity organization also eliminates the constraint of announcement advancement on the cultural activity participation ratio.

This paper contributes to the research field by introducing cultural activity forms into the impact system of cultural activity performance. The online activity organization form can provide more entrance tickets, attract more attention and eliminate the time limit for the public to participate. People prefer to participate in offline cultural activities on weekends, but this does not apply to their preference for online cultural activities. On the contrary, they are willing to participate in online cultural activities during weekdays to meet their cultural needs with a flexible schedule. Moreover, activity announcement in advance has no impact on the participation ratio of online cultural activities. An explanation for this might be the convenience such a new form of cultural activity organization provides and the reduced time the public needs on transportation. Therefore, such a newly-invented form of online activity organization deserves more attention in the practice field to satisfy the cultural needs of the public flexibly and conveniently.
ACKNOWLEDGMENTS
We thank all the volunteers and all publications support and staff who wrote and provided helpful comments on previous versions of this document. Besides, we gratefully acknowledge the grant from the National Social Science Foundation of China (key project, No.18AZD036).

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Multilingual Knowledge Organization of Cultural Routes: The Case of the Grand Canal

Wen, Xinyue  Wuhan University, Wuhan, China | stellawen@whu.edu.cn
Liang, Shaobo  Wuhan University, Wuhan, China | liangshaobo@whu.edu.cn
Wu, Dan  Wuhan University, Wuhan, China | woodan@whu.edu.cn

ABSTRACT
This study collects heterogeneous information from multiple sources related to the Grand Canal, a cultural route in China, to construct a multilingual ontology of the Grand Canal. The research designs a data translation, optimization, and multilingual ontology construction method to reveal the internal and external characteristics and associations of the Grand Canal, which can provide users with multilingual and ordered knowledge of the cultural route, providing a feasible solution for digital preservation and global sharing of the cultural routes. On this basis, a multilingual knowledge service system is built.

KEYWORDS
Cultural routes, multilingual ontology, multilingual knowledge service system

INTRODUCTION
Cultural routes are channels of human interaction and migration that contain communities of tangible and intangible cultural heritage. They are one of the most important types of cultural heritage. The Grand Canal is a highly representative cultural route in China, which contains various closely related and long-standing cultural heritage, including water facilities remains of the canal, attached remains of the canal, and canal-associated heritage. In the conservation of the Grand Canal, the introduction of multilingual knowledge organization tools can help to explore the internal and external connections of cultural heritage, provide innovative ways of presenting cultural heritage, break the temporal and spatial limitations of traditional cultural routes conservation, and promote the international learning and dissemination of canal culture. Therefore, this study takes the 58 world heritage sites of the Grand Canal as an example to sort out the knowledge of cultural heritage, introduce knowledge organization tools such as multilingual ontology and knowledge graph, and build a Canal Culture Multilingual Knowledge Service System (CCMK, http://hcicc.whu.edu.cn/) as an innovative application of multilingual ontology on this basis.

RESEARCH DESIGN
This study explores the organization and visualization of cultural heritage sites of the Grand Canal according to the technical path of the data layer-semantic association layer-application display layer, using methods such as multilingual ontology and knowledge graph, and its primary technical approach is shown in Figure 1.

This study integrates text and image information from libraries, museums, and web pages at the data layer, determines a unified standard for processing heterogeneous data from multiple sources, and finally stores it in a database as a data table. At the data translation and optimization stage, this study selects English, French, and Japanese as the target languages. It adopts a translation scheme based on multiple data sources to translate culture-specific items and domain terms into a reference glossary. Then, post-translation editing experiments were conducted on the reference glossary to form a multilingual corpus of canal culture.

In this study, Protégé software is used to construct a multilingual ontology of canal culture at the semantic association layer, and convert OWL files into an RDF format that is easier to manage and store. RDF files are eventually stored using a neo4j graph database that better represents entities, attributes, and relationships.

This study builds CCMK with corpus and ontology data support at the application presentation layer. The front-end technologies include HTML, CSS, Javascript, and JQuery; Java implements the back-end functions; and the database uses MySQL for data storage. The knowledge graph function is implemented by neo4j with the front-end visualization script neovis, and the panoramic map of the canal is drawn using the Canvas drawing tool.

MULTILINGUAL ONTOLOGY CONSTRUCTION AND VISUALIZATION
The construction of multilingual ontology is the technical core of this study. Data translation and optimization and ontology model construction are critical tasks. At the data translation and optimization stage, this study adopts a translation scheme based on multiple data sources, incorporating various types of web data sources such as machine translation software, tourism websites, maps, search engines, encyclopedias, and thesauruses, and finally builds a high-quality reference glossary. To ensure the accuracy of the translation, this study adds translation optimization to the data translation. On this basis, English, Japanese, and French postgraduate students were recruited to post-translation editing, edit and revise the reference glossary derived from machine translation, and conduct multiple rounds of proofreading and discussion to form a multilingual corpus of canal culture to meet translation quality...
standards. In the process of ontology model construction, this study mainly refers to CIDOC CRM, CDWA: Archaeological and other ontologies and word lists, reusing their mature class relationship structures and combining them with the characteristics of canal culture to construct canal culture ontology. Among them, the core class is the Canal Cultural Heritage class, which contains a sub-category Type class to organize the canal culture heritage by category, and the rest of the classes include the Place class, Time-Span class, Event class, and Actor class. The Place class contains sub-categories of Address class and Region class, and the Region class is used to label the administrative divisions such as province, city, district, and county where each canal heritage is located to establish the location association between canal heritage sites. In this study, object properties reveal the association between core classes, and data properties disclose long textual information related to canal culture, such as the history, characteristics, and functions of cultural heritage. Among them, the instances in the ontology are presented as nodes in the knowledge graph, the lines between the nodes are object attributes, and the contents annotated with data attributes can be viewed in the node information.

Based on the multilingual ontology, this study constructs a CCMK which supports cross-language retrieval and the graphical visualization of retrieved content. The system is divided into four major sections: Canal Panorama, Canal Remains, Canal Illustrations, and Canal Literature. This system has the following advantages: (1) Support for multilingual visualization of canal culture: In the section on Canal Remains and Canal Literature, the system has set up a multilingual display function, which can be used to cross-reference information in multiple languages, facilitating the use of multilingual users and providing support for multilingual users to learn canal culture. (2) Support for knowledge graphs of search results: Search results and their knowledge graphs appear simultaneously in the system. The knowledge graph allows users to understand the connections within the heritage and to explore the content further through the links. Combining text and knowledge graphs gives users a more intuitive overview of the canal's remains and their associations. (3) Support user interaction with system content: CCMK provides a panoramic view of the canals on a map, and users can access information on heritage sites in the corresponding province by clicking on the node. In addition, users can collect information on Canal Illustrations and Canal Literature to build a secret canal knowledge base. This interactive operation gives users a fresher sensory experience and increases their sense of engagement and knowledge acquisition.

![Image of CCMK Construction Flowchart and Page Views](image)

**CONCLUSION**

In this study, we take the Grand Canal as an example to explore the intrinsic associations of cultural routes, construct a multilingual ontology, and build a CCMK to apply the multilingual ontology. In future research, we will expand the canal culture corpus, dig deeper into the knowledge of the cultural routes domain, correlate more content such as canal celebrities and canal poetry collections, and gradually form a system with a rich range, well-organized and broad audience.

**ACKNOWLEDGMENTS**

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HERU Ontology for Linking Chinese Classics Texts and its Commentaries

Weng, Mengjuan
Wuhan University, People's Republic of China | mengjuan_weng@whu.edu.cn
Hou, Xilong
Qufu Normal University, People's Republic of China | houxilong2008@163.com
Lei, Jueying
Wuhan University, People's Republic of China | jueyinghi@163.com
Wang, Xiaoguang
Wuhan University, People's Republic of China | wxguang@whu.edu.cn

ABSTRACT
Commentaries are derivative texts formed by commentators’ interpretations of classics texts, which not only reflect the commentators’ understanding and values in their era but also play an irreplaceable role in contemporary people's understanding of classics texts. At present, the literature in which commentaries are written collected by the library is organized in commentator-centered and it is difficult to efficiently collect all the commentaries of the same classic texts and analyze the citations in the annotation texts. The development of Semantic Web technology has changed the way of knowledge representation and provided new ideas and methods for the organization and sharing of commentaries. We use the seven-step method to design the HERU ontology. Finally, we conduct a semantic annotation experiment using some commentaries of the Analects of Confucius as an example to illustrate the practicality of the ontology in constructing annotation diachronic evolution and citation data. This study is of great significance to the inheritance and interpretation of Chinese classics and has reference significance for the semantic management between classic texts and their commentaries in other countries.

KEYWORDS
Chinese classic texts; Commentaries; HERU ontology; Knowledge Organization; Knowledge Graph

INTRODUCTION
Chinese Classics are significant because they reflect the cultural value orientation of the Chinese people. Commentaries are derivative texts formed by commentators’ interpretations of classics texts (Figure 1 shows an example of the text structure of one Zhushu document related to the Analects of Confucius.,) which not only reflect the commentators’ understanding and values in their era but also play an irreplaceable role in contemporary people's understanding of classics texts. In the Chinese context, Chinese Classics are called “original documents(原典)” , and the books in which commentaries are written are called “Zhushu Documents(注疏文献)”. Zhushu documents are organized in commentator-centered, that is, the commentaries of one or more classic texts by the same commentator are compiled in one book. In other words, the commentaries of the same classic texts are still scattered in different literature in the form of printed books or digital versions, which makes it difficult to access, read and analyze commentaries. In addition, commentators have the habit of "quoting the classics and using the allusions” (Shu, 2019) when commentating, which is important in teasing out the inheritance and evolution of ideas but gets little noticed in modeling (Ma, 2013).

METHOD
We use the seven-step method (Noy, 2001) to construct the ontology, which is named HERU ontology.

Figure 1. The text structure of one Zhushu document related to the Analects of Confucius

The development of Semantic Web technology provides a solution to the above two problems. Based on the digital version of ancient books, building a data model and using the model to build knowledge bases such as knowledge graphs or linked data, and then to support digital reading and digital humanities research, is also becoming an issue (Zeng, 2019). Starting from these considerations, we focus on two aspects: (1) design an ontology model for linking classic texts and their commentaries to realize the automatic compilation of commentaries in different Zhushu documents of the same classic text; (2) The separation of citations from commentaries should be realized in the ontology to realize the modeling of citation relationships.

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THE HERU ONTOLOGY

HERU ontology includes 4 first-level classes, 4 second-level classes, and 10 attributes (See Figure 2(a), Peroni, 2012; Daquino, 2020). The main content of the model contains: Who made what commentary to the original texts the predecessors wrote and when? who wrote the original texts and commentaries and when? And what ancient books do the original texts and commentaries come from? Four kinds of knowledge units are defined: interpretation unit formed by an instance of the InterpretationObject class and an instance of the InterpretationResult class through the hasInterpretation relation, reference unit formed by an instance of the InterpretationResult class and an instance of the Citation class through the cito:cites relationship, source unit for describing the source of the texts (including three attributes: dcterms:creator, prov:hadPrimarySource and hico:isExtractedFrom), and alignment unit which is represented by owl:sameAs and aims to establish links between texts with different sources but similar or identical content. HERU ontology supports the construction of author citation networks, citation sentence networks, and ancient book citation relationship networks through reasoning (see Figure 2(b)). The HERU ontology file has been released to http://dh.whu.edu.cn/heru/.

USE CASE

We use HERU ontology to semantically annotate some Zhushu documents related to the Analects of Confucius, as a sample corpus for describing the application (The corpus is stored in GraphDB in RDF format and can access at http://dh.whu.edu.cn:7481/). There are two typical use cases. (1) reference relationship inference (see Figure 3(a)): We obtained citation data based on inference. This means that it is possible to automatically obtain data for different levels of citation analysis, and (2) diachronic evolution of commentaries (see Figure 3(b)): We formulate the SPARQL template to retrieve all the commentaries of specific sentences and arrange them in chronological order to obtain the diachronic evolution. The missing values in the results can be used as the direction in compiling and editing scattering documents and manuscripts.

CONCLUSION

This paper designs HERU ontology for representing commentaries. This ontology links complex Zhushu documents and classic ancient books through interpretation and citation relationships. It can not only achieve cross-text association and semantic representation at different granularity levels, making it possible to obtain the diachronic interpretation of the same classic text; it also makes it possible to measure and analyze citations at different levels. The limitation of the research is that we don’t define the value range of attributes such as, genreOf, functionAs and typeOf, which also is our future research direction.
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Academic Casualization, Precarity, and Information Practices: Initial Findings

Willson, Rebekah
McGill University, Québec, Canada | rebekah.willson@mcgill.ca
Stewart-Robertson, Owen
McGill University, Québec, Canada | owen.stewart-robertson@mcgill.ca
Julien, Heidi
University at Buffalo, USA | heidijul@buffalo.edu
Given, Lisa M.
RMIT University, Australia | lisa.given2@rmit.edu.au

ABSTRACT
There is increasing recognition of the challenges academics working on short-term contracts experience, as well as universities’ increasing reliance on their labor. While discussions of these issues have expanded, there is a lack of empirical research around the information experiences of contract academic staff. This poster reports on initial findings of a qualitative research project that interviewed 34 contract academic staff (CAS) from across Canada, exploring institutional provisions of information, information practices in the workplace, and how marginalization and social inclusion influence workplace information practices. We present preliminary findings in three themes: precarity and uncertainty necessitate holistic and situational understandings, exclusion and isolation are enacted and experienced on many levels, and uncertainty as a barrier to investment and furthering careers, exploring what these findings mean for contract academic staff members.

KEYWORDS
casualization, precarity, information practices, information marginalization, academic staff

INTRODUCTION
Around the world, academics working on short-term contracts make important contributions to teaching and research in higher education, yet they often experience increasingly precarious and challenging working conditions (e.g., Kezar et al., 2019; Zheng, 2018). Working on limited contracts, frequently with little certainty or continuity between appointments, contract academic staff (CAS) (also known as adjunct faculty, sessionals, contingent faculty, etc.) are often marginalized (Lopes & Dewan. 2014) within their academic units and not given the information, resources, or supports needed to successfully complete their work and develop their careers (Heffernan, 2018; Willson, 2016). Despite concerns about resulting impacts on quality of education (Riddell, 2017) and the profound and differentially experienced effects on the professional and personal lives of CAS (Loveday, 2018; Willson & Julien, 2020), universities are increasingly reliant on CAS for teaching (al-Gharbi, 2020) and their bottom lines (Smithers et al., 2021). Moreover, while often still desiring tenure-track appointments, CAS increasingly remain in such positions long-term (Spina et al., 2022), shattering myths of such work as a steppingstone to full-time employment, limiting their possibilities for advancement, and compounding the impacts on their personal lives.

Despite increased attention in recent years, a scoping review conducted by the research team (Willson et al., 2022) found a dearth of empirical research and a lack of studies exploring the information practices of CAS. To address these gaps, this research addressed the following research questions: (1) How do CAS negotiate their information environments in order to situate themselves in their workplaces and career trajectories? and (2) How does perceived career instability and marginalization influence the information practices of CAS?

METHODOLOGY AND METHODS
Approaching the problem of academic casualization from an information practices perspective, this study broadly views workers’ information experiences as involving complex cultural, historical, embodied, and situated practices (e.g., Lloyd, 2007; Olsson, 2013). The information marginalization (Gibson & Martin, 2019) and information precarity (Stewart-Robertson, 2022) experienced by many academic workers further complicates information practices, as CAS often exist in unstable, isolated, and liminal spaces, experiencing multiple contexts simultaneously or serially. Thirty-four in-depth semi-structured interviews were conducted between February and May 2023 with contract academic staff in Canada. Participants had varied disciplinary backgrounds, years of experience (from less than one year to more than 25 years), and contract lengths, though the majority had contracts of less than a year. The interviews explored participants’ perceptions of their precarious working conditions including institutional provision of information, information practices used in the workplace, facilitators and barriers to information, and how marginalization and social inclusion influence workplace information practices. Reflexive thematic analysis (Braun & Clarke, 2006, 2019) was used to analyse interview transcripts, involving deep engagement with the data and systematic and recursive approaches to generating initial codes and developing themes.

PRELIMINARY FINDINGS
As part of an ongoing study seeking to increase understanding of their information experiences, this poster presents initial findings from semi-structured interviews with contract academic staff (CAS).
Precarity and Uncertainty Necessitate Holistic and Situational Understandings

That's pretty well two weeks’ notice that there's no teaching. What do I do in that situation? I think part-timers are very crafty about always having a backup plan or being able to get a grant or find other employment or something. But with two weeks’ notice, it's just horrible . . . it was almost traumatic . . . I'm trying to figure out if I even have a job to return to when I come back. It just felt so incredibly uncertain. And of course, my partner is there picking up the emotional pieces of all of that. There's the level of stress that I think is just kind of a constant.

This situation described by “Cara” points to the complexity of the circumstances many CAS navigate. In response to challenging situations, overarching uncertainty, and a lack of institutional support, participants described difficulties managing professional duties and information needs, as well as dealing with the affective dimensions of their jobs. In the interviews conducted, structural issues around how universities are organized and operate appear as intertwined with wider political and economic realities, the material conditions, and the social and emotional lives of participants. The complexity of their situations thus requires addressing CAS’ experiences holistically (Polkinghorn & Given, 2021), entangled with structures, power dynamics (Costello & Floegel, 2021), and the multiple ways in which precarity is induced and experienced, to better understand and support their information practices.

Exclusion and Isolation Are Enacted and Experienced on Many Levels

I know there are programming changes coming, but again, contract folks are not getting that kind of information . . . Those [are the] kinds of pieces of information that would make people feel included but also make them do their jobs better.

“Avery” noted shortcomings in receiving necessary workplace information. Being excluded from departmental meetings, internal communications, course planning, and professional development, many participants felt isolated in their workplaces and, for some, this isolation stemmed from a “lack of respect.” For many, the complexities of situations were compounded by the multiple ways CAS are isolated, including through institutional information practices, by feeling diminished and disrespected, and through limited access to the spaces and resources needed for their work. Multiple participants described how their information-related activities were shaped by a lack of physical access to information sources. For example, “Ari” described the consequences of not having an office, “I have students that want to review their midterms and meet about their papers and whatever else, and I don't have space.” Being physically and socially excluded from workplaces means CAS miss out on important information shared in various ways, such as through information grounds (Fisher et al., 2007) and sharing information between colleagues (e.g., Willson, 2018).

Uncertainty as a Barrier to Investment and Furthering Careers

Sometimes you don't put as much of an investment in because you don't know if you're going to be here next semester.

“Jill” was one of many participants who adapted their information practices to uncertain employment conditions, wary of investing too much in a job that could be changed or cancelled without warning. Despite often noting love for their work and subject areas, several participants mentioned being reticent about investing too much time, energy, or resources into institutions that invest little in their casual employees. Instead, participants described having to work in new ways to allow them to fulfill their contracts without stretching themselves too thin. However, for many participants, this meant going against inclinations toward engaging deeply with their work. This further demonstrates how individuals’ information practices are rooted in and reflect structures and power relations (Huttunen, 2023; Ortiz-Myers & Costello, 2021). Without changes to contracts and working conditions, stresses and uncertainty may force many CAS, particularly those without secondary incomes or family support, to abandon the careers they desire. However, some participants did note that some relatively simple changes could foster stronger connections, helping to manage uncertainty and support positive information practices.

CONCLUSION

Academic casualization has far-reaching implications for CAS, including their information experiences and practices. Particularly important to how their information practices are expressed is understanding CAS’ experiences of exclusion and isolation, and how this influences their investment in their work. Precarity and uncertainty exert significant pressures, and resulting complexities require broader, more holistic conceptualizations of the information experiences of CAS in order to develop new strategies for supporting their information practices and academic careers. To further understand the varied and dynamic situations of CAS, subsequent phases of this research project will involve in-depth, semi-structured interviews with university department chairs and analysis of social media postings.

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Novels and the NSTC: A Quantitative Study of Legal Deposit

Wingate, Alexandra Indiana University Bloomington, USA | alewinga@iu.edu

ABSTRACT
The Nineteenth-Century Short Title Catalog (NSTC) attempts to provide comprehensive coverage of the print record in the English-speaking world from 1801 to 1918 based primarily on the catalog records of Britain’s five legal deposit libraries during the 19th century. Previous studies have used the NSTC to quantitatively study broad trends in Victorian-era British publishing, but they have not sufficiently acknowledged the NSTC’s limitations. This study works within the NSTC’s limitations by using it to quantitatively study the phenomena of legal deposit. Analysis of two, 90-volume random samples of first edition English novels reveals the impact of changing library acquisition practices and legal deposit legislation on the comprehensiveness of Britain’s legal deposit libraries, as well as the NSTC’s comprehensiveness and how it can be utilized for quantitative book history despite its deficiencies.

KEYWORDS
Quantitative book history; Legal deposit; Publishing; Digital humanities; Bibliographic data

INTRODUCTION
In the 19th century, five libraries held legal deposit privileges in Britain: the British Museum (now British Library), Oxford University’s Bodleian Library, Cambridge University Library, the Library of the Faculty of Advocates in Edinburgh (now National Library of Scotland), and Trinity College Dublin in Ireland. Legal deposit entitled these libraries to free copies of all books published in Britain, and so they should hypothetically contain copies of all 19th-century British books. Following this hypothesis, the Nineteenth-Century Short Title Catalogue’s (NSTC) editors combined the catalog records of these five libraries plus those of the Library of Congress, Harvard University, and the University of Newcastle in order to document all books published from 1801 to 1918 in Britain (NSTC, 1983).

As a result, scholars have used the NSTC to quantitatively study British publishing to reveal general trends and estimate novel publishing rates, though sometimes without sufficient consideration of the NSTC’s limitations (Eliot 1998; Riddell & Betancourt, 2021). The NSTC’s comprehensiveness and quality as a dataset are suspect due to its reliance on relatively few libraries, use of catalog records instead of examining physical books (the usual practice for creating high-quality bibliographies and short-title catalogs), numerous duplicate records, and lack of editing (Alston, 1984; McKitterick, 1987; Shatock, 2004; Suarez, 2009). These limitations can be mitigated, however, by using the NSTC to specifically study legal deposit instead of Victorian publishing more generally, since it is essentially a union catalog of the deposit libraries’ collections.

Previous scholarship demonstrates 19th-century British legal deposit was often not perfectly implemented, which implies neither the legal deposit libraries nor the NSTC are likely to be completely comprehensive (Eliot, 2000; Feather, 1988; Feather, 1994; Field, 2022). Looking at novels specifically, publishers generally registered novels for copyright and deposited them as a way of protecting their intellectual property, meaning deposit libraries should have good coverage of first edition novels. However, libraries sometimes refused copies sent by publishers or replaced earlier editions with later ones because novels were not desirable acquisitions for their scholarly collections (NSTC, 1983). Following Field (2022), who compares lists of legal deposit books rejected by Oxford and Cambridge from 1818 to the NSTC’s holdings to find patterns in these rejections, this study uses the NSTC to investigate the legal deposit of first edition British novels in English through the following research questions:

1. How comprehensive was legal deposit libraries’ acquisition of first edition English novels in 19th-century Britain?
2. What factors contributed to the absence or presence of first edition English novels in British legal deposit libraries?

METHOD
Two, 90-title random samples of first edition novels published in English in Britain were selected from records of the database At the Circulating Library (ATCL). ATCL is a bibliographic database aiming for complete coverage of first edition novels published in Britain for 1837-1901. Unlike the NSTC, it relies on a variety of bibliographic resources versus legal deposit (Basset, 2023). One sample was drawn from ATCL’s records for 1838 and one from 1862 because these are the most complete years in the database and, therefore, most likely represent the complete population. In addition to data provided in ATCL records (title, number of volumes, publication information, author information), each title was coded for price, format (size), and whether the NSTC indicates it was held by each of the five libraries. The data was then analyzed for statistically significant associations between coded variables within each sample and between samples (i.e., to compare 1838 to 1862) using Fisher’s exact test due to the test’s appropriateness for small sample sizes of categorical data.

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FINDINGS AND DISCUSSION

Comparing 1838 and 1862, the NSTC (“All libraries”) and the legal deposit libraries individually, except Trinity, improved in terms of whether or not they held a title (Figure 1). However, the Fisher’s exact tests comparing 1838 and 1862 were significant ($\alpha < 0.05$) only for whether an NSTC record existed for a title (meaning it was held by at least one library), whether a title was infrequently or frequently held by the deposit libraries (0-2 libraries vs. 3-5 libraries), and for the British Library (BL) (Figure 2). This suggests an overall improvement in legal deposit libraries’ acquisition and retention of novels and therefore the NSTC’s comprehensiveness later in the century, but one primarily driven by the BL.

Multiple factors likely contributed to the BL’s success, with just one missing title from the 1862 sample versus eight in 1838. First, as the nation’s library, the BL could convince legislators and publishers they deserved a copy of every book (McKitterick, 1986). Second, the 1842 Copyright Act stated the BL would receive a copy of every book without the need to demand a copy from publishers, as opposed to the 1814 Copyright Act where all libraries needed to request copies (McKitterick, 1986; Feather, 1994; Seville, 1998; Eliot, 2000). Other libraries still had to demand copies from publishers after the 1842 Act, which accounts for the lack of statistically significant difference between 1838 and 1862 for these libraries. Third, the BL’s Keeper of Printed Books, Anthony Panizzi, aggressively pursued publishers not complying with the Copyright Act of 1842 in the 1850s (Harris, 1998; Manley, 1991).

Statistically significant associations ($p$-value < 0.05) between coded variables and whether a title was held by the deposit libraries also include price, book size, number of volumes, and the total number of novels published by a title’s publisher that year. Cheaper, smaller-size novels, single-volume novels, and novels published by less frequent novel publishers were less likely to be held by deposit libraries. On one hand, the fact that cheaper, smaller, single-volume works were less likely to be held indicates libraries were rejecting these books despite publishers being more likely to send them because depositing five free copies of a cheap work was less costly than a large, expensive, multi-volume work. On the other hand, the fact that novels by less frequent novel publishers were less likely to be held suggests major publishers of novels would likely have been better known to libraries, making them more obvious targets for deposit demands. Crucially, all of these significant associations only exist in 1838, not 1862. This indicates libraries ceased using material traits of books as rejection criteria for legal deposit acquisition, and their accession practices moved towards comprehensiveness as they more fully adopted their identity as legal deposit libraries. Similarly, smaller publishers could less easily evade libraries’ notice in 1862 due to improvements in the documentation of what was being published (McKitterick, 1986). Libraries were, therefore, better informed about who was publishing and to whom they should direct their demands for deposit copies.

CONCLUSION

This study shows the NSTC is not a comprehensive database for 19th-century books, especially earlier in the century. At the same time, the NSTC is clearly useful for quantitatively studying legal deposit since it unites the catalogs of the deposit libraries. For first edition novels, legal deposit did not guarantee that deposit libraries had perfectly comprehensive collections of these works. Libraries often did not collect small, cheap first editions, while smaller publishers did not send their works to libraries, and libraries did not know to ask for copies. There is, however, a marked improvement between 1838 and 1862, demonstrating the effect that changes in legislation, library accession practices, and documentation of the book trade could have on the contents of libraries. Future research should resample 1838 and 1862 to corroborate these results, as well as sample the years after 1863 when the Copyright Agency was created among the deposit libraries to collaborate in pursuing deposit copies to determine whether there was more consistency between the libraries at this point. Most importantly, however, this study shows that the NSTC and bibliographic databases used for digital humanities research in the history of books and libraries should be closely scrutinized by researchers so that studies work with their limitations, not despite them.
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Measuring Unequal Knowledge Distance by Network Embedding and Multiple Relationships

Wu, Keye  
Nanjing University, People's Republic of China | wky1221@smail.nju.edu.cn

Kang, Lele  
Nanjing University, People's Republic of China | lele.kang@nju.edu.cn

Xie, Ziyue  
Nanjing University, People's Republic of China | xieziyue97@126.com

Du, Jia Tina  
University of South Australia, Australia | Tina.Du@unisa.edu.au

Sun, Jianjun  
Nanjing University, People's Republic of China | sjj@nju.edu.cn

ABSTRACT
Knowledge distance, representing the dissimilarity between different knowledge units, has been considered as an important dimension of recombination novelty and technological innovation. Previous measurements merely rely on the citation relationship and ignore their directions and weights. To fill this gap, this study proposes a new measurement which not only captures the unequal citation relationship but also integrates multiple information to depict knowledge distance. The results show that our method can accurately portray the knowledge distance in both scientific areas and technical fields.

KEYWORDS
Knowledge distance; Network embedding; Multiple relationship; Link prediction; Network visualization

INTRODUCTION
The term “knowledge distance” denotes the extent of separation or differentiation between knowledge units (Capaldo et al., 2017). Because knowledge integration across previously unconnected areas has the potential to generate remarkable outcomes and receive extraordinary rewards, knowledge distance is often used to measure recombination novelty, such as disciplines disparity for interdisciplinarity (Rafols & Meyer, 2010) and technological distance for technology convergence (Cho & Yoon, 2022). Literature on innovation has also claimed that firms with greater knowledge acquisition distance tend to have superior innovation performance (Stephan et al., 2019; Wang & Zhao, 2018). When it comes to measurement, previous studies commonly use citation relationships between fine-grained knowledge categories. For example, cross-citation between disciplines is employed to measure the distance in scientific areas (Uzzi et al., 2013) and International Patent Classification (IPC) co-citations are used to depict the distance between technical fields (Cho & Yoon, 2022). However, citation implies a directional and weighted knowledge flow from cited area to citing area, the existing measurements are failed to capture this unequal relationship. Furthermore, besides the citation relation, there are many other information can depict the distance between knowledge categories which is also ignored. To fill this gap, this study introduces a new measurement which captures the unequal citation relationship and combines multiple information to jointly depict the knowledge distance in both scientific areas and technical fields.

DATA AND METHOD
For our research purpose, we firstly construct the discipline citation network, IPC citation network and IPC co-occurrence network from the full dataset of Microsoft Academic Graph (MAG) and Worldwide Patent Statistical Database (PATSTAT), which record about 2 billion papers and 180 million patents with their bibliometric information respectively. Each edge in all three networks has weight information representing the citation/co-occurrence intensity. While only edges in citation networks are directional which represent the unequal knowledge flow.

Then, we adopt the Node2Vec method (Grover & Leskovec, 2016) to generate node embeddings which capture the unequal relationships. This method can selectively aggregate neighbor information based on edges’ directional and weight information through a biased random walk. By this way, IPC/discipline citation similarity (CS_s/CS_d) and IPC co-occurrence similarity (OS_s) can be calculated through cosine similarity of node embeddings. In order to further comprise the semantic information, we also calculate semantic similarity (SS_s/SS_d) based on the semantic embeddings, which are generated from the official interpretation content of IPC and discipline in WIPO (World Intellectual Property Organization) website and WOS (web of science) website respectively. Finally, we normalize and average all the three similarities and use 1 minus to be the measurement. Equation (1) shows the formula for IPC distance. Since disciplines rarely co-occur in one scientific paper, we only consider semantic and citation information. The formulation for disciplinary distance has been shown in Equation (2).

\[
\text{Distance}_s = 1 - \frac{\text{normalized}(\text{CS}_s) + \text{normalized}(\text{OS}_s) + \text{normalized}(\text{SS}_s)}{3} \quad (1)
\]

\[
\text{Distance}_d = 1 - \frac{\text{normalized}(\text{CS}_d) + \text{normalized}(\text{SS}_d)}{2} \quad (2)
\]
RESULTS
We verify the efficiency of proposed method in two steps. Firstly, we design the link prediction task to demonstrate the validation of Node2vec in capturing the unequal relationship. For all of three constructed networks, 15% edges have been randomly masked to be the validation and test set, then the remaining 85% edges have been used to train the model and generate node embeddings. In order to highlight the superiority of our method, we compare with several popular network embedding methods (Spectral Cluster, DeepWalk, Graph Convolution Network) which focus only on the network structure information but ignore the linkage weights and directions. The AUC (area under ROC curve) indicator is used to assess the robustness of all models. Table 1 shows that Node2Vec performs relatively well in most cases. Better than Deepwalk demonstrates Node2Vec can characterize weighted relationship, while better than GCN illustrates it can capture the directional information. However, Node2Vec has a weaker performance at the discipline network than GCN, which may probably due to high density (0.98) of discipline citation network.

<table>
<thead>
<tr>
<th>Model</th>
<th>IPC citation network (directed)</th>
<th>Discipline citation network (directed)</th>
<th>IPC co-occurrence network (undirected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC</td>
<td>0.44</td>
<td>0.39</td>
<td>0.51</td>
</tr>
<tr>
<td>DeepWalk</td>
<td>0.65</td>
<td>0.67</td>
<td>0.68</td>
</tr>
<tr>
<td>GCN</td>
<td>0.75</td>
<td>0.85</td>
<td>0.72</td>
</tr>
<tr>
<td>Node2vec</td>
<td>0.77</td>
<td>0.78</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Table 1. Link prediction results comparison

Secondly, Figures 1 and 2 visualize the IPC and disciplines similarity networks which integrate citation, co-occurrence and semantic relationships. We adjusted the layout to bring the nodes with high similarity closer together in each network. The results are not only consistent with the knowledge classification but implicate more detailed and valuable information. For example, disciplines in social sciences are distant from most natural sciences, while computer science is becoming a bridge between the two. Similar findings can also be observed in the IPC network, the 4-digit IPCs which under the same IPC department are basically clustered together. Nevertheless, there are also few IPCs scattered in other clusters, such as Part A and Part D IPC(4-digit) classification numbers involving chemical materials fall in Cluster C which is focused on chemistry and metallurgy.

CONCLUSION
This study proposes a new measurement for knowledge distance which captures the citation inequality and integrates multiple relationships including citation, co-occurrence and semantics. Our measurement not only demonstrates strong performance in quantitative link prediction tasks but also provides a comprehensive landscape of both scientific areas and technological fields. In future research, we aim to incorporate more information to enhance the depiction of knowledge distance and apply our method to other disparity measurements.
REFERENCES


Making Sense of Responders’ Evaluations of Question Answerability from Academic Q&A Sites

Wu, Qian  
Nanyang Technological University, Singapore | qian003@e.ntu.edu.sg

Lee, Chei Sian  
Nanyang Technological University, Singapore | LeeCS@ntu.edu.sg

Goh, Dion Hoe-Lian  
Nanyang Technological University, Singapore | ASHLGoh@ntu.edu.sg

ABSTRACT
In academic Q&A, question cues are characteristics of natural language for respondents to understand askers’ needs. However, knowledge is limited concerning respondents’ answerability evaluations which could be influenced by question cues (e.g., emotional expressiveness, complexity) and topic types. To address the gap, this research conducted an experiment to investigate how different question cues and topic types influence evaluations of question answerability. Sentiment analyses were conducted to assess responders’ evaluations of question answerability. Results showed that responders favored answering complex questions rather than simple ones. Responders also held more divergent opinions regarding whether to answer STEM questions with different cues while holding a more inclusive answerability evaluation of non-STEM questions.

KEYWORDS
Question answerability; Question cues; Responders’ evaluation; Sentiment analysis; Academic Q&A.

1 INTRODUCTION
Academic question and answer (Q&A) sites are platforms for individuals to raise and respond to academic questions (Li et al., 2018). They connect askers with responders who are the users that act on questions, provide peer support, and co-create knowledge with askers (Li et al., 2018; Srba et al., 2019; Wu et al., 2022a). For an asker, question answerability is important as it indicates whether or not the question could be answered (Baker, 2020; Chua & Banerjee, 2015). Thus, understanding responders’ evaluations of question answerability can help to improve askers’ question expressions and foster asker-responder relationships. To analyze question answerability, question cues are the linguistic characteristics for responders to identify the asker’s needs (Banerjee, 2017; Chowdhury, 2003) and make decisions regarding whether to answer. Importantly, it was found that askers can utilize various question cues to specify goals (Wu et al., 2023): (1) cognitive cues include complexity and specificity that specify the cognitive goals for responders (Te’eni, 1990; Wu et al., 2022a); (2) emotional cues convey personal feelings (i.e., emotional expressiveness, self-disclosure) (Fu et al., 2022; Kring et al., 1994; Shi et al., 2018); and (3) social cues refer to collaborative climate and politeness that stress on collective goals and support social interactions (Petrov et al., 2020; Wu et al., 2022b) (refer to Figure 1). However, the influences of question cues on responders’ evaluations of question answerability are not yet well understood.

Figure 1. Framework of Question Cues

Further, topic types influence responders in academic Q&A (Calefato et al., 2018; Jeng et al., 2017; Wu et al., 2020). There are considerable differences between science, technology, engineering, and mathematics (STEM) and non-STEM topics. Non-STEM problems emphasize reflective thinking (Jang, 2016) while STEM problems focus on logical reasoning (Pleasants, 2020). Hence, the two research questions this study aims to answer are: How do question cues influence responders’ evaluations of question answerability? How do STEM and non-STEM topics influence the relationship between question cues and responders’ evaluations of question answerability?

2 METHOD
An online experiment with a 2×3 factorial design was conducted and 109 university students were recruited. Half were male (50.5%) and the remaining were female (49.5%). The average age was 23.9 years. The between-group variable was topic type, comprising: (1) STEM topics (with 54 responses), and (2) non-STEM topics (with 55 responses). For each group, participants read three questions which comprised the within-group variable. The sequence of the three questions was randomized. These questions were based on those downloaded from two academic Q&A communities from Stack Exchange, namely, English Language & Usage, and Mathematics. The questions were adapted to contain the three most frequently used combinations of question cues identified by Wu et al. (2022a). As shown in Table 1, the three questions have the following cues: (1) cognitive, social, and emotional cues; (2) only cognitive cues; and (3) only emotional cues. After reading each question, responders were asked to evaluate the question answerability and explain their evaluations. Each participant was paid 10 SGD for their participation. The experiment was approved by the authors’ Institutional Review Board.
The responders’ evaluations of question answerability were examined using sentiment analysis. Specifically, positive sentiments suggested responders’ willingness to answer questions, while negative sentiments indicated a reluctance to provide answers. The positive and negative tones dictionary in Linguistic Inquiry and Word Count (LIWC) was used to determine positive or negative sentiments (Tan et al., 2021).

<table>
<thead>
<tr>
<th>Question cues</th>
<th>Treatments</th>
<th>Question 1</th>
<th>Question 2</th>
<th>Question 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive cues (i.e., complexity specificity)</td>
<td>Presence of cognitive cues: “a question about acronym: What’s the equivalent of ‘There are many automated teller machines?’”</td>
<td>Presence of cognitive cues: “This is a question about orthography. According to Merriam-Webster dictionary…”</td>
<td>Absence of cognitive cues: “My daughter is in primary school. Today, she asked me a question about her homework…”</td>
<td></td>
</tr>
<tr>
<td>Emotional cues (i.e., emotional expressiveness, self-disclosure)</td>
<td>Presence of emotional cues: “It is so interesting!...My youngest daughter is now 8 years old and she loves English…”</td>
<td>Absence of emotional cues</td>
<td>Presence of emotional cues: “It is so interesting!...My youngest daughter is now 8 years old and she loves English…”</td>
<td></td>
</tr>
<tr>
<td>Social cues (i.e., collaborative climate, politeness)</td>
<td>Presence of social cues: “I know many of you are experts. Could someone kindly help me with it? Thank you!”</td>
<td>Absence of social cues</td>
<td>Absence of social cues</td>
<td></td>
</tr>
</tbody>
</table>

### 3 RESULTS

By conducting sentiment analysis, means and standard deviations of the positive and negative sentiments are shown in Figure 2. The results of two-way repeated analysis of variance (ANOVA) showed that the main effect of question cues was significant on positive evaluations, $F(1.94, 207) = 3.40, p < .05$, but did not significantly influence negative evaluations, $F(1.62, 173) = 0.87, p = .40$. The interaction effects were nonsignificant for both positive evaluations, $F(1.94, 207) = 0.43$, $p = .64$, and negative evaluations, $F(1.62, 173) = 0.85$, $p = .41$. Post-hoc analysis indicated that more responders favored Question 2, whereas there were fewer positive evaluations of Question 3, $p < .05$. More responders had divergent evaluations of STEM questions than non-STEM questions, $p < .05$.

### 4 DISCUSSION AND CONCLUSION

This preliminary research seeks to understand responders’ evaluation of question answerability. The results showed that the presence of cognitive cues significantly increased responders’ positive evaluation (e.g., “interesting food for thought”). In contrast, simple questions (i.e., Question 3) made people stand by and wait for others to respond (e.g., “answering this is not a good use of my time as it is simple”). By comparing responders’ answerability evaluations using their sentiments for Questions 1 and 2, we found no significant difference for complex questions with or without social and emotional cues. This finding contradicts prior studies suggesting that STEM communities prefer neutral rather than emotional questions (e.g., Calefato et al., 2018). Surprisingly, responders to STEM questions held more polarized evaluations. STEM questions require responders to decompose problems with terms and mathematical relationships (Pleasant, 2020), attracting professionals (e.g., “I’m good at analyzing geometry”), but discouraging novices (e.g., “this question is too niched for me”). In contrast, responders to non-STEM questions had a relatively neutral evaluation. Non-STEM questions encourage communication with persons outside the professional domains (Jang, 2016), making the question more inclusive for different responders. For instance, two responses to non-STEM questions stated that the “tone of question is fine” and “use the phrase as you like”. Theoretically, this research reveals how different question cues and topic types influence responders’ evaluations of question answerability. Practically, the results suggest using different question cues in STEM academic Q&A for targeting specific responders, whereas non-STEM askers can freely use question cues as non-STEM responders hold more inclusive answerability evaluations. The limitation of this research is that all participants were university students, as we aimed to control the confounding influences of educational background. The replication of this research to other populations, such as working adults, might improve the generalizability of our results.
REFERENCES


Untangle the Characteristics of Disruptive and Consolidating Citations of Nobel-winning Papers

Yang, Alex Jie  
Nanjing University, People's Republic of China | alexjieyang@outlook.com  
Zhao, Yuehua  
Nanjing University, People's Republic of China | yuehua@nju.edu.cn  
Wang, Hao  
Nanjing University, People's Republic of China | ywhaowang@nju.edu.cn  
Deng, Sanhong  
Nanjing University, People's Republic of China | sanhong@nju.edu.cn

ABSTRACT

Scientific breakthroughs have the potential to revolutionize the course of research and shape the trajectory of scientific knowledge. This study investigates the characteristics of Disruptive Citing Papers (DCP) and Consolidating Citing Papers (CCP) associated with Nobel-winning scientific breakthroughs, aiming to provide insights into the mechanisms of knowledge creation and dissemination. By analyzing a dataset of Nobel-winning papers and their citation networks, we find that Nobel-winning papers tend to attract a higher proportion of DCP compared to CCP. However, CCP exhibit a higher impact, as evidenced by their citation counts and likelihood of becoming hit papers. Furthermore, DCP are associated with larger research teams, highlighting the collaborative nature of disruptive research, while CCP employ a higher degree of professional language style characterized by shorter titles and specialized jargon. These findings deepen our understanding of the role played by disruptive and consolidating impact in scientific breakthroughs, shedding light on the dynamics of knowledge creation and dissemination in the scientific community. This research contributes to the broader understanding of scientific progress and provides valuable insights for researchers, policymakers, and stakeholders in the scientific ecosystem.

KEYWORDS

Science of Science; Disruption; Consolidation; Nobel-winning Papers; Citation Networks.

INTRODUCTION

Recent contributions by Funk et al. (2017), Wu et al. (2019), and Park et al. (2023) have introduced a novel approach to quantifying the disruptive nature of papers, offering valuable insights into disruptive citing patterns. By examining the underlying structure of deep citation networks, these studies have introduced the Consolidation-Disruption (CD) index, which evaluates the extent to which patents and scientific papers consolidate or disrupt existing trends or disciplinary fields (Azoulay, 2019). These indices enable the quantification of research impact by new researchers and categorization of scientific research impact into two dimensions: disruptive impact and consolidating impact (Bu et al., 2021; Chen et al., 2021; Lin et al., 2022). Disruptive Citing Papers (DCP) encompass papers that cite the focal paper but do not reference the focal paper's cited references. On the other hand, Consolidating Citing Papers (CCP) include papers that not only cite the focal paper but also reference at least one of the focal paper's cited references. By examining DCP and CCP separately, a more comprehensive understanding of the role played by disruptive and consolidating impact in scientific research can be attained.

Despite the widespread use of disruptive and consolidating impact concepts across various fields (Bornmann & Tekles, 2021; Leydesdorff & Bornmann, 2021; Ruan et al., 2021; Wang et al., 2023), the differences between DCP and CCP of scientific breakthroughs have not been adequately discussed. Therefore, this study aims to address this gap by examining the difference between DCP and CCP of scientific breakthroughs represented by Nobel-winning papers. This analysis is expected to provide insights into the mechanisms of knowledge creation and dissemination and offer a more complete understanding of the role of disruptive and consolidating impact in scientific research.

This study aims to examine the characteristics of the DCP and CCP of scientific papers, particularly Nobel-winning papers. To achieve this objective, the research questions guiding this investigation are as follows:

1. To what extent do Nobel-winning papers attract Disruptive Citing Papers (DCP) compared to Consolidating Citing Papers (CCP), and how does this balance of DCP and CCP contribute to the impact of the scientific breakthroughs?
2. What are the disparities in the impact exhibited by DCP and CCP of Nobel-winning papers, and how do these disparities relate to the intrinsic disruptive and consolidating nature that characterizes scientific breakthroughs?
3. How do variances in team size and linguistic features manifest between DCP and CCP of Nobel-winning papers, and how do these variances influence the overarching disruptive and consolidating impact of scientific breakthroughs?

METHODOLOGY

This paper builds upon the existing disruptive and consolidating impact methodology (Funk & Owen-Smith, 2017; Leydesdorff & Bornmann, 2021; Park et al., 2023; Wu et al., 2019; Yang et al., 2023), to propose a novel approach that divides the citations of a focal publication into two categories: disruptive and consolidating citations. As shown in Fig. 1A, a focal paper (FP) in the citation network, along with its reference set $R = \{r_1, r_2, \ldots, r_m\}$ and citation set...
\[
C = \{c_1, c_2, \ldots, c_n\}, \quad \text{form a coherent knowledge flow sub-network that provides deep citation information about the forward and backward central nodes in the citation network. To explore the implicit relationships among articles, the citation set of } R \text{ is also considered, denoted as } RC = \{r_{c_1}, r_{c_2}, \ldots, r_{c_k}\}. \text{ Notably, nodes in } RC \text{ may include more nodes as they point to multiple articles. Thus, the consolidating citation can be represented as } CC = RC \cap C, \text{ and the disruptive citation can be represented as } DC = C - CC.
\]

This approach allows for the division of citing papers into two categories: Disruptive Citing Papers (DCP) and Consolidating Citing Papers (CCP). Subsequently, we can quantitatively assess the temporal structure of the dual impact exerted by the disruptive and Consolidating Citing Papers, respectively. To illustrate this methodology, we select an exemplary paper, “Ordering, metastability and phase transitions in two-dimensional systems” (Kosterlitz & Thouless, 1973), which received the Nobel Prize in Physics in 2016. Fig. 1B-C demonstrates the dynamic patterns of DCP and CCP within the citation network of this paper. As the citation network evolves over time, new citation links can be categorized as either disruptive or consolidating, depending on whether they connect to the references cited by the focal paper. At the initial stages, CCP may dominate the citation network, while over time, DCP may gain prominence.

**RESULTS**

The impact of Nobel-winning scientific breakthroughs on both the scientific community and society at large holds immense significance. To provide a comprehensive evaluation of the impact of these breakthroughs, we employ citation analysis to delve into the characteristics of two distinct types of citing papers: Disruptive Citing Papers (DCP) and Consolidating Citing Papers (CCP) in the context of Nobel-winning scientific breakthroughs. Utilizing the Microsoft Academic Graph (MAG) dataset, we extracted all forward and backward citation links associated with Nobel-winning papers, resulting in a dataset comprising 1,124,254 citing papers. Among these, a substantial proportion of 940,250 (83.6\%) are categorized as Disruptive Citing Papers (DCP), while 184,004 (16.4\%) are identified as Consolidating Citing Papers (CCP).

Given the log-normal distribution exhibited by the citation-based data (Peterson et al., 2010), we employed the Mann-Whitney U test and Kolmogorov-Smirnov (K-S) test to examine the differences between DCP and CCP in each field (Li et al., 2020). As depicted in Fig. 2, the results are highly revealing, demonstrating that the average number of DCP for Nobel-winning papers is significantly higher than that of CCP in the fields of Physics (p-values < 0.001), Chemistry (p-values < 0.001), and Medicine (p-values < 0.001), respectively. This finding posits that Nobel-winning papers tend to attract a greater number of DCP than CCP. DCP represents citing papers that challenge established ideas and facilitate paradigm shifts, whereas CCP build upon existing knowledge and refine established paradigms. Given that Nobel-winning papers often embody groundbreaking and avant-garde research that disrupts established paradigms and fields, it is unsurprising that they are more likely to attract DCP than CCP.

Our measure of impact is the citation counts each paper receives, which has been shown to correlate with research quality (Waltman, 2016; Wang et al., 2013). Our results, as depicted in Fig. 3, provide empirical support for the second hypothesis formulated in this study. The average citation counts for citing papers in Physics are 32.4 (DCP) and 49.4 (CCP) (p value < 0.001), in Chemistry are 45.4 (DCP) and 68.8 (CCP) (p value < 0.001), and in Medicine are 49.7 (DCP) and 68.0 (CCP) (p value < 0.001), supporting that DCP receive more citations than CCP. To address the potential bias arising from the citation window (Wang, 2013), we further analyzed the 10-year citation counts (Sinatra et al., 2016) for both DCP and CCP. The average 10-year citation counts for citing papers in Physics are 24.1 (DCP) and 33.4 (CCP) (p value < 0.001), in Chemistry are 29.5 (DCP) and 40.9 (CCP) (p value < 0.001), and in Medicine are 33.1 (DCP) and 44.3 (CCP) (p value < 0.001). Additionally, we examined the average citation counts that excluded zero-cited papers (Fig. 3D), as well as the probability of becoming zero-cited papers (Fig. 3E). Our analysis reveals that the average citation counts, excluding zero-cited papers, are significantly higher for DCP compared to CCP. Furthermore, DCP also exhibit a higher likelihood of becoming zero-cited papers in each respective field.

Moreover, to assess the robustness of result regarding the higher impact of CCP compared to DCP, we conducted an analysis of their probability to become hit papers. Hit papers are defined as those receiving the top 1\% highest citations within their specific subfield and publishing year, representing recognized achievements in the scientific community (M. Y. Wang et al., 2020). The results, depicted in Fig. 4, consistently demonstrate that CCP are more likely to become hit papers. In Physics, the probability of CCP becoming hit papers is 4.9\%, whereas for DCP it is 3.3\%. Similarly, in Chemistry, the probability of CCP becoming hit papers is 4.9\%, while for DCP it is 3.1\%. In Medicine, the probability of CCP becoming hit papers is 5.6\%, compared to 3.9\% for DCP. These findings indicate that CCP have a higher likelihood of achieving hit status compared to DCP.

Finally, in order to investigate the disparities in team sizes between DCP and CCP associated with Nobel-winning papers, we conducted a rigorous analysis. The outcomes, depicted in Fig. 5A-B, suggesting that CCP are associated with smaller research teams compared to DCP. Specifically, in the field of Physics, the average team size for citing
papers related to Nobel-winning scientific breakthroughs is 11.1 (DCP) and 4.9 (CCP) ($p$ values < 0.001). In Chemistry, the average team size is 4.1 (DCP) and 3.7 (CCP) ($p$ values < 0.001), while in Medicine, it is 3.9 (DCP) and 3.6 (CCP) ($p$ values < 0.001). These findings suggest that the disruptive nature of DCP in the context of Nobel-winning papers necessitates the involvement of larger teams capable of harnessing diverse expertise, resources, and perspectives to challenge established paradigms and propel scientific progress. In contrast, CCP, which emphasize consolidating and refining existing knowledge, may require smaller team sizes to efficiently build upon pre-existing breakthroughs. By examining the team sizes associated with DCP and CCP, we gain valuable insights into the collaborative dynamics and knowledge generation processes underlying Nobel-winning scientific breakthroughs.

FIGURES
All figures in this paper are stored at https://github.com/AlexJieYang/Figures-for-ASIST2023-POSTER.

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Unlocking Privacy Paradox in Social Media from a Configurational Perspective

Yang, Ruoxi
Shanghai University, China | yrx18830465601@163.com
Chen, Xiaoyu
Shanghai University, China | xiaoyu-chen@shu.edu.cn
Fu, Shaoxiong
Nanjing Agricultural University, China | fu_shaoxiong@163.com

ABSTRACT
Based on the privacy calculus theory, users’ decision-making on privacy disclosure was traditionally viewed as a trade-off between perceived values and privacy concerns. However, recent studies suggest that the impacts of users’ cognitive style and platform trust cannot be ignored in the context of social media platforms. From a configurational perspective, this study explores how these factors collectively affect users’ privacy disclosure. Data from 452 respondents on a Chinese social media platform were collected through an online survey. The results suggested that users’ decision-making on privacy disclosure in social media is a complex process involving different configurations. For field-dependent individuals, the trade-off between perceived values and privacy concerns is less important than the role of cognitive style. For field-independent individuals, beyond the trade-off between perceived values in different dimensions and privacy concerns, their decisions are also contingent on platform trust.

KEYWORDS
Privacy paradox, Configurational perspective; Cognitive style; Platform trust; Social media

INTRODUCTION
Nowadays, users have left more digital traces by disclosing private information in this highly connected world than ever. Even though users are reportedly concerned about their privacy leakage, they may still choose to share their personal information so as to enjoy various services. This interesting phenomenon, also known as the “privacy paradox,” has raised attention from academia and practitioners alike (Masur, 2023). Our research joins the discussion in the context of social media platforms. According to the privacy calculus model (PCM), users are likely to disclose privacy if they perceive higher benefits than privacy concerns. By contrast, they may decrease privacy disclosure when privacy concerns are high (Dinev & Hart, 2006). Nonetheless, PCM cannot effectively explain how users make decisions when their perceived values and privacy concerns are both at a high level.

Previous research shows that users’ decision-making on privacy disclosure may rely on their perceptions of values in different dimensions (Sun et al., 2022). Synthesizing relevant literature with our research context, we conceptualized the perceived values into three important dimensions. Utility value refers to the extent to which one can perceive usefulness (Slade et al., 2015). Emotional value refers to the extent to which one can obtain enjoyment and pleasure. Cognitive style refers to the extent to which one may gain specific knowledge (Sheth et al., 1991).

Furthermore, based on related literature (Sun et al., 2020; Lo, 2010), the current study proposes two significant constructs to capture individual differences in the privacy calculus process: cognitive style and platform trust. Cognitive style describes how one thinks, perceives and processes information, generally classified into field independence (FI) and field dependence (FD) (Witkin & Goodenough, 1981). Platform trust refers to the extent to which the platform is perceived as credible and reliable (Pavlov & Dimoka, 2006).

Despite the importance of perceived values, privacy concerns, cognitive style and platform trust, the understanding of how they collectively work to influence users’ privacy disclosure on social media platforms remains largely unknown. In particular, past research tends to adopt a variance-based view that primarily focuses on each factor’s respective effect on users’ privacy disclosure (Sun et al., 2022). However, any individual factor may not lead to the outcome sufficiently. We employ a configurational perspective that powerfully reflects the trade-off among the four constructs. This perspective assumes that multiple configurations of these factors may lead to users’ high/low privacy disclosure respectively. We thus propose two research questions here. RQ 1: What are the configurations for users’ high privacy disclosure? RQ 2: What are the configurations for users’ low privacy disclosure?

HYPOTHESES DEVELOPMENT
We address the two research questions by developing hypotheses to determine the causal conditions of high and low privacy disclosure. Based on the PCM, two hypotheses are proposed here. H1: When perceived values are low, individuals have a low degree of privacy disclosure. H2: When perceived values are high and privacy concerns are low, individuals have a high degree of privacy disclosure.

Further, when both perceived values and privacy concerns are high, we hypothesize that cognitive style and platform trust may work. FD individuals may treat the social media platform they often use as a comfortable zone for disclosing private information (Nosko et al., 2012; Tufekci, 2008). Hence, FD individuals on social media platforms...
will likely have a high degree of privacy disclosure. On the contrary, FI individuals rely on their critical thinking capability to determine privacy disclosure (Witkin & Goodenough, 1981). In this case, the extent to which they trust the platform is critical in the decision-making process. Accordingly, three hypotheses are proposed below.

**H3:** When perceived values and privacy concerns are both high, FD individuals have a high degree of privacy disclosure.  
**H4:** When perceived values and privacy concerns are both high, FI individuals have a low degree of privacy disclosure if their platform trust is low.  
**H5:** When the perceived values and privacy concerns are both high, FI individuals have a high degree of privacy disclosure if their platform trust is high.

**RESEARCH DESIGN**

Xiaohongshu (www.xiaohongshu.com), an increasingly popular social media platform in mainland China and other regions where many young overseas Chinese reside, was chosen as the research setting. Measures of the proposed constructs are adapted from mature scales in the existing literature. The classification of FD and FI is based on the questionnaire designed by Witkin et al. (Reid, 1995). Other constructs were measured using seven-point Likert scales (Krasnova et al., 2012; Malhotra et al., 2004; Milberg et al., 2000; Chellappa & Sin, 2005). Data was collected on Credamo (www.credamo.com). This professional platform has over 3 million registered samples in China. We finally collected 452 valid respondents. In the sample, more than half of the respondents (59.96%) were between 21 and 30 years old, and most (65%) were female. Most respondents had a bachelor’s degree or higher (85.84%). Fuzzy-set qualitative comparative analysis (fsQCA) method is adopted in this study. First, according to related literature (Pappas & Woodside, 2021), three anchor points (0.95, 0.5 and 0.05) were set to calibrate the variables, representing full membership, crossover and no membership, respectively (Park et al., 2020). Thereafter, the necessity analysis identified that none of the factors were necessary for high/low privacy disclosure. Finally, when conducting configurations analysis, we referred to relevant research (Ragin, 2008) to set raw consistency (0.8), PRI (0.75), and frequency cutoff (1), resulting in 4 configurations of high disclosure and 5 of low.

**RESULTS & CONCLUSION**

Due to the page limitation, we omit the details of the results. Overall, our research suggested that H1, H3, and H4 are well supported, while H2 and H5 have both supported and unsupported configurations. We respectively draw the privacy decision tree of FD and FI individuals, as shown in Figure 1 and Figure 2.

Three key findings are gleaned from the research. First, users’ privacy decisions on social media platforms included more situational factors and individual differences rather than a simple calculus of perceived values and privacy concerns. Second, FD individuals held a direct trade-off between perceived values and privacy concerns, whereas FI individuals had to consider the levels of platform trust. Third, FI individuals may require more perceived values than FD to disclose privacy. Figures 1 and 2 showed that FD individuals were likely to have high privacy disclosure even if their perceived values only existed in one or two dimensions. On the other hand, only when the three dimensions of perceived values existed could FI individuals have high privacy disclosure.

Our research holds both theoretical and practical implications. On the theoretical front, this study represents an important extension of PCM. On the practical front, our research may inform providers of social media platforms and privacy policymakers about revising and adapting the current privacy regulations. For example, social media platform operators may consider reducing the privacy concerns of FI individuals by enhancing their platform trust. There are some limitations in our research. First, we categorized perceived values into three dimensions. Future research is suggested to explore the differential impact of perceived values in other dimensions. Second, given the complexity of privacy issues, the proposed decision tree model may not be applicable in other cultural contexts different from Chinese social media.
ACKNOWLEDGMENTS
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Emotional Intelligence in Science

Yang, Yunhan
The University of Hong Kong, People’s Republic of China | yunhany@connect.hku.hk

Zhang, Chenwei
The University of Hong Kong, People’s Republic of China | chwzhang@hku.hk

Ding, Ying
University of Texas at Austin, USA | ying.ding@ischool.utexas.edu

ABSTRACT
This is the first on-going project presenting a four-dimension metric to identify scholars’ emotional intelligence (EI), which has yet to receive much attention. Current study proposes a data-driven metric rather than a subjective survey to reflect EI’s first dimension, self-awareness. By employing paired-T-tests on the DBLP dataset, we found that highly self-aware scholars are more likely to strive to improve with higher stability, leading to higher productivity and impact. Meanwhile, they have a more significant number of higher diverse collaborators. This research highlights the importance of one’s self-awareness to his/her scientific performance.

KEYWORDS
Emotional intelligence; self-awareness; bibliometric.

INTRODUCTION
To meet the challenges of a wide range of society, economy, and environment, the United Nations Summit set out several sustainable development goals (Martin, 2015). The quality education goals prioritize emotional competencies as critical knowledge and skills for citizens to critically review lifestyles, as emotions are a prerequisite for any transformations in action and behavior. EI was formally defined by Salovey and Mayer (1990), which is an ability to observe and differentiate one’s own and other’s emotions, then proceed to guide their behaviors. Goleman (1995) popularized this concept and believed EI forecasts individual future and effective team performance.

EI has shown its power in fields. First, it could predict psychological and physical health (Martins et al., 2010) and associate with harmonious social relationships (Alzoubi & Aziz, 2021), leading to human happiness and fulfillment. Second, EI distinguishes high from average performers (Kotsou et al., 2019) and predicts potential leadership (Byrne, 2004). Third, leaders’ EI and interactions among team members influence team effectiveness (Druskat et al., 2013). Thus, in many large organizations, EI guides recruitment, promotion decisions, and performance predictions as well as serving as a guide to help people advance their careers (Nel & De, 2004; Sanchez-Nunez et al., 2015).

However, scholars’ EI in science has yet to be studied. Previous findings have pointed out the high demands on reputation, intense competition for funding and publications, and enormous challenges when leading diverse faculty, staff, and students are all impacting scholars’ mental health (Urbina-Garcia, 2020; Kruse et al., 2020). It is worth exploring whether scholars’ EI will affect their behaviors then influence their performance. Currently, the existing EI instruments depend on self-report and suffer from social desirability or acquiescence bias (van de Mortel, 2005; Hill & Roberts, 2023), leading to subjective and untruthful results. The widely used scholarly databases have provided us with a promising direction to assess scholars’ EI in science in a data-driven way in this project.

EI MODEL AND QUANTIFYING SELF-AWARENESS
Based on Goleman’s definition (1995), this project defines EI as an ability to reflect on oneself, manage oneself and interpersonal relationships to work effectively in teams, lead others, and predict the future. Based on Goleman’s model, this project defines EI as a four-dimension metric, as shown in Fig. 1. Self-aspect can be captured from a scholar’s personal behaviors, such as publications; social aspects can be reflected in relationships with others, such as collaborations. The model also shows the necessary process at each science stage, from reflection (awareness) to making change (regulation). The study presented in this poster focuses first on self-awareness.

![Figure 1. Model of Emotional Intelligence in Science](image-url)
Self-awareness in psychology is the ability to reflect oneself to be in tune with the internal state (Duval & Wicklund, 1972), which has an external and an internal dimension (Govern & Marsch, 2001). According to Eurich (2018), internal self-awareness and external self-awareness keeps emerging as two categories of self-awareness; the former one reflects how we clearly see ourselves while the latter one represents our understanding on how others view us. In this study, self-awareness refers to an introverted evaluation process in which individuals make internal/external comparisons for better self-knowledge and improvement. One’s successfully published work implies his/her belief that such work will be helpful and contribute to academia. Published papers are thus evidence of the author’s internal self-awareness. Citations to the focal papers can be seen as recognition by other scholars; therefore, knowing whether one’s work has been cited or not indicates a scholar’s external self-awareness. In this study, we integrate both internal self-awareness and external self-awareness to assess a scholar’s self-awareness in science.

DATA
We used the DBLP dataset (https://www.aminer.cn/citation) and employed Acuna & Liang’s model (2021) to predict the authors’ gender and ethnicity information. After excluding publications without gender or ethnicity information, there are 3,570,450 scholars and 3,658,127 publications from 1980 to 2020 in our dataset.

METHODOLOGY
Measuring Self-awareness
Cited ratio. It refers to the proportion of cited papers and indicates the degree of self-awareness of a scholar. We only checked whether a paper had been cited rather than the number of citations. The higher the cited ratio of a scholar is, the more harmonious his/her external self-awareness and internal self-awareness are, implying a higher degree of his/her overall self-awareness. We used two different citation windows to check whether the publication was cited, including two-year and five-year citations. Meanwhile, self-citations have been excluded from the citation count in advance. We only included papers published by the author as the first author in the calculation.

Measuring Publication and Collaboration Behaviors
We calculated indicators of a scholar’s publishing behavior, such as (1) productivity, i.e., the number of publications; (2) the h-index; (3) career age, subtracting the year of the first publication from the year of the last; (4) stability, the average interval years of publications, reflects scholars’ reactions to obstacles and setbacks in their careers; (5) achievement, the incremental papers published at each stage (five years), reflecting a scholar’s effort in reputation accumulation. The formula is as follows:

\[
\text{Achievement} = \frac{\text{actual productivity} - (\text{early stage publication number}) \times n \text{ stage}}{(\text{early stage publication number}) \times (n - 1) \text{ stage}}
\]

We also calculated indicators of a scholar’s collaboration behaviors, such as (1) the number of coauthors; (2) coauthor diversity: average Shannon entropy of all coauthors by career age, ethnicity, gender, institution, and country.

We first calculated the cited ratio of scholars with a ten-year career length and at least three publications. Scholars in the top 25% by cited ratio were considered high self-awareness scholars (HSA), while the remaining 75% were considered low self-awareness scholars (LSA). We then used paired T-tests to investigate whether the two groups of scholars differed regarding h-index, productivity, stability, achievement, number of coauthors, and diversity.

RESULTS & CONCLUSION
Table 1 shows the significant differences between HSA and LSA, grouped by cited ratios. We calculated four cited ratios. Cited2 and cited5 are cited ratios for the entire career, while early cited2 and cited5 are cited ratios for the first five years; cited2 and cited5 differ in citation window. The cited2 ratio checks the citation status within two years after publication, while the cited5 ratio examines within five years. We got the same pattern from four comparisons.

We found that scholars with higher self-awareness tended to work harder to manage themselves better. Specifically, scholars with higher self-awareness were more likely to publish more papers in subsequent stages and had higher stability. They are also more likely to have more coauthors and a diverse team. Ultimately, scholars with higher self-awareness were more productive and influential in this study than those with lower self-awareness.

<table>
<thead>
<tr>
<th>Author number</th>
<th>Achievement</th>
<th>Stability</th>
<th>Coauthor number</th>
<th>Diversity</th>
<th>Productivity</th>
<th>H-index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cited2 ratio</td>
<td>56,989-168,714</td>
<td>3.13 1.94</td>
<td>2.43 3.08</td>
<td>45.36 33.41</td>
<td>0.38 0.35</td>
<td>32.99 24.86</td>
</tr>
<tr>
<td>Cited5 ratio</td>
<td>58,221-167,482</td>
<td>2.43 2.17</td>
<td>2.67 3</td>
<td>40.77 34.92</td>
<td>0.38 0.35</td>
<td>28.53 26.35</td>
</tr>
<tr>
<td>Early cited2 ratio</td>
<td>56,433-169,270</td>
<td>3.19 1.92</td>
<td>2.3 3.12</td>
<td>46.23 33.16</td>
<td>0.38 0.36</td>
<td>35.24 24.14</td>
</tr>
<tr>
<td>Early cited5 ratio</td>
<td>64,439-161,264</td>
<td>2.79 2.02</td>
<td>2.6 3.04</td>
<td>39.65 35.15</td>
<td>0.37 0.36</td>
<td>28.66 26.21</td>
</tr>
</tbody>
</table>

Table 1. Differences between HSA and LSA Grouped by Cited Ratio
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Female College Students' Perceptions on the Internet Use for Reproductive Health Information

Yoon, Hyunsoo  
Sungkyunkwan University, Republic of Korea | yunhs9@g.skku.edu

Oh, Sanghee*  
Sungkyunkwan University, Republic of Korea | sangheeoh@skku.edu | corresponding author

ABSTRACT
This study aims to explore the factors related to young women's Internet use for reproductive health information, specifically focusing on female college students. The research model is based on the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB). A convenience sample of female college students who have recently used the Internet for reproductive health information will participate in an online survey. The survey will collect demographic information, background details on Internet use for reproductive health, and perceptions of reproductive health behaviors. Data analysis will examine correlations among the perceptions and their association with the intention to continue using the Internet for reproductive health information. The findings will contribute to understanding female college students' influential factors and information behaviors, informing the development of educational programs, intervention strategies, and online resources to improve reproductive health outcomes and empower young women.

KEYWORDS
Female college students, reproductive health information, health information behavior, Health Belief Model (HBM), Theory of Planned Behavior (TPB)

INTRODUCTION
Women's reproductive health is vital to their overall well-being and quality of life. The World Health Organization (WHO, 2023) defines reproductive health as encompassing the health issues related to reproductive organs and functions, including safe sexual life, pregnancy, childbirth, and postpartum care. Women's bodies undergo constant changes throughout their lifetime, even after the onset of secondary sexual characteristics, making them more susceptible to reproductive disorders, such as bladder infections, endometriosis, sexually transmitted infections, and cervical cancer (Ahn, 2014; CDC, 2022; Lee et al., 2016; NIH, 2018). Reproductive health of young women, especially women in their 20s, is essential to care for several reasons. Early adulthood is crucial for women to establish positive, healthy behaviors and habits that can have long-lasting impacts (Han, 2019; Harris, 2010; Kwan et al., 2012). Proactive management of reproductive health in their 20s allows for the prevention, early detection, and treatment of various reproductive conditions or infections (Ahn, 2014; Min & Cha, 2017). Regular check-ups, screening, and discussions with healthcare professionals can help them promptly identify and address any concerns, promoting overall well-being and reducing the risk of long-term complications (Lee, 2015).

However, in Korea, unmarried young women are reluctant to visit obstetric and gynecological clinics due to the prevailing perception that these clinics primarily cater to pregnant women or those seeking reproductive health assistance within the context of marriage (Jang & Kim, 2021). In addition, the traditional norms and conservative values surrounding premarital sexual activity contribute to their fears of being judged, stigmatized, or labeled as promiscuous within their families and communities (Jang & Kim, 2021; Min & Cha, 2017). Consequently, young women often explore productive health information through the Internet, which offers easy and quick access to vast information and anonymity features that allow them to ask sensitive questions without criticism and stigma (Malik et al., 2022). Nonetheless, the factors influencing these behaviors remain relatively understudied. Therefore, the purpose of this study is to explore the factors related to use the Internet for reproductive health information of young women, specifically female college students. We identified and examined the influential factors based on the Health Belief Model (HBM) and Theory of Planned Behavior (TPB) to better understand the information behaviors related to reproductive health.

LITERATURE REVIEW
Many female college students rely more on the Internet than healthcare professionals or parents as a source of reproductive health information to avoid potential stigmatization associated with seeking such information (Basch et al., 2018; Hassan & Masoud, 2021). They use search engines, social media platforms, online communities, and other websites (Abdoh, 2022; Dadaczynski et al., 2021) to explore various health topics, including dieting, skin issues, reproductive health, and mental health on the Internet (Hassan & Masoud, 2021; Montagni et al., 2016). Additionally, they engage in self-protective behaviors by health information. They prefer using the Internet to delete the search history with related keywords or censoring their activities on social media platforms that pertain to reproductive health (Kvasny & Payton, 2018).
HBM is a model used to explain and predict an individual’s health behaviors and has four constructs: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Champion & Skinner, 2008; Rosenstock, 1974). Perceived susceptibility refers to an individual's belief in their likelihood of getting a disease. Perceived severity involves an individual’s evaluation of the physical and social consequences if the health condition is left untreated. Perceived benefits represent the belief in the effectiveness of recommended actions to reduce the risk or impact of the disease. Finally, perceived barriers refer to the potential negative aspects of specific health behaviors that hinder the performance of the recommended actions.

TPB aims to explain human behaviors and attitudes, subjective norms, and perceived behavioral control which are key factors influencing individual behavior (Ajzen, 1991). Attitudes refer to an individual's evaluation of favorability towards the behavior. Subjective norms represent the social influence that affects the execution of the behavior. Lastly, perceived behavioral control refers to the perceived ease or difficulty of performing the behavior. HBM and TPB have been extensively used, either independently or in combination with other models or theories, to examine the factors that influence a wide range of health-related behaviors (Malik et al., 2022; Shang et al., 2021; Yang & Wu, 2021; Zhao et al., 2022)

RESEARCH MODEL

The definitions of the perceived factors that we put forth to investigate the use of the Internet for reproductive health information among young women are as follows. We did not use attitudes from TPB in our research model because the perceptions related to attitude were covered from the factors from HBM.

- Perceived susceptibility refers to the belief of young women regarding their likelihood of experiencing reproductive health problems.
- Perceived severity involves young women’s evaluation of the physical and social consequences of having reproductive health.
- Perceived benefits represent the belief in the effectiveness of using the Internet for reproductive health information.
- Perceived barriers refer to the potential negative aspects of using the Internet for reproductive health information.
- Perceived subjective norms refer to the social influence that could impact young women seeking reproductive health information.
- Perceived behavior control represents the perceived ease or difficulty of seeking reproductive health information based on past behaviors and anticipated obstacles and barriers.

The correlation between the perceptions and the association of the factors with the intention to continually use the Internet for reproductive health information will be tested and analyzed in this study.

METHODS

Female college students who have had experiences using the Internet for reproductive health information in the past month have been invited to participate in an online survey. The survey questionnaire consists of demographic and background information of using the Internet for reproductive health and perceptions related to reproductive health behaviors. A five-point Likert scale was used to measure the degree of perceptions. For data collection, a convenience sampling method was employed to reach as many female college students as possible. Currently, the online survey questionnaire is being distributed via several online communities of universities in Korea. Data collection is in progress, and we plan to collect survey responses until we reach a sample size of 300 students. It is expected to complete data collection and analyses within two months. Pearson’s correlations and linear regression analyses will be used to examine the association among the factors. The primary findings will be reported during the ASIST 2023 conference.

DISCUSSION AND CONCLUSION

Three implications can be derived from this study. First, the findings can specify the factors that significantly influence female college students’ use of the Internet for reproductive health information. Second, the findings can assist healthcare professionals, researchers in information behaviors, and policymakers in healthcare in developing intervention strategies and educational programs fostering positive information behaviors regarding reproductive health among female college students. Third, the findings could inform the design and development of online resources that cater to the specific needs and preferences of female college students in reproductive health. Such implications could lead to improved reproductive health outcomes and increased empowerment for female college students.
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Real or Fake: Eliciting Deepfake Identification Strategies through a Diary Study

Zeng, Ruoyao  Nanyang Technological University, Singapore | ze0001ao@e.ntu.edu.sg
Song, Siyi  Nanyang Technological University, Singapore | ssong009@e.ntu.edu.sg
Guo, Zhengxi  Nanyang Technological University, Singapore | zguo011@e.ntu.edu.sg
Goh, Dion Hoe-Lian  Nanyang Technological University, Singapore | ashlgoh@ntu.edu.sg
Lee, Chei Sian  Nanyang Technological University, Singapore | leecs@ntu.edu.sg

ABSTRACT
The prevalence of deepfake technology has led to concerns about the ability of people to spot real videos from fakes. We address these concerns through a diary study to elicit strategies people use to identify deepfake and real videos. Results indicate that different strategies were associated with deepfake and real video identification. Interestingly, popular strategies were often not as effective as less popular ones. Implications of our work are discussed.

KEYWORDS
Deepfake videos; Identification strategies; Diary study; Misinformation; Disinformation

INTRODUCTION
The deepfake video is a relatively new entrant to the increasingly serious problem of mis/disinformation (Olan et al., 2022). As a potential source of mis/disinformation, deepfakes can undermine the authority of news and affect public trust in media (Vaccari & Chadwick, 2020; Godulla et al., 2021) as well as bring potential risks to individuals and society (Westerlund, 2019). It is therefore essential to help people effectively identify deepfake from real videos.

Most studies to date focus on algorithmic implementations of deepfake identification. Human-oriented work is only beginning to emerge but is primarily done in controlled, cross-sectional data collection settings such as interviews (Goh et al., 2022; Thaw et al., 2020) and Internet experiments (Groh et al., 2022). While yielding valuable insights, these studies do not model after the way in which people actually encounter deepfakes.

The present study thus aims to complement prior work through a naturalistic diary study of how people identify deepfakes. The two research questions are: (1) What strategies do people use to identify deepfakes? (2) How do these strategies differ from identifying real videos?

METHODOLOGY
This research used a diary study which comprised three rounds of data collection in naturalistic settings, equally spaced over a three-week period. Participants watched two videos from a pre-created pool in each round for a total of six. For each video, they completed a diary entry which elicited perceptions of authenticity and the process by which this was ascertained. The pool of videos comprised three real videos (speeches by President Joe Biden and Donald Trump, and a segment from the Ellen Show), and three fake videos (Kim Kardashian's personal chat, Tom Cruise’s daily life, and a speech by Jeremy Corbyn). Videos were randomly selected in each round.

Content analysis was conducted on the diary entries. A coding scheme guided by previous work (e.g., Thaw et al., 2020; Goh et al., 2022) was created based on content and video features for deepfake and real video identification.

RESULTS
Participants were recruited through convenience and snowball sampling, and comprised 17 females and seven males. The age range was 21 to 30 years. Thirteen were university students, and 11 were employed in diverse fields. Most participants watched online videos at least once a day, with topics including entertainment, comedy, news, and politics. Across three rounds, 144 completed diary entries were received of which 101 correctly identified the videos as real or deepfake, leading to an average accuracy rate of about 70%. The accuracy rate did not fluctuate significantly through the three diary rounds, and the entertainment videos had a better accuracy rate (79.1%) than political videos (61.1%).

Table 1 summarizes our findings for identification strategies, frequency of use and accuracy rate. For deepfakes, the three most common strategies used were: (1) Personal knowledge (frequency = 29.8%) where a person’s knowledge of the topic was used to ascertain authenticity, but no external sources were used as verification. (2) Vocal irregularities (24.3%) including the accent, tone and pace of the speaker. (3) Abnormal body movements (23.6%) including gestures and postures. While popular, their accuracy rates were only moderate. In contrast, the three most effective deepfake identification methods had accuracy rates exceeding 80%, although they were used less than 20% of the time: (1) Inaccurate eye movements (accuracy = 90%) including unnatural blinking rate and gaze direction. (2) Facial blurring or distortion (84.2%) including pixelation on the face or in its surrounding environment. (3) Unnatural skin texture (83.3%) including overly smooth or patchy skin tones.

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Table 1. Top Three Most Used and Most Accurate Strategies for Identifying Deepfakes and Real Videos

<table>
<thead>
<tr>
<th>Video Type</th>
<th>Characteristic</th>
<th>Strategy</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Accuracy rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deepfake</td>
<td>Most used</td>
<td>Personal knowledge</td>
<td>43</td>
<td>29.8%</td>
<td>67.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal irregularities</td>
<td>35</td>
<td>24.3%</td>
<td>77.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Abnormal body movements</td>
<td>34</td>
<td>23.6%</td>
<td>73.5%</td>
</tr>
<tr>
<td></td>
<td>Most accurate</td>
<td>Inaccurate eye movements</td>
<td>10</td>
<td>6.9%</td>
<td>90.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Facial blurring or distortion</td>
<td>19</td>
<td>13.1%</td>
<td>84.2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unnatural skin texture</td>
<td>6</td>
<td>4.1%</td>
<td>83.3%</td>
</tr>
<tr>
<td>Real</td>
<td>Most used</td>
<td>Personal knowledge</td>
<td>52</td>
<td>36.1%</td>
<td>67.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocal irregularities</td>
<td>40</td>
<td>27.7%</td>
<td>62.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Authentic scene settings</td>
<td>25</td>
<td>17.3%</td>
<td>68.0%</td>
</tr>
<tr>
<td></td>
<td>Most accurate</td>
<td>Authentic video elements</td>
<td>12</td>
<td>8.3%</td>
<td>91.6%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Message credibility</td>
<td>13</td>
<td>9.0%</td>
<td>76.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Search</td>
<td>17</td>
<td>11.8%</td>
<td>70.5%</td>
</tr>
</tbody>
</table>

For real video identification, two of the top three methods for identifying real videos were similar to those used in deepfake identification: **Personal knowledge** (frequency = 36.1%) and **Vocal irregularities** (27.7%). The third method was unique, **Authentic scene settings** (17.3%), referring to the environment in which the video was recorded. The goal was to ascertain if the expected environment matched the speaker and/or its content such as the official-looking backdrop of President Joe Biden’s speech. Interestingly their accuracy rates were worse than those of deepfake identification. Similarly, there were three relatively effective methods with high accuracy rates but low usage rates: (1) **Authentic video elements** (accuracy = 91.6%) which referred to logos, icons, subtitles, captions and other elements consistent with the message, speaker and scene setting. (2) **Message credibility** (76.9%) where the content is assessed for comprehension and rationality but not necessarily accuracy. (3) **Search** (70.5%), in which search engines were consulted for information about the video or the actual video itself as a means of authenticity verification.

**DISCUSSION AND CONCLUSION**

Overall, the accuracy rate for identifying deepfake and real videos was moderate, with the performance for the former better than the latter. It should be noted that individual participants had accuracy rates of less than 50% in our study. Surprisingly, this accuracy rate did not change significantly across the three data collection points. This suggests that in the absence of any intervention, the ability to distinguish real from fake will likely not improve over time. Put differently, the lack of feedback about identification performance or absence of new knowledge results in a person adhering to his/her existing identification practices and perceptions which may not be effective.

Next, we also uncovered strategies not found in prior work (e.g., Groh et al., 2022; Thaw et al., 2020) that relied on cross-sectional data collection. These include evaluating message quality and examining background and foreground video elements. Our results thus indicate that a naturalistic setting facilitates the elicitation of more realistic identification strategies than controlled data collection methods. Finally, frequently used strategies to identify deepfake and real videos share commonalities. However, strategies associated with deepfake and real videos with high accuracy rates were different. Nevertheless, it was encouraging to note that besides surface audio-visual features, message quality assessments were also performed for both types of videos. This suggests that some of our participants realized the importance of processing message content rather than just examining a video’s surface features.

In conclusion, this study contributes to knowledge about the human-oriented detection of deepfakes using a diary study, which is a naturalistic data collection method. This approach allowed us to better ascertain the effectiveness of identification strategies, significantly enriching existing research. In addition, unique strategies that differ from prior research were also found. Practically, the findings can help people better understand and use effective verification methods for videos encountered in daily life. Finally, our results about non-fluctuating accuracy rates over time call for the need for education about the nature of deepfakes and how people can spot them.

There are however limitations in the present study. The small number of participants and their narrow age group may limit the generalizability of our findings. Future research could consider a greater variety of video genres as well as the use of larger-scale, quantitative data collection methods to validate the identification strategies uncovered.
ACKNOWLEDGMENTS
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The Spatial-Temporal Trajectories of the Poets and the Sociocultural Environment of the Age

Zhan, Yiying
Central University of Finance and Economics, China | Zyy18928268186@163.com
Wang, Xi
Central University of Finance and Economics, China | xiwang@cufe.edu.cn

ABSTRACT
This research in progress presents a deep learning-based approach to identifying named entities, including geographical locations and poetic imagery in ancient Chinese poetry. By leveraging association rule mining, this study establishes a connection between historical events, spatial-temporal trajectories of poets, and sociocultural phenomena of the age. From the perspective of digital humanities, this study hopes to be able to provide new evidence for socioeconomic status, cultural openness, or historical events at different ages and to picture a better view of the development of classical Chinese.

KEYWORDS
Digital Humanities, Ancient Poetry, Spatial-temporal Trajectories, Social Culture.

INTRODUCTION
As the treasure and essence of Chinese traditional culture, ancient Chinese poetry has been developed and evolve over thousands of years. The poets created millions of classics not only to describe trivia and personal emotions but also to express patriotism and ambitions. Moreover, the poetry could reflect the historical and cultural customs, economic status, and social realities of the age as well (Yang, 2010). It is of great significance to take advantage of the rich information in ancient Chinese poetry to study the wording, literary, and social-cultural environment of the time. Nevertheless, knowledge extraction in ancient Chinese poetry is highly disparate. Such knowledge not only exists in the poetry itself, but can also be embedded in various interpretations, translations, and appreciations of the poetry. Researchers in traditional literary disciplines are used to identify such aesthetic value manually by integrating trivial knowledge from multiple sources. Lacking digital and intelligent methodology for text mining is an open challenge for studies in the field. In particular, from the perspective of digital humanities, implementing digital excavations to vast amounts of data such as recognizing events or named entities (Tang et al., 2018) would offer new opportunities for researchers in related research areas (Song et al., 2022).

Our current research presents a deep-learning-based approach for identifying named entities, such as geographical locations and poetic imagery, in ancient poetry. By combining the identified name entities with the time of poem creation, this study takes the first step towards depicting the spatial-temporal trajectories of the poets. Subsequently, the association rule mining would enable us to identify correlations between dynamics in historical events in time and poetic imagery, as well as the geographical location of poets.

RELATED WORK
Modern technology offers a novel opportunity for humanistic inquiry, named the digital humanities, which enables the re-evaluation of ancient culture through a technological lens and encourages its subsequent inheritance. In recent years, there has been a lot of research on ancient poetry in this interdisciplinary field, which mainly focuses on constructing knowledge graphs (Hong et al., 2020; Hong, Hou, & Zhou, 2020) and generating ancient poetry through algorithms (Yi et al., 2017; Zhang et al., 2022). These findings built social networks, hotspots, and maps of works, provided character relationships, and offered visual displays of poetry to support digital humanities projects. Nevertheless, there is a paucity of computational research investigating the economic and cultural information that ancient poetry contains, starting from its historical event. For example, after the An Shi Rebellion (Chamney, 2012), many of the poets in the Tang Dynasty expressed homesickness and the turmoil of war in their works, reflecting the unease and despair of society at that time. However, extensive text annotation, which is time-consuming and labor-intensive, is necessary for drawing such conclusions. Mining the ancient text, as a benefit of digital humanities, on the contrary, would allow us to identify such correlations automatically.

Named entity recognition is a critical task that can help researchers better understand the background and events in ancient literary works, such as the names of people, places, and imagery (Zhao et al., 2022; Zhou et al., 2022). In particular, imagery, as a highly artistic means of expression, referring to something other than themselves, has been used to express profound thoughts and emotions concisely (Yu, 1981). In ancient poetry, natural scenes, such as the moon, flowers, rain, and snow, were used to express emotions; animal images, such as butterflies, birds, and insects, were used to express human feelings; while the plant images, such as pines, cypresses, plum blossoms, and bamboo, were used to symbolize human characters. The algorithms such as time series analysis, Conditional Random Field (CRF), long short-term memory (LSTM), and BERT have been widely used in the named entity recognition in the classical Chinese (Ahmad et al., 2020; Chang & Wan, 2021; Liu et al., 2022; X. Yu & Chang, 2023).
METHODOLOGY AND PRELIMINARY RESULTS

Based on a public Chinese ancient poetry dataset (cnkgraph.com), this study collected 1,267,945 poems over 2000 years. These poems were predominantly created during the Tang, Song, Yuan, Ming, and Qing dynasties, accounting for nearly 90% of the total corpus. Selecting 2,728 poems from the Tang Dynasty with ground truth labels of geographical locations and plant names and with actual poetry creation years, this study conducted a preliminary analysis of named entity recognition and association rule mining.

The semantic tagging, BIO (Marquez et al., 2005), is used to transform geographical location entities into a sequence annotation problem. “B-Place” represents the beginning of the entity, “I-Place” represents the part of the place name entity except the beginning, and “O” represents the non-place name entity. The text input is transformed into a sequence of word embedding, and an end-to-end BiLSTM-CRF-based model is applied to identify named entities. In particular, this study utilizes a BiLSTM neural network architecture to encode input characters. The input undergoes a character embedding layer that transforms each character into a character vector, and these are subsequently passed through a bidirectional LSTM layer to obtain a sequence of hidden states. The output layer of the model is configured with a CRF, which employs the hidden states as feature vectors to determine the optimal labeling sequence for each word in the text. This approach ensures to prevent cases where toponymic entities do not start with the “B-Place” label. Finally, the predicted labeling sequence is decoded from these probabilities. A batch size of 128 and 100 epochs are chosen as the hyperparameters, with Cosine Annealing as the method used for optimizing the objective function with gradient descent. The model achieved an accuracy of 93.01% and an F1-score of 0.80. In the coming months, the focus will be on refining the accuracy of our location identification algorithm. Additionally, the same idea will be applied to imagery recognition. After optimizing the algorithm on the training set, the aim is to automatically identify named entities in all unlabeled data.

Meanwhile, utilizing the labeled dataset, association rule mining was conducted to establish the correlation between historical events and poetic imagery in the text, as well as geographical locations. This will enable us to build up a connection between the spatial-temporal trajectories of the poets and the sociocultural environment of the age. Specifically, the annotated data was selected from the Tang Dynasty and partitioned by the An Shi Rebellion (755-763 AD), a catastrophic civil war that claimed millions of lives. This study segregated the numerical data of poetry creation years into two periods, pre- and post-An Shi Rebellion, and employed Apriori algorithms (Agrawal & Srikant, 1994) to explore the association between the periods and the utilization of plant-based imagery and geographical locations. Table 1 presents identified association rules with a confidence greater than 0.1 and lifts greater than 1.0, which indicates that the use of imagery and geo-locations differs before and after the An Shi Rebellion. For instance, pine trees are used to symbolize strength and heroism, expressing the great ambitions of poets a lot during peaceful years, while bamboo represents nobility and independence, which is more prevalent in poetry after the rebellion. It is possible indicting the rebellious sentiments and longing for a utopian world amid the war-torn era. Moreover, there is a high frequency of poems describing the Jiangnan region before the rebellion and a shift in focus to the northern regions where the rebellion took place after the event. This may be attributed to the far-reaching political, economic, and cultural transformations wrought by the rebellion.

<table>
<thead>
<tr>
<th>Antecedents</th>
<th>Named entity</th>
<th>Consequents</th>
<th>Support</th>
<th>Confidence</th>
<th>Lift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-An Shi Rebellion</td>
<td>Poetic imagery (Plant)</td>
<td>Pine</td>
<td>0.032</td>
<td>0.174</td>
<td>1.356</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Willow</td>
<td>0.023</td>
<td>0.123</td>
<td>1.109</td>
</tr>
<tr>
<td></td>
<td>Geographical locations</td>
<td>Jiangsu</td>
<td>0.040</td>
<td>0.144</td>
<td>1.107</td>
</tr>
<tr>
<td>Post-An Shi Rebellion</td>
<td>Poetic imagery (Plant)</td>
<td>Bamboo</td>
<td>0.121</td>
<td>0.168</td>
<td>1.086</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Willow</td>
<td>0.080</td>
<td>0.111</td>
<td>1.005</td>
</tr>
<tr>
<td></td>
<td>Geographical locations</td>
<td>Henan</td>
<td>0.189</td>
<td>0.310</td>
<td>1.103</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hubei</td>
<td>0.128</td>
<td>0.210</td>
<td>1.159</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shaanxi</td>
<td>0.100</td>
<td>0.164</td>
<td>1.078</td>
</tr>
</tbody>
</table>

Table 1. Results of Association Rules

FUTURE RESEARCH AGENDA

The present paper provides an initial analysis of the dataset. Future research aims to optimize deep-learning algorithms for identifying named entities in unlabeled data. Furthermore, it is desired to interpret association rules in conjunction with specific poetic content. A DID analysis will be conducted to provide empirical evidence on the influence of historical events on the development of poetic style. Moreover, the intention to include poems from various eras in the dataset aims to derive broader conclusions.

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Health Information Use of Older Adults with Diabetes: A Preliminary Analysis

Zhang, Xiaoqian
McGill University, Canada | xiaoqian.zhang@mail.mcgill.ca
Bartlett, Joan C.
McGill University, Canada | joan.bartlett@mcgill.ca

ABSTRACT
This poster presents research investigating the health information use of older adults with diabetes in the context of the COVID-19 pandemic. Data were collected using semi-structured interviews and were analyzed using thematic analysis. Results-to-date showed self-reported changes in using health information during the pandemic; that is, some participants endeavored to protect themselves during the pandemic, they carefully made health-related decisions, and they had a challenging time following their caregivers’ suggestions (e.g., taking medicine and exercising) even though they knew they should. However, other participants reported no changes during the pandemic.

KEYWORDS
Information behavior; information use; COVID-19; older adults

INTRODUCTION AND BACKGROUND
Although information use represents the ultimate purpose of information needs and information-seeking, it is understudied (Liang et al., 2017; Savolainen, 2009; Wilson, 1999). Evidence is lacking on how information is used once it has been received (Case & Given, 2016; Wilson, 1981, 1999, 2020).

Health information behavior is age-related (Manafo & Wong, 2012). Research evidence shows that the usage of the Internet and other (non-Internet) information sources for health information decreases slightly with increasing age (Medlock et al., 2015; Weber et al., 2020). Some older adults were easily distracted by unrelated information and lacked confidence in their ability to evaluate health information online (Magsamen-Condral et al., 2019; Tennant et al., 2015). Since older adults with chronic diseases may need long-term health management and regular interaction with caregivers, they have been seen to show different information behaviour (Lee et al., 2014; Zhao et al., 2021). However, little research has investigated the information behaviour of older adults with diabetes. How older adults with diabetes use health information during the COVID-19 pandemic is a practical problem to be solved. As the world tries to recover from the COVID-19 pandemic, resilience may worsen among some older adults, especially those with diabetes (Chen, 2020). As such, it is necessary to know how older adults with diabetes use health information during the COVID-19 pandemic and their changes in the post-pandemic age.

This poster is part of a doctoral dissertation which investigates how older adults with diabetes are using health information during the COVID-19 pandemic and the implications for the post-pandemic era. This poster here reports the preliminary results and focuses on the question: What are the self-reported changes in older adults’ use of health information during the pandemic?

METHODS
The data was collected through semi-structured interviews and was iteratively analyzed using thematic analysis. This poster here reports the preliminary analysis of the first five interviews that took place both in-person and online in March 2023. The participants were adults over age 65, who have diabetes, and live in Canada. Table 1 demonstrates more background information about them.

<table>
<thead>
<tr>
<th>ID</th>
<th>Gender</th>
<th>Age</th>
<th>Education</th>
<th>Diabetes history</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>M</td>
<td>74</td>
<td>N/A</td>
<td>41 years</td>
</tr>
<tr>
<td>P2</td>
<td>M</td>
<td>70</td>
<td>Technical training</td>
<td>17 years</td>
</tr>
<tr>
<td>P3</td>
<td>M</td>
<td>69</td>
<td>Master’s degree</td>
<td>27 years</td>
</tr>
<tr>
<td>P4</td>
<td>M</td>
<td>75</td>
<td>Bachelor’s degree</td>
<td>7/8 years</td>
</tr>
<tr>
<td>P5</td>
<td>F</td>
<td>75</td>
<td>Technical training</td>
<td>5/6 years</td>
</tr>
</tbody>
</table>

Table 1. Participants’ background

RESULTS
Participants reported needing information about diabetes (e.g., symptoms and complications), medicine, diet, physical exercise, and health services. They further mentioned that they looked for and encountered information from health providers, websites, social media, family, friends, peers, and printed materials (i.e., books, magazines, newspapers, and brochures). Once they obtained the information, they indicated that they changed their daily

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routine of diet and exercise, 2) made decisions, 3) saved the information for future use, 4) shared the information with others, especially with those who also have diabetes; or 5) did not do anything.

Most participants said they put efforts into protecting themselves because of the lack of information during the pandemic. More specifically, COVID-19 severely threatened their health because they have low-health immune systems and are already in a vulnerable health situation. However, little trustworthy information about this new virus was available initially, forcing them to pay more attention to their health.

“Because at the beginning, there was no protection at all, there was no vaccines, there was nothing. And it sounded pretty scary. And they already had, you know, diabetes. And I have other health issues as well. And I thought better to protect myself, right?” P3

A couple of participants became cautious when making health-related decisions during the pandemic. One participant mentioned that he had to think twice about having surgery considering the influence of the pandemic (e.g., the greater chance of getting COVID and more difficulties during the recovery phase). He started to look for information from different sources, such as reading academic books and talking to experts, to help him make decisions.

“...of course, I am more careful about the whole thing of doing surgery during the pandemic...you can’t afford any mistakes that happen to your body. You shouldn’t believe everything doctors tell you; your immune system is your best doctor” P4

Managing personal health was challenging for a few participants, even if they knew the appropriate way. The COVID-19 pandemic hindered people from accessing healthcare providers; most participants reported having trouble scheduling appointments with their doctors and waiting longer. One participant, who had recently migrated from China to Canada and always relied on traditional Chinese medicine to manage her diabetes, was particularly affected by this situation. This participant had to modify how she took her medication because she had fewer opportunities to travel internationally and visit her doctor in China.

“...I was supposed to take two pills every day, but I am hesitating about it...I can’t go back to China and get more medicine from my doctor now [because of the expensive flight tickets and quarantine policy], so I am saving the medicine he prescribed. I only take one pill occasionally." P5

Many restrictions were implemented to prevent the transmission of the virus during the pandemic. People were encouraged to stay home and reduce public gatherings. Some participants mentioned that they had learnt from health professionals that they were supposed to go outside and do physical exercise for their diabetes. However, the COVID-19-related restrictions limited their ability to follow their health professionals’ suggestions.

“You know, I didn't want to cycle around with a mask because sometimes, on bicycle paths, you're in close proximity to other people. I tended to do a lot less cycling.” P3

Not all participants experienced changes during the pandemic. One participant was doctor-driven; he only looked for information from his healthcare providers and always directly followed their instructions. He also reported sufficient support from his healthcare providers, so COVID-19 made no difference to him.

“And through the pandemic, pandemic made no difference to me. It's because I had my supply of drugs and got more if I needed them... I've been very well-schooled by the healthcare team here. So, I don't have any questions. I can always ask them if I have a question ” P2

CONCLUSIONS AND FUTURE WORK
This poster reports a preliminary analysis of the changes in older adults with diabetes use of health information during the pandemic. The next step is to finish the interviews with around 10-15 more participants and complete the analysis of how older adults with diabetes use health information during the pandemic and the reasons behind their behavior. Overall, this dissertation research will provide more research evidence to understand information use and contribute to understanding information behavior in a context of a global health crisis.

ACKNOWLEDGMENTS
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Exploring Laypeople's Engagement with AI Painting: A Preliminary Investigation into Human-AI Collaboration

Zhang, Xiaoyu  
Nanjing University, People's Republic of China | zxyunj@smail.nju.edu.cn

Zhu, Sicheng  
Nanjing University, People's Republic of China | mg21140049@smail.nju.edu.cn

Zhao, Yuxiang (Chris)  
Nanjing University, People's Republic of China | yxzhao@vip.163.com

Hansen, Preben  
Stockholm University, Sweden | preben@dsv.su.se

Zhu, Qinghua  
Nanjing University, People's Republic of China | qhzhu@nju.edu.cn

ABSTRACT
As advancements in artificial intelligence (AI) technology have opened new avenues for artistic expression and creation, human-AI collaboration in creative activities has garnered increasing attention. Through semi-structured interviews with 15 participants, we investigate the intrinsic and extrinsic factors that motivate laypeople’s engagement with AI painting, as well as challenges and concerns faced by users. Our findings reveal that laypeople engage with AI painting for emotional needs like entertainment, aesthetics, surprise, and curiosity, personal utilitarian needs such as self-expression and customization, and social interaction through sharing and communication. Despite the appeal of novelty and unpredictability they also encountered challenges related to technical and system functionality, personal and environmental factors, as well as concerns about algorithm bias, pornography misuse, employment risks, copyright disputes and ethical implications. Findings provide preliminary evidence of the potential and limitations of AI in democratizing creative activities, and offer implications for designing and developing of AI assistance tools.

KEYWORDS
Human-AI Collaboration; generative AI; laypeople; user engagement; user experience

INTRODUCTION
Traditionally, painting has been considered a skill requiring extensive training and practice. For many laypeople, who have not undergone specialized training in a particular domain (Bromme et al., 2001), painting has seemed inaccessible. However, advancements in artificial intelligence (AI) technology have reduced these barriers, enabling laypeople to create paintings easily and efficiently without formal training (Roos, 2022). To some extent, the penetration of AI into daily life calls for more consideration of the universality and usability of such technologies, as they have the potential to revolutionize how we perceive and engage with creative activities. In addition, effective collaboration entails human and AI being aware of each other's strengths and limitations, negotiating and aligning intentions, and supporting one another (Cila, 2022). From the perspective of cooperation, the human-computer collaboration promoted by AI painting also needs to be further explored, especially for some creative work. Investigating laypeople's engagement with AI painting can help us better understand that, which can amplify human capacity for creative activities, leading to enablement and empowerment.

Despite there is a growing interest in AI-assisted creative activities (Huang et al., 2020; Frich et al., 2019), most research has focused on the perception and evaluation of AI-generated paintings, with little literature exploring users' engagement behavior (Cabitza et al., 2021; Chong et al., 2022; Dikmen & Burns, 2022). Some research on human-AI collaboration in painting has primarily focused on expert users such as artists and professionals (Guzdial et al., 2019; Karimi et al., 2020; Lu et al., 2022), leaving the perception and experience of laypeople's engagement largely unexplored. To address the research gap, this study explores laypeople's engagement with AI painting, focusing on their motivation and experience. Specifically, this study addresses the following research questions: What motivates laypeople to engage with AI painting? How does human-AI collaboration manifest in laypeople's engagement with AI painting, and what challenges and concerns arise in this collaborative process? Our findings may contribute to the understanding of the potential of human-AI collaboration in creative activities and inform future design and development of AI assistance tools to a broader audience.

METHOD
This study defined the sample as people who have experience in using AI for painting but are not professional painters or haven't received formal training in fine art. An interview protocol was developed that included inquiries about participants' exposure and duration of use, platforms used for AI painting, motivations and preferences for use, engagement strategies, positive and negative experiences, and benefits and challenges encountered while engaging with AI painting. We recruited 15 participants from different social media platforms or communities. Due to geographical and time limitations, we conducted online interviews, recording each interview with an approximate duration of 90 minutes. We used an open coding method and thematic content analysis to identify key themes and patterns relevant to our study. Two coders were involved to ensure the reliability of our coding process, with an inter-coder reliability score of K= 0.92, which is considered substantial to excellent agreement (McHugh, 2012).

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PRELIMINARY RESULTS

The sample consisted of 10 males and 5 females, aged between 20 and 45 years. Participants from diverse backgrounds, such as finance, IT, medicine, and education. They used various AI painting platforms like Midjourney, Stable Diffusion, as well as mobile applications and applets. The majority of participants perceived AI painting as a novelty and a positive experience. They described it as "enjoyable", "interesting", "fresh", "magical", "engaging", "surprising", and "amazing". In this process, users provided prompts, adjusted parameters, and adapted their artistic goals or expectations based on AI's capabilities and limitations to achieve outcomes beyond individual capabilities, with AI responding and refining as a social actor. Initially, many participants were not entirely satisfied with the effects of AI-generated paintings. As familiarity increased, they were impressed by its low tech-barrier, effects, and efficiency ("I didn't quite understand the mechanism of prompt at the beginning, so I input a good long paragraph directly, and the generated stuff was not very satisfying. Later on, I became much more proficient").

Laypeople engage with AI painting for multiple motivations, and all participants engagement with AI painting was largely for entertainment. They sought to derive fun and enjoyable experiences, hedonistic pleasure, as well as passing time, playing around. Aesthetics was another key motivator for participants. While many participants had an interest in drawing and art (73.3%, n = 11), they lacked formal systematic training. As a result, generating visually appealing images became a common goal ("I want to see something beautiful, but I can't draw, so I want AI to make something that is more amazing to me"). Additionally, the novelty and unpredictability of AI-generated painting brought participants a sense of surprise (86.7%, n = 13) and was described as "surprising", "amazing", and "unbelievable". The thrill of the unexpected outcomes motives their engagement ("I really like the randomness, like 'unpacking the blind box', sometimes surprised, sometimes feeling disappointed"). The next significant motivation appeared to be curiosity (73.3%, n = 11). Most participants mentioned their curiosity towards technology (P2), model resources (P13), and engagement experiences (P6), particularly in the beginning stages of their exposure.

Another significant motivational category emerged from personal and utilitarian needs, with self-expression being the most prominent 80% (n = 12). Some participants consider it as a valuable tool for creative expression, enabling them to bring their ideas to life ("I have no background in painting, but that can't be realized. The advantage of AI painting is that the threshold is very low and anyone can create"). Some individuals used AI to generate specific characters (P8, P10, P14), support personal production (P6, P12) and hobbies (P8, P10) or fulfill other personal needs. Others sought opportunities to generating income or new jobs (P1, P7, P9).

Moreover, 86.67% (n = 14) of respondents engaged with AI painting for social interaction. Participants interacted with various individuals. For instance, some participants were introduced to AI painting through friends' recommendation (P4, P6), or simply through following others (P14). Some posted their works on social media for record-keeping and updating (P15), promoting related community (P9), or increasing their online following (P4, P7). Some take it as a communicative utility to get things to talk about with others (P11, P12), help others to generate the images they needed (P5, P12), or collaborate with others to create (P4, P6, P15).

Although the convenience and usability of AI painting attracted participants, some challenges and obstacles also emerged during collaboration with AI. These include technical and system functionality issues, such as homogeneity, content expression, details, construction, efficiency, and operating instructions, as well as personal factors like lack of technical skills, inadequate aesthetic knowledge, insufficient computer configurations, difficulty in expressing prompts, and hard to be tech-savvy. Additionally, external environmental challenges, such as payment costs, social norms can also hinder user engagement.

Participants also expressed concerns about algorithm bias, misuse of pornography, employment risks, copyright disputes and ethical implications, all of which have impacted their sharing and communication behavior. We also found that users faced challenges in balancing human control and AI autonomy, as well as concerns like ethical considerations in human-AI collaboration, such as authorship and impact on professional artists' livelihoods. Interestingly, AI-generated art is already affecting the division of labor and efficiency in the art creation industry, which will inevitably lead to ongoing debates.

CONCLUSION AND FUTURE WORK

This study contributes to human-AI collaboration literature with the investigation of laypeople's experience in AI painting. The findings indicate that AI painting provides a new entertaining experience for laypeople. Although challenges and concerns need to be further explored and addressed, we still see the possibilities of generative AI, such as new ways of creation, expression, collaboration, and possibly new social divisions of labor. As an ongoing study, we will continue to analyze our research questions and provide more insights into this topic.

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Understanding the Motivation of Participants in Innovation Open Data Contests: A Task Presentation Affordance Perspective

Zhang, Yan | Nanjing University, China | strawberries_z@163.com
Liu, Zhouying | Nanjing Forestry University, China | liuzhouying0908@163.com
Zhao, Yuxiang (Chris) | Nanjing University of Science and Technology, China | yzxhao@vip.163.com
Wu, Dawei | Nanjing University of Science & Technology, China | fyawdw@163.com

ABSTRACT

Innovation Open Data Contest (IODC) is an effective way to take advantage of public efforts to realize the great potential value of open data in the field of digital humanities. Previous literature focuses more on the challenge open data contest rather than innovation open data contest. Given this, understanding the underlying factors motivating participants to actively engage in the contest is necessary. Based on the task affordance theory and self-determination theory (SDT), this study aims to identify and examine how task presentation affordances of IODC influence participants' motivations and thereby shape their level of effort. We employ partial least squares structural equation modeling (PLS-SEM) techniques to analyze the responses from 215 individuals who have previously participated in the IODC. The findings indicate that participants' level of effort in the IODC is contingent upon their perception of relatedness and competence. Moreover, hedonic affordance and connective affordance positively influence participants' perceptions of relatedness and competence. Our findings contribute to the extant literature by proposing a theoretical model to understand the participants' motivation and have practical implications for IODC's organizers.

KEYWORDS

Digital humanities; Innovation open data contest; Task affordance; Self-determination theory; Participation motivations

INTRODUCTION

As the huge potential value of open data to be mined, open data contests can efficiently call for the public participation to realize the value of open data (d’Aquin et al., 2014). Depending on the objectives of the contest, open data contests can be divided into two categories: Challenge Open Data Contest (CODC) and Innovation Open Data Contest (IODC). CODC usually aims to obtain excellent algorithms or computational models dedicated to solving problems related to practical production applications involving accuracy models, universal models, and computationally feasible models (Li et al., 2022). Such contests require a high level of domain knowledge and expertise. The purpose of IODC is to mine open data to develop innovative applications. Compared to CODC, IODC relies more on the imagination and creativity of the participants (Zeng, 2019). In the field of digital humanities, to promote the utilization and dissemination of cultural heritage resources, Galleries, Libraries, Archives, and Museums (GLAMs), collaborated with enterprises and government agencies, have launched some IODCs. Extant literature related to open data contests mainly focuses on three aspects: contest design, participant motivation, and winning entries. Most of them were conducted in the context of CODC. The existing literature explores the critical open elements of the contest and focuses on the technical applications, data processing, model combinations, and common features of the winning entries (Iglovikov et al., 2017). In terms of participant motivations, some factors, such as different reward strategies, prize amounts, number of competitors, contest duration, and past experiences, have significant impacts on participants' behavior (Yan et al., 2017). However, little attention has been paid to the influence of tasks. Thus, we propose the research question —how the contest task presentation affordance affects the participants’ participation efforts?

THEORETICAL BASES AND HYPOTHESES

Based on Stimulus, Organism, Response (SOR) model, we used the task affordance presentation theory to identify the stimulus, employed SDT to describe the psychological perception of the organism, and regarded participation effort as participants’ response. The contest task affordance would influence the participants' motivation, thereby triggering the public to participate in the contest (Zhao & Zhu, 2016). Task presentation affordance refers to the ability of the platform to present task content and format. Affordance theory presents a perspective to understand the possibility of action occurring in the interaction between participants and contest tasks (Schulze et al., 2012; Zhao & Zhu, 2016). In this study, we identified four task presentation affordances, including monetary, hedonic, autonomy, and connective affordances. SDT provides a theoretical underpinning for understanding the basic psychological motivations of human beings, including perceived autonomy, perceived relatedness, and perceived competence.

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The monetary affordance mainly refers to the influence of tangible rewards through IODCs on participants' motivations. Lerner et al. (2003) determined the effect of external incentives on participants' sense of competence by balancing cost and benefit calculations. The hedonic affordance focuses on the level of fun of the contest task. The purpose of participating in a contest is not only to win but also to have enough fun (Epstein & Harackiewicz, 1992). The more interesting the task, the greater the participants' perceived competence (Patall, 2013). Autonomy affordance indicates the degree of creative freedom that a contest gives to its participants (Boudreau et al., 2011). IODC is an activity that encourages team participation, with connective affordance as its natural attribute. People are more willing to participate in community events that are highly related (Lu et al., 2011). When contests are highly connected, participants have a higher level of confidence, that is, a sense of competence (Zhao & Zhu, 2014).

We proposed the following hypotheses: Participants' perceived autonomy (H1a), perceived relatedness (H1b), and perceived competence (H1c) positively influence their participation efforts in the IODC; H2: Monetary affordance positively affects participants' perceived competence; Hedonic affordance positively affects participants’ perceived relatedness (H3) and perceived connectiveness (H4); H5: Autonomy affordance positively affects participants’ perceived autonomy; Connective affordance positively affects participants’ perceived relatedness (H6) and perceived competence (H7).

RESEARCH METHOD AND DATA COLLECTION
In this study, we chose a typical Shanghai library open data contest as the research context. The 8 construct measures were adapted from existing scales that have been validated. These measures are based on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) to assess the respondent's attitude towards each statement. The affordances measures were adapted from Gassenheimer et al. (2013). The motivations were measured by scales adapted from Kauffeld (2006). Participation effort was measured through three items developed by Zhao & Zhu (2014). With the help of contest organizers to distribute the questionnaire, 215 valid responses were obtained from 17 December to 29 December 2022.

RESULTS
The data for this study was analyzed by using the partial least squares (PLS) method. The measurement model and structural model were examined separately using SmartPLS 4.0. Model reliability was assessed by Cronbach's alpha and composite reliability values. The results of the analysis showed that all Cronbach's alpha and composite reliabilities exceeded the recommended threshold of 0.7, indicating a good level of reliability. We assessed convergent validity using the value of average variance extracted (AVE). The results showed that the AVE was greater than 0.5 and that all item loadings were above the recommended value of 0.7, indicating an adequate level of convergent validity. The results of our structural model, constructed using the standard bootstrapping procedure in SmartPLS, are shown in Figure 1.

CONCLUSION
In crowdsourcing contests, lucrative monetary incentives have been an important stimulus for participants. However, this is not the case in IODCs. Organizers should consider factors that inspire participants' competence and relatedness in the contest design, such as establishing a contest community to facilitate communication among participants. In addition, it is recommended that organizers design appropriate contest tasks and give participants limited autonomy. Hedonic affordance is an important component in stimulating participants to participate. Participants can perceive that they are making friends with like-minded people and building connections. Moreover, they will feel confident in their ability to complete the contest. Our study has several limitations, such as the data is self-reported, lack of consideration of participants’ personal characteristics, etc.
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Revisiting the Benefits of Duplicate Questions: Evidence from Knowledge Evolution on Stack Overflow

Zhang, Yiwei  
Nanjing University, China | zhangyiweinju@163.com

Jiang, Na  
BNU-HKBU United International College, China | naijiang@uic.edu.cn

Liu, Xiaohui  
University of Shanghai for Science and Technology, China | xiaohui@usst.edu.cn

Zhang, Qi  
Nanjing University, China | qi.zhang@smail.nju.edu.cn

Deng, Sanhong  
Nanjing University, China | sanhong@nju.edu.cn

ABSTRACT

Stack Overflow (SO) represents one of the most vibrant Question Answering Communities (QACs), providing a crucial platform for developers to pose and respond to questions. SO preserved duplicate questions due to their potential for furnishing additional insights or suggestions. In this paper, we delve into the study of duplicates within SO, with the objective of unraveling their positive value, particularly through the lens of knowledge networks and the evolution. We propose a categorization of knowledge evolution within QACs into two key dimensions: depth and breadth. Our exploration reveals that duplicate questions play a constructive role in fostering both the depth and breadth of knowledge evolution. This finding illuminates the underestimated value of duplicate questions, underlining their significance for the ongoing expansion of knowledge within QACs.

KEYWORDS

Duplication; Question Answering Communities; Knowledge Evolution

INTRODUCTION

Question Answering Communities (QACs) have emerged as significant knowledge generators, aiding users in fulfilling their information requirements (Ahmad et al., 2018). Specialized QACs, such as Stack Overflow, serve as repositories for human knowledge. Questions on these platforms reflect the expertise and interests of professionals in various domains, fostering the generation and evolution of specialized knowledge (Liu et al., 2019). Typically, users seek pre-existing answers before posing new questions, a process that inevitably leads to the posting of duplicate questions. Despite being labeled as such, these duplicate questions are preserved for their potential informational value.

Prior research primarily centered on enhancing detection algorithms for duplicate questions (Kale et al. 2022), typically viewing duplicates negatively (Kumar et al. 2023) and overlooking their potential benefits. Despite this trend, studies by Mathias Ellmann (Ellmann 2019) and others have begun to uncover the potential value of duplicates on Stack Overflow. However, these works have not accurately pinpointed where this value lies. Despite these findings, research exploring the role of duplicate questions as key knowledge components in QACs, particularly in terms of their contribution to knowledge evolution, remains scant.

In this paper, we investigate the positive impact of duplicate questions in QACs, we conceptualize knowledge evolution into two dimensions: depth and breadth. Further, we quantified measure the positive influence of duplicate questions on the depth and breadth of knowledge evolution. Using the Stack Overflow Torrent dataset, we address the following research questions: 1) How can the evolution of knowledge networks be understood within CQA platforms? 2) What impact do duplicate questions have on the depth and breadth of knowledge network evolution?

METHODOLOGY

This study scrutinizes the iOS domain knowledge on Stack Overflow from 2008 to 2021, generating a dataset of 114,563 question entries. Employing an enhanced distil-BERT pretraining model (Sanh et al. 2020), we facilitate a data-driven approach to identifying duplicates. Each question's structure, including the question and its tags, underpins the construction of knowledge networks via complex networks and a Folksonomy-based knowledge organization model (Peters and Stock 2007). The adjacency matrices were built on tag co-occurrence networks (Feicheng and Yating 2014), leading to a dynamic exploration of these networks via time-series analysis. Knowledge evolution measured by depth and breadth. Influence of duplicates on knowledge evolution investigated via regression analysis with duplication score as independent variable and knowledge evolution indicators as dependent variables.

Figure 1. Knowledge Network Construction
FINDINGS
Knowledge Network Evolution: Depth and Breadth Explained
Knowledge evolution signifies the spatiotemporal dynamics of knowledge transmission and growth (Pontis and Blandford 2015). This study focuses on the network topology (Momennejad 2021), with depth reflecting knowledge density and intricacy, denoting internal interactions and transactions during evolution. Conversely, breadth represents diversity, illustrating the expandability of network structure, continuity, and capacity for expansion.

Specifically, the depth of the knowledge network is characterized by measures such as the clustering coefficient, closeness centrality, eigenvector centrality, degree, and the extent of the largest connected subgraph. Alternatively, the breadth of the knowledge network is represented through the average shortest path length, assortativity coefficient, betweenness centrality, and the number of major branches (Zou et al. 2019).

The Role of Duplicate Questions in Knowledge Network Evolution
This study scrutinizes the role of duplicate questions in the evolution of iOS domain knowledge network. Our findings (Table 1) establish that duplicate questions significantly enhance the depth and breadth of this evolution.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Variables</th>
<th>Standardized Coefficients</th>
<th>T</th>
<th>R²</th>
<th>Adjusted R²</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Depth</td>
<td>Clustering Coefficient</td>
<td>1.8999***</td>
<td>16.710</td>
<td>0.6462</td>
<td>0.6439</td>
<td>279.4576</td>
</tr>
<tr>
<td></td>
<td>Closeness Centrality</td>
<td>0.2378*</td>
<td>1.6679</td>
<td>0.0179</td>
<td>0.0114</td>
<td>2.7818</td>
</tr>
<tr>
<td></td>
<td>Eigenvector Centrality</td>
<td>18.4443***</td>
<td>8.6781</td>
<td>0.3299</td>
<td>0.3255</td>
<td>75.3088</td>
</tr>
<tr>
<td></td>
<td>Degree</td>
<td>-4.9459***</td>
<td>-7.4674</td>
<td>0.2670</td>
<td>0.2622</td>
<td>55.7213</td>
</tr>
<tr>
<td></td>
<td>Largest Connected Subgraph</td>
<td>-31.6719***</td>
<td>-8.9664</td>
<td>0.3445</td>
<td>0.3402</td>
<td>80.3971</td>
</tr>
<tr>
<td>Knowledge Breadth</td>
<td>Average Shortest Path Length</td>
<td>-1.5369***</td>
<td>-5.2994</td>
<td>0.1551</td>
<td>0.1496</td>
<td>28.0841</td>
</tr>
<tr>
<td></td>
<td>Assortativity Coefficient</td>
<td>-2.9332***</td>
<td>-7.3955</td>
<td>0.2633</td>
<td>0.2585</td>
<td>54.6934</td>
</tr>
<tr>
<td></td>
<td>Betweenness Centrality</td>
<td>28.0378***</td>
<td>8.3149</td>
<td>0.3112</td>
<td>0.3067</td>
<td>69.1384</td>
</tr>
<tr>
<td></td>
<td>Number of Major Branches</td>
<td>-25.1586***</td>
<td>-8.4677</td>
<td>0.3191</td>
<td>0.3146</td>
<td>71.7026</td>
</tr>
</tbody>
</table>

Note: * p < 0.05, ** p < 0.01, *** p < 0.001

Table 1. Impact of Duplicate Questions on the Knowledge Network Evolution

Influence on knowledge evolution depth: significant positive findings associated with the clustering coefficient suggest that duplicate questions augment knowledge depth evolution by fostering inter-nodal connections. Further, they positively impact closeness and eigenvector centrality, thereby reducing network distance and promoting ties with significant questions. This implies duplicate questions may enhance knowledge depth by linking new and existing knowledge. However, an excessive proliferation of duplicates negatively affects the degree metric and largest connected subgraph, implying the trade-off between connectivity enhancement and potential information redundancy.

Influence on knowledge evolution breadth: duplicate questions negatively correlate with average shortest path length and assortativity coefficient (Mulders et al. 2020), suggesting an expansion of the network diameter and increased connection of dissimilar degree nodes. This indicates that high-degree nodes, such as popular questions, are more inclined to connect with low-degree nodes, thus potentially expanding the knowledge spectrum. Duplicates also exhibit a positive impact on betweenness centrality, serving as 'bridges' to facilitate knowledge linkage and dissemination. Interestingly, the negative correlation with the number of major branches reveals the role of duplicates in consolidating sub-communities, thereby fortifying knowledge evolution depth and curtailing fragmentation.

In conclusion, duplicate questions play a dual role in knowledge network evolution. They enrich both the depth, by augmenting the density and intricacy of knowledge, and the breadth, by reinforcing the network connectivity.

CONCLUSION
This paper provides a unique examination of duplicate questions from a knowledge evolution perspective. We envision knowledge evolution as the temporal progression of a Folksonomy-embedded complex network, concentrating primarily on the role of duplicate questions in fostering knowledge evolution within these QACs.

Interestingly, we discern that duplicate questions have a positive effect on both the depth and breadth of knowledge evolution within these QACs. To quantify the specific role of duplicate questions in knowledge evolution depth and breadth, regression analysis was utilized. The outcomes corroborate the positive value of duplicate questions in knowledge evolution, thereby affirming their significance within knowledge communities.

This research has profound implications for the realm of duplicate questions within question-and-answer communities. It intends to deepen our understanding and measurement of the value inherent in duplicate questions. While extensive discussions and research focus on the detection, identification, or avoidance of duplicate questions, the potentially beneficial value of duplicates has been largely neglected. This study thus illuminates the oft-overlooked merits of duplicate questions in the process of knowledge evolution.
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Drivers of the Virality of COVID-19 Misinformation Sharing on Social Media

Zhao, Yuehua
School of Information Management, Nanjing University, China | yuehua@nju.edu.cn
Da, Jingwei
School of Information Management, Nanjing University, China | m18805156308@163.com
Yan, Jiaqi
School of Information Management, Nanjing University, China | jiaqiyan@nju.edu.cn
Wang, Hao
School of Information Management, Nanjing University, China | ywhaowang@nju.edu.cn
Deng, Sanhong
School of Information Management, Nanjing University, China | sanhong@nju.edu.cn
Chen, Ye
School of Information Management, Nanjing University, China | cheny@nju.edu.cn

ABSTRACT

During global health crises, identifying the key factors of the misinformation dissemination process on social media can provide decision support for public health management. Drawing on the elaboration likelihood model (ELM), this study characterizes the effects of content types and social capital of social media users on the virality of misinformation related to the COVID-19 pandemic. We used scale, depth, and width to quantify the extent and structure of the virality of misinformation spreading on social media. The findings reveal that both the social capital of users and the content types have major influences on the dissemination of misinformation. Surprisingly, we discovered that the number of followers a user possesses has a varied influence on the dissemination scale, width, and depth, demonstrating the importance of considering dissemination structure.

KEYWORDS

Misinformation dissemination, Social media, ELM, COVID-19.

INTRODUCTION

In public health emergencies, the dissemination of misinformation not only threatens people’s health and life safety but also hurts disease prevention and control, social governance, and even international relations. Therefore, understanding the dissemination of misinformation is a key prerequisite to mitigating its negative effects. In this study, elaborating on the ELM model, we explore the influence of the central route feature (i.e. content types) and peripheral feature (i.e. publisher’s social capital) of misinformation on its dissemination on social media.

THEORETICAL FOUNDATION AND HYPOTHESIS DEVELOPMENT

Influence of central route feature on the virality of misinformation dissemination

It has been shown that different topics/types of misinformation related to COVID-19 spread in different patterns on Weibo (Cinelli et al., 2020). Inspired by previous research, this study classified COVID-19-related misinformation into medical-related misinformation (including misinformation related to treatment, prevention, etc.) and non-medical misinformation. In addition, non-medical-related misinformation was further categorized into pandemic-control-related misinformation (i.e., misinformation related to government response, the spread of the pandemic, etc.) and non-pandemic-control-related misinformation (i.e., celebrity-related misinformation, international related misinformation, etc.). Therefore, the following hypothesis is proposed: H1a: The dissemination of medical-related misinformation is more viral (especially in terms of breadth, depth, and width of dissemination) than non-medical-related misinformation. H1b: The dissemination of pandemic-control-related misinformation is more viral (especially in terms of the breadth of dissemination) than non-pandemic-control-related misinformation.

Influence of peripheral route feature on the virality of misinformation dissemination

The credibility of misinformation relies heavily on the credibility of the source. According to social capital theory, participants’ relational networks and the resources embedded in them strongly influence their knowledge-sharing behavior, especially in the social media domain (Nahapiet & Ghoshal, 1998). From a network perspective, the number of social media users’ followers can represent their structural capital. Therefore, we propose the following hypotheses: H2a: The number of users’ posts positively influences the viral spread of misinformation. H2b: The number of users’ followers positively influences the viral spread of misinformation. In addition, Lee and Sundar (2013) argue that information posted by publishers with authority affects people’s perceptions of message credibility. Therefore, the following hypothesis is proposed: H2c: The dissemination of misinformation posted by authenticated users is more viral than that posted by non-authenticated users. Above all, this study establishes the research model shown in Figure 1.

Figure 1. Research model and scale, depth, and width calculated for a sample cascade.

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METHODOLOGY
Data collection
To collect the circulated posts containing COVID-19 pandemic-related misinformation, we extracted the keywords from official fact-checked misinformation, and then created corresponding queries for an advanced search on the Weibo.cn website from January 23 to May 31, 2020. We ended up building the reposting cascades for a total of 2,363 misinformation posts.

Operationalization for variables
Information dissemination on social media can generally be measured by quantity and structure. We construct the cascade of misinformation reposting and measure the virality of misinformation dissemination from the perspective of scale, depth, and width (as shown in Figure 1). The definitions of the variables are presented in Figure 2.

DATA ANALYSIS AND RESULTS
The variance inflation factor (VIF) values for all variables were all below 5 (no larger than the threshold of 10), indicating that multicollinearity is not an issue in our data sample. The regression results are presented in Figure 2.

For the central route, medical-related misinformation had a significant positive impact, especially on the dissemination scale ($\beta=0.077, p<0.01$) and width ($\beta=0.076, p<0.05$). However, pandemic-control-related misinformation had a significant negative impact on the dissemination of misinformation, especially for scale ($\beta=-0.105, p<0.05$) and width ($\beta=-0.093, p<0.05$).

For the peripheral route, the number of posts has a significant positive impact on the dissemination scale ($\beta=0.112, p<0.001$), depth ($\beta=0.057, p<0.001$), and width ($\beta=0.070, p<0.001$). The number of followers has a significant negative impact on dissemination depth ($\beta=-0.019, P<0.01$), but has a significant positive impact on dissemination width ($\beta=0.034, p<0.05$). The impact of verified users is mixed. Public figures had a significant negative impact on the dissemination scale ($\beta=-0.147, p<0.01$), depth ($\beta=-0.039, p<0.05$), and width ($\beta=-0.143, p<0.001$); authority agencies have a significant positive impact on the dissemination scale ($\beta=0.207, p<0.001$) and width ($\beta=0.214, p<0.001$).

DISCUSSION AND PRELIMINARY CONCLUSION
In terms of the central route, information topics are shown to significantly impact the dissemination of misinformation. Medical-related misinformation positively impacts the dissemination of misinformation. On the contrary, the dissemination of pandemic-control-related misinformation was significantly lower than other misinformation. Secondly, among the factors of the peripheral path, the number of posts issued by authority agencies has been proven to positively affect the dissemination of misinformation. The misinformation posted by authority accounts diffuses farther, deeper, and more broadly than others. Such accounts need more scrutiny when posting information to avoid spreading misinformation. The number of followers negatively impacts the dissemination depth of misinformation but positively impacts the dissemination scale (not significant) and width.

Drawing on the ELM model, this study discussed the influence of the content and posters’ characteristics on misinformation dissemination on social media during the COVID-19 pandemic. We defined scale, depth, and width to measure the dissemination of misinformation scope and structure, and explore how the characteristics impact them. The empirical results show topics and posters’ social capital significantly impact misinformation dissemination. Interestingly, we found that the number of users’ followers has different effects on the dissemination scale, width, and depth, which effectively supports the necessity of considering dissemination structure. Our research methodology and empirical findings contribute to the current literature on health emergency management and information dissemination. Furthermore, this study also provides practical implications for curbing the dissemination of misinformation.

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Key Factors of Knowledge Base Adoption in Chinese Local Governments: Based on a Third-Tier City

Zhou, Jing  
Wuhan University, People's Republic of China | zhoujingwinky@whu.edu.cn  
Si, Li  
Wuhan University, People's Republic of China | lswhu@163.com

ABSTRACT
This research seeks to identify critical factors that have an impact on government knowledge base adoption, which is based on the local government of Yi Chang, a typical third-tier city in China. Firstly, the knowledge base and its development in Chinese local governments are introduced. Secondly, to build the adoption model, factors from the UTAUT and TOE framework were integrated and trust to knowledge base and intention to knowledge reuse are introduced. Thirdly, a questionnaire is designed based on the model and distributed to civil servants from Yi Chang local government. Finally, the proposed model is validated, and the collected data is analyzed by PLS-SEM. The results show the factors (effort expectancy, social influence, competitive pressure, trust to knowledge base, intention to knowledge reuse) have a positive impact on the adoption of knowledge base in Chinese local governments.

KEYWORDS  
Government knowledge base; The Unified Theory of Acceptance and Use of Technology (UTAUT); Technology-organization-environment (TOE) framework; Chinese local government

INTRODUCTION
Government knowledge base (GKB) is the end product of collecting and organizing the government information about a particular subject into a useful form. It systematically records, organizes and manages the experience, lessons and knowledge, so as to provide reference for future decision-making with a strong knowledge integration, classification, storage, distribution, decision support and other functions. Guiding Opinions of the General Office of the State Council on Further Optimizing Local Government Service Hotlines (The General Office of the State Council of the People’s Republic of China 2020) pointed out that all cities are required to establish a government service hotline knowledge base with "unified standards, real-time updates, and joint construction and sharing". After that, some governments in developed cities started to construct knowledge bases for the government service hotline. During the COVID-19 epidemic, more governments adopted knowledge bases to handle complicated business because of limited manpower. As for first and second tier cities in China, the functions of GKB and the level of its intelligence have developed well. Third-tier cities began to attach importance to and invest GKB. According to the web survey conducted, about 87.1% third-tier cities (70 overall) have constructed GKB. Some of them have rich functional modules and intelligent knowledge reasoning. 20% of GKB have FAQs and 32.9% have AI-guided chatbots. It’s easy to deduce that local governments in third-tier cities, operate within different regulatory, policy, organizational contexts. Thus, exploring the key factors that affect local governments of third-tier cities invest in knowledge bases is critical for the promotion and application of them.

In spite of the growing interest of GKB for both practice and research, very little is known about its actual application in third-tier cities and the factors leading to adopt it. Previous research focused mainly on knowledge base in firms(Wei, Xu, and Liu 2021), national governments(Dushkov and Haase 2020) or local governments of developed cities(Reforgiato et al. 2016). Thus, this paper takes the government of a third-tier city, Yi Chang, Hubei Province, as an example, which is situated in Central China area. What drives or hinders adoption and use as key factors is examined. This study contributes to the knowledge base adoption literature by being among the first to listen to civil servants and gain a perspective on what they think about the knowledge base.

RESEARCH METHOD
(1) An integration of UTAUT and TOE framework is proposed. The UTAUT framework is used to explore the individual perspective, whereas TOE is used to understand the organizational perspective. In UTAUT, effort expectancy and social influence are chosen. Effort expectancy is the degree of ease associated with use of the system and social influence measures the degree to which an individual perceives that important others believe he or she should use the new system. In TOE, competitive pressure and compatibility are selected to measure the environmental and technological contexts respectively. Meanwhile, intention to knowledge reuse and trust to knowledge base are introduced into the framework. (2) The GKB in Yi Chang is chosen and the key factors of its adoption is investigated through the model. As is shown in Figure 1, the GKB in Yi Chang is based on data collected from citizens and government departments. It has intelligent conversation and knowledge reasoning platforms with AI technology. It’s faced with enterprise, citizens and civil servants with 5 application scenarios and it can be accessed with multiple entries, such as AI-guided chatbots and FAQs. (3) A questionnaire is distributed to civil servants in Yi Chang to collect the data. The questionnaire consists of the items measuring the constructs in the model. 319 valid questionnaires were finally collected and determined. (4) A two-phase data analysis is employed.
Through data analysis, the measurement model demonstrated adequate construct reliability and validity, while structural model analysis validates the relationship between the constructs, i.e. hypothesis testing. Based on PLS-SEM (Hair et al. 2021) i.e. a measurement model and structural model analysis. A measurement discriminant validity. As for structural model, the main assessment criterion for the goodness of fit of the structural (1) Effort expectancy and (2) social influence. The individual factors both have a positive association with behavioral intention to use GKB. As such, this finding is supported by the studies about mobile banking (Ammar and Ahmed 2016) and blockchain (Park 2020) respectively. These civil servants choose to use GKB mainly because their leaders’ or colleagues’ influence or urge. (3) Competitive pressure. It is found to have a positive effect on behavioral intention to use GKB. Some far-sighted leaders begin to realize the great importance and urgency in the adoption of knowledge base, especially after seeing successful examples in other departments. Because they compete to deliver their services in a perfect manner in terms of invisible competition among different cities. (4) Compatibility. Unexpectedly, it does not have an association with behavioral intention to use GKB, which is inconsistent with past studies on adoption of cloud computing (Ali et al. 2021) and city management applications (Annis, Hou, and Tang 2021). One possible reason is the significant effect of effort efficiency in this study. That’s to say, when the staffs find it’s easy to handle with business with GKB, they would choose to adopt it without considering its compatibility. (5) Intention to knowledge reuse. It plays an important supportive role in GKB adoption. And effort expectancy and compatibility both have a significant effect on intention to knowledge reuse. On the one hand, knowledge reuse can break through the physical barriers between government departments, reducing conflicts and contradictions. On the other hand, knowledge reuse can also reduce the operating costs of training new staffs when experienced staffs depart. Through GKB, the knowledge can be reused in an open, convenient and sharing platform so those who urgently need to reuse knowledge tend to adopt it. (6) Trust to knowledge base. The study also identifies positive relationships between trust to knowledge base and behavioral intention to use GKB, intention to knowledge reuse. Trust to knowledge base can also promote behavioral intention to use GKB and intention to knowledge reuse because trust shows those staffs believe that GKB can protect data security and personal privacy, and the system is robust enough to cope with emergent IT crisis like system breakdown. The positive relationship between trust and e-government is consistent with the viewpoints of previous research (Garcia and Zúñiga 2020; Li 2021).
REFERENCES


ABSTRACT
This study represents our preliminary work focused on the health information seeking of caregivers of ovarian cancer (OvCa) patients and survivors. Previous research has predominantly focused on OvCa patients' needs, while neglecting caregivers' needs independently. Through the analysis of social media posts by OvCa caregivers, this study explores seven categories of information needs desired by caregivers and examines how these needs evolve throughout the disease trajectory. By distinguishing between caregiver-specific needs and those on behalf of the patient, our study contributes to the development of a holistic caregiver support framework.

KEYWORDS
consumer online health information seeking, caregivers, ovarian cancer, surrogate seeker, social media

INTRODUCTION
Cancer not only impacts the patient but also their family caregivers who share the distressing trajectory (Chua et al., 2020). As a result of ongoing changes in the current healthcare system, most aspects of general cancer care have been shifted to outpatient management, which heavily relies on caregivers of cancer patients and survivors (Laizner et al., 1993). Unprepared cancer caregivers often seek information and support online to fulfill their changing needs (Reifegerste et al., 2017). In this study, we focus on exploring how caregivers of ovarian cancer (OvCa, hereafter) patients and survivors seek health information and support on social media.

OvCa is a leading cause of death among women, with significant burdens on patients and caregivers due to late diagnosis, multiple recurrences, complex treatments, and high mortality rates (Le et al., 2003). Despite recent researchers having begun to investigate the online information seeking of OvCa patients and caregivers, the focus has primarily been on the patients' needs (Thaker et al., 2022; Chi et al., 2021; Madathil et al., 2013), while neglecting the caregivers' needs independently. Recognizing that distress and unmet needs among caregivers may exceed those of cancer patients (Le et al., 2003), our study aims to explore the understudied OvCa caregivers, and their information seeking on social media. We anticipate the findings will provide valuable insights into the evolving needs of OvCa caregivers throughout the disease trajectory.

METHODS
Our data was collected from the Reddit platform (https://www.reddit.com), an open social media platform with various communities (subreddits) where users collaborate and exchange information and support. Four specific subreddits were selected: "ovarian cancer," "ovarian cancer new," "cancer," and "askdocs." Posts from the first two subreddits, focused explicitly on ovarian cancer, were included in the dataset. From the latter two subreddits, only posts mentioning ovarian cancer were considered. To identify posts from caregivers, GPT-3 (Brown et al., 2020) was utilized. The posts were anonymized and sent as input to the GPT-3 model along with a prompt specifying caregiver-related concerns. The fill-the-gap format prompt was appended at the end of the post: "I have concerns for my __." If the model generated names such as mom, daughter, wife, sister, sister-in-law, or aunt, it was considered an indicator of a post by a caregiver. A total of 121 posts, ranging from 2014 to 2023, were collected, which were then manually reviewed to identify 93 final posts from caregivers. The removed posts were not related to OvCa or the post content part was deleted by the reddit user.

Thematic content analysis, along with deductive and inductive coding (Fereday & Muir-Cochrane, 2006), was applied to the obtained data. Due to the lack of established health information needs for OvCa caregivers in the literature, we used earlier studies (Xie et al., 2015; Xie et al., 2011) that examined the types of health information caregivers sought in various healthcare settings and Chi et al.'s (2022) list of OvCa patients' information needs as thematic foundations for content analysis. Two coders independently coded a randomly selected 20 posts in two rounds to resolve disagreements and reach a consensus. A codebook was developed in the second round by combining the agreed thematic foundations (deductive) and open coding (inductive). The codebook was composed of three meta-level themes: (1) disease trajectory; (2) information seeking for whom; and (3) information needs, which formed the foundation for subsequent analysis. Two coders together coded the remaining posts in accordance with the codebook, and weekly discussions helped to resolve disagreements by the research team.
**FINDINGS AND DISCUSSION**

Figure 1 summarizes the seven distinct information categories sought by OvCa caregivers across the disease's six stages. The findings indicate that the information sought by caregivers for rare cancers, like OvCa, on social media closely aligns with the information desired by family caregivers for various types of cancer that proposed by Xie et al. (2015). However, it is important to acknowledge that dynamic and evolving needs arise when considering factors such as the disease trajectory and whether caregivers are seeking information for themselves or on behalf of the patients.

![Figure 1. OvCa Caregivers Health Information Seeking Across the Disease Trajectory: A Heatmap](image)

OvCa caregivers actively seek (1) information related to coping strategies for dealing with feelings, family, and social concerns across the progression of the disease, naming **Psychosocial care**. Even before the patient's official diagnosis, caregivers themselves express a strong desire for this informational support, which lasts through diagnosis confirmation and the start of treatment. Although it may receive less mention when the patient’s condition improves in the remission stage, the need resurfaces as the cancer recurs and intensifies during the end-of-life stage. Another type of information largely identified from the analysis is (2) information relating to the rationale of using (or not using) a method (traditional, alternative, or predictive) to treat, manage, or prevent the disease (referred to as **Treatment and medication**). Aside from their main efforts to gather information on treatment methods for patients during diagnosis and treatment, caregivers, particularly female caregivers like daughters or granddaughters, also search for preventive methods related information due to concerns regarding their genetic predisposition to the disease, especially when the care recipient exhibits symptoms before receiving an official diagnosis or during the end-of-life stage. Caregivers also express a high desire for (3) information regarding the disease, including its definition, prognosis, and causes (referred to as **Characteristics of health condition**). On one hand, caregivers have a strong inclination to fulfill their own knowledge about the disease, especially when encountering unfamiliar aspects of the condition, such as P26 asked: “cancer has not been confirmed yet, her CA-125 marker at 4852, is it normal to have it that high?” On the other hand, they proactively seek information on behalf of patients to help them navigate through different stages. For instance, P1052 described: “this is a woman who used to run three miles before starting chemotherapy, and now it seems like they damaged her since she experienced bad shortness of breath as a result of the treatment?” Moreover, (4) **Daily care practice** encompasses practical instructions and care tips that relate to everyday life (e.g., dietary actions, transportation, physical activities) are largely desired by caregivers in preparing for and providing care after the patient’s diagnosis and during the treatment process.

In addition, although the available data provide limited insights, OvCa caregivers express unique needs for patients that are not extensively discussed in other contexts. These needs include (5) **Advanced care**, which involves seeking information about disease management at later stages, such as finding specialized gynecologic oncologists or institutes when cancer recurs; practical aspects of advanced care planning and coordination, and (6) **Symptom management**. Unlike the initial focus on understanding the disease's various conditions, caregivers seek practical instructions for effectively managing symptoms during new situations like diagnosis, remission, or recurrence, as these circumstances can give rise to different symptoms.

While it is less mentioned, OvCa caregivers, like other cancer caregivers, express their need for (7) practical information to address legal, financial, and insurance related concerns and dilemmas, particularly during the early stages of the disease, such as when they get the OvCa diagnosis and move into the treatment preparation.

**CONCLUSION**

This preliminary study reveals the changing information that sought by OvCa caregivers across patients' disease trajectory, which can inform healthcare providers to offer proactive support, therefore enhancing the quality of care. The caregiver's role as surrogate information seeker is an important aspect, and providing resources from those aspects can make caregivers more informed about patients' current as well as upcoming care needs. Our future work includes further research into OvCa that focuses on exploring the unique needs and disparities between caregivers and patients over the disease trajectory. This will enable the development of tailored support strategies to improve caregiver well-being and enhance patient care.
REFERENCES


