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RESEARCH ARTICLE

One Size Does Not Fit All: Self-Archiving Personas Based On Federally Funded Researchers at a Mid-Sized Private Institution

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ABSTRACT

Introduction: This mixed-method study analyzes the self-archiving behaviors and underlying motivations of researchers at an institution very recently recategorized by the Carnegie Classification system from “Doctoral–High Research Activity (R2)” to “Doctoral–Very High Research Activity (R1).”

Methods: A quantitative analysis of data provided by CHORUS, a multi-institutional open access (OA) infrastructure project designed to minimize the administrative costs of complying with federal public access mandates, was followed by semi-structured qualitative interviews with researchers to determine the underlying motivations for self-archiving research papers resulting from federal grant support.

Results: Fifty-one authors with federal research funding published 71 journal articles; 139 OA versions of these 71 articles were intentionally made available by researchers across nine types of platforms, including and in addition to those provided by publishers. Interviews with 11 investigators revealed motivators such as a dedication to public access to knowledge, learned behaviors in specific disciplines, and enlightened self-interest. Challenges included concern regarding confidentiality, confusion about intellectual property and funder requirements, administrative overhead, and integrity of the scholarly record.

Discussion: Despite concerns and a lack of an OA mandate and other drivers more commonly present at larger, more research-intensive universities, several researchers interviewed actively engaged in self-archiving article versions, not always with clear motivations. These findings have implications for both scholarly communications and collection development services.

Conclusion: These quantitative and qualitative data informed the creation of three distinct personas intended to help librarians at similar universities design services in a manner that aligns with investigator motivations.

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IMPLICATIONS FOR PRACTICE

1. Self-archiving is driven by a complicated and, at times confusing, interplay of motivations and behaviors, all of which must be considered in library service design.
2. Library services related to self-archiving can be designed with empathy by using mixed-method persona design.
3. Self-archiving behaviors can help libraries understand researchers' perceptions of publishing and collection development in addition to self-archiving motivators.
4. Libraries serving small to mid-sized colleges and universities with growing research trajectories are presented with risks and opportunities that may not be shared by R1 universities; this study provides both useful results and a replicable methodology.

INTRODUCTION

Increased differentiation in the U.S. higher education enterprise is leading to library services being designed not simply in relationship to other libraries, and not simply measuring success by the size of the library collections, but instead designing library services in alignment with their parent institutions' goals (Malpas et al., 2018). Within this larger strategic service alignment, the current pace and trajectory of change in the scholarly communications ecosystem requires libraries to understand what motivates researchers in their campus context if they are to successfully design scholarly communications and related services.

As part of the University of Denver's (DU) ongoing exploration of small to mid-sized academic libraries in a changing scholarly communication landscape, DU has been involved in a project led by ITHAKA S+R on the effects of big deal cancellations (Cooper & Rieger, 2021) and another led by Schack and Macklin (2020), who wrote in a successful proposal to the Institute for Museum and Library Services that “[w]hat we are left with in academic libraries that are not ... (R1) ... is a broad yet vague gray space wherein we lack the agency that our consortia have given us until now to pursue our collective interests” (p. 2).

This article describes the results of one of DU's earliest explorations into the changing scholarly communication landscape (this “broad yet vague grey space” in which we increasingly find ourselves) when we served as the exemplar of a medium-sized library in the CHORUS pilot project in 2016. CHORUS is a publisher-led response to the Obama-era White House Office of Science and Technology public access policy (Anderson, 2013; OSTP, 2013), the goal of which was to develop a service that gathers and displays data on publicly funded research outputs. The project was a collaborative effort among the University of Florida Libraries, DU Libraries, Elsevier, Wiley, Oxford University Press, the American Physical Society,

the American Chemical Society, and the Association for Computing Machinery. Although efforts to understand how change in different spheres of scholarly communication (big deal cancellations, read-and-publish arrangements, self-archiving, compliance with funder mandates) are disparate, our work converges in our local environment in ways that allow us to position services in a customized fashion.

That local environment, DU, includes approximately 12,000 students largely evenly divided between undergraduate and graduate programs—it combines the experience of a small liberal arts college with that of a research university, and its graduate offerings tend toward professional programs (e.g., business, law, international affairs, social work, counselling psychology, education). Classified for years as “higher research activity” by the Carnegie Classification system (R2), DU’s research trajectory is also steeply on the ascendancy, with annual research expenditures of \$40.7M in fiscal year 2021, an increase of 56% over five years (Lengsfeld, 2021). A report commissioned by the Faculty Senate and Office of the Vice Provost for Faculty Affairs found that this “enormous growth in research funding over the last five years ... might cause the Carnegie Foundation to change our status to an R1 [“Very high research activity”] institution” (Hood, 2020, p. 1). Indeed, shortly after this manuscript was submitted, DU was changed to an R1 status, well ahead of internal projections.

DU is, then, an institution changing quickly, seeking to hold on to student-focused values that have served it well for 160 years, even as it grows and changes with respect to its research enterprise.

In addition, a sizable portion of funding for DU’s sponsored research is sourced from private and philanthropical foundations, but a non-trivial (and increasing) source is federal monies. Projects funded by federal agencies are like what one might find at other institutions—sciences and engineering—but research in the behavioral and social sciences is also on the rise. In addition, DU’s most productive research faculty are also some of its most dedicated teachers. Tenure and promotion practices tend to be decentralized. Given these qualities, and DU’s recent growth in funded research, certain motivators and behaviors of faculty at DU may differ from that of other institutions, particularly large public universities that focus more on research.

The research presented in this paper is a mixed-methods case study to better understand how DU faculty funded by federal agencies self-archive their work, why, and what these behaviors and motivations mean for library services. DU does not have an open access (OA) mandate and has only very recently created a centralized fund for supporting OA article processing charges (APCs). DU Libraries also did not experience for many years some of the budgetary drivers, such as serials cuts, that can catalyze OA efforts at other universities. In a recent survey

of faculty ($N = 44$) conducted by a graduate student in the Library and Information Science Program at DU, 75% of respondents reported “never” (38.6%) or “sometimes” (36.4%) publishing in fully-OA (as opposed to hybrid) journals, with only 11.4% reporting that they “sometimes” do. Only a single respondent indicated that they “always” publish fully-OA, and an absolute majority, 59.1%, conveyed that they had either an “extremely negative” (2.3%), “somewhat negative” (25%), or “neither positive nor negative” (31.8%) opinion of OA publishing generally (Howick, 2020). These data may not be generalizable, but they do suggest a publishing culture not fully supportive of OA efforts, adding cause to understanding those who self-archive.

Exploring why some of DU’s faculty choose to self-archive, despite a lack of institutional history supportive of OA or a firm awareness of the many challenges presented to mid-sized libraries, is critical and an impetus shared by similar institutions. In fact, in a recent study of publication patterns in one of DU’s consortia peers, Vandagriff (2020) finds a similar dynamic and research impetus at the University of Colorado Colorado Springs (UCCS), which was categorized as an M1 school (“Master’s Colleges and Universities—Larger programs”) until 2018, when it was reclassified as an R2. Vandagriff explains that “[w]ith this new classification comes growing attention to research outputs at UCCS” and concludes “[t]his change presented an opportunity for the Kraemer Family Library (KFL) to assess UCCS’s research outputs and to strategically expand its existing support of scholarly communications” (p. 3).

Indeed, the convergence of challenges at DU are shared elsewhere: namely, a small to medium-sized research operation vulnerable to swift shifts in the economics of journal publishing; a relative lack of OA awareness among its faculty; an expansion of research initiatives; and a library budget hard-pressed to meet the needs of such growth. In this context, it is critical that libraries work strategically with faculty and administration to address these challenges, but doing so requires an understanding of what motivates and disincentivizes productive researchers to share their work openly.

Simply put, the results of this study will help inform scholarly communications and related efforts at institutions of comparable size or that share similar characteristics, which cannot always apply findings from larger institutions that have contended with OA issues for a longer period, at a greater scale, and with more resources.

LITERATURE REVIEW

Although there is a wealth of research on OA, this review will focus on faculty motivations for and barriers to self-archiving. Many of the findings in this literature review are echoed in this

study, but it is important they are not taken as simply replicable to any given institutional setting. The context in which this case study operates reveals unique challenges for small and mid-sized libraries, shared elsewhere, particularly given that the library and information science literature disproportionately represents R1 institutions, and has for decades. For example, Budd and Seavey conducted an analysis in 1990 that resulted in the 20 “most productive institutions,” with respect to librarian publication patterns, and all were R1s (p. 427). Twenty-seven years later, Blečić et al. (2017) concluded that 19 of the 20 most productive institutions were R1s.

Motivations for self-archiving

Academic researchers are compelled by a number of reasons to self-archive their publications. With different options available to them, from institutional or subject repositories to academic social networks (ASNs) to personal or departmental webpages, they may use one or multiple venues and have different reasons for making those choices. Current research demonstrates that faculty are likely motivated by a complex combination of intrinsic and external factors that determine their self-archiving behavior.

J. Kim (2010) identified seven primary factors that influenced faculty’s self-archiving practices in both positive and negative ways and across a range of venues. Based on survey and interview data with faculty at Carnegie doctorate universities, J. Kim concluded that faculty were primarily motivated to self-archive by three factors: 1) altruism, or a belief that they were acting in the public good by making their research freely available; 2) belonging to a discipline in which self-archiving was common practice (e.g., the prevalence of a self-archiving culture); and 3) their perceptions that self-archiving either benefited or had a neutral impact on their tenure and promotion evaluations. To a lesser degree, J. Kim also reported that technology skills and faculty age play a role in whether they were motivated to self-archive their research. Much of the literature about self-archiving builds upon J. Kim’s initial framework.

Self-archiving as an altruistic act, or the idea that self-archiving represents the underlying spirit of OA, was seen to be a motivating factor in several studies (Abrizah, 2009; Covey, 2011; Heaton et al., 2019; Lee et al., 2019). Reciprocity appears to be closely aligned with these altruistic reasons for making one’s research available, since many researchers often utilize OA versions of articles and, consequently, feel a responsibility to provide access to their research for readers in the same way. In fact, Lee et al. (2019), whose study focused on motivations for self-archiving on the ASN site *ResearchGate*, concluded that after accessibility, altruism, reciprocity, and trust were the next highest-rated motivations

for users, indicating that researchers supported the open exchange of research in order to benefit others (p. 571).

Although often identified as a separate motivating factor, accessibility is very closely interrelated to altruistic motives and reciprocity (and is, by far, the most often cited reason for self-archiving). Researchers aim to increase the accessibility of their work, and by making it available in institutional and subject repositories or through websites and social networking sites, researchers believe that they can reach more people and also make their work more easily discoverable than through subscription journals alone (Creaser et al., 2010; Baro et al., 2018; Lee et al., 2019; Hailu & Wu, 2021). Lee et al. (2020) classified psychology with other “soft pure” sciences (such as sociology) in their study of disciplinary differences in motivations for self-archiving on *ResearchGate* and found that this group was more highly motivated by accessibility, as well as personal and professional benefits, than the hard sciences, although they did not identify significant differences in motivations between pure and applied groups. For researchers in the sciences and biomedical fields, there is an additional imperative that scientific knowledge should be accessible and shared (Greussing et al., 2020, p. 5). While astronomers and mathematicians describe their primary motivation for self-archiving as faster dissemination of research results, they also mention accessibility as an important secondary motivation, because it aids colleagues in their field who cannot afford to access the published versions of articles (Fowler, 2011; Taubert, 2021). For many researchers, ASNs were the preferred venue, specifically for their ability to increase the availability and visibility of research (Borrego, 2017; Laakso et al., 2017; Jordan, 2019). Lovett et al.’s (2017) study at the University of Rhode Island, which compared faculty compliance with the OA policy mandating deposit in the university’s institutional repository with participation in *ResearchGate*, found that faculty were motivated to use both venues in order to share their work more broadly and increase the visibility and impact of their research, although *ResearchGate* had an edge over the institutional repository, both in terms of faculty motivations to use the site and perceived benefits of participation.

In addition to altruistic reasons for self-archiving, researchers are also driven to make versions of their work freely available for a variety of personal and professional factors. The wider readership enabled by self-archived research may increase a researcher’s visibility and, accordingly, lead to greater professional recognition for oneself and one’s institution (Harnad, 2003; Creaser et al., 2010; Brand, 2012; Jordan, 2019). For these reasons, Khalil et al. (2018) advised authors, even at the beginning stages of article writing, to plan ahead with strategies for increasing the visibility of their published research through online repositories, self-archiving on personal websites, and promotion through ASNs. Coonin’s (2011) study of OA publishing in business research found that more than a third of researchers who self-archived did so in order to increase the impact of their research, because with increased

recognition and broader readership comes the opportunity for more researchers to cite an author's archived research. In many disciplines, especially within the sciences and social sciences, the number of citations (and other bibliometrics) serves as an indicator of the researcher's impact on the field and is considered, along with other factors, in tenure and promotion reviews (Coomes et al., 2017).

As identified by J. Kim (2010), belonging to a disciplinary culture in which self-archiving is a common and widely supported practice greatly influenced researchers' behavior. Physics and economics, for example, have had a thriving online preprint culture to facilitate early dissemination of research, and their subject repositories, *arXiv* and *RePEc* (Research Papers in Economics), have been in existence for more than 20 years (Creaser et al., 2010). Antelman (2006) examined the self-archiving practices of faculty in six social science fields: anthropology, economics, geography, political science, psychology, and sociology. She concluded that disciplinary norms were a more significant factor than publisher policies in determining behavior. In the articles she reviewed, social sciences faculty self-archived to personal websites or repositories at a moderate rate compared with the sciences, and there were notable differences between the disciplines. Disciplinary practices, as well as the influence of departmental colleagues and co-authors, can motivate authors to self-archive (Spezi et al., 2013; Y. Kim, 2018). Covey's (2009) study of faculty self-archiving at Carnegie Mellon, however, found that even departments without widespread adoption and strong commitments to self-archiving articles often had one or more faculty members who were active supporters of self-archiving. Lee et al. (2019) also noted that self-archiving culture and peer influence were less significant motivating factors for *ResearchGate* users. In general, researchers in physics, astronomy, mathematics, medical sciences, economics, and psychology disciplines are more likely to make their research publicly available through self-archiving venues.

Finally, funding agency or institutional mandates to make research available in a subject or institutional repository serve as a motivating factor for researchers (Swan & Brown, 2005; Xia, 2007). For federally funded researchers in the United States who were impacted by the National Institutes of Health (NIH) 2008 policy (Suber, 2008) and the 2013 OSTP public access memo (OSTP, 2013), archiving articles in publicly available subject repositories, such as *PubMed Central*, has been common practice for years. After 10 years of the NIH public access policy, O'Hanlon et al. (2020) interviewed medical fellows who still had concerns about the prestige of OA journals but were generally familiar with and supportive of the NIH public access policy—one respondent described the policy as “just part of the research process for me” (p. 54). Many academic institutions also adopted mandates or policies that required or encouraged their faculty to deposit an OA version of published research in their institutional repositories, although compliance with these

mandates and policies varies, especially with other competing options (Creaser, 2010; Brand, 2012).

Barriers to self-archiving

J. Kim (2010) concluded that the two biggest barriers to faculty self-archiving were 1) concerns about copyright and 2) reservations about the amount of time and effort required to self-archive their work. Creaser et al. (2010) identified an additional barrier to self-archiving as an “unwillingness to place outputs where other content had not been peer reviewed” (p. 157). J. Kim (2011) describes a similar attitude under the category of trust: faculty are more likely to trust a repository if they perceive the repository as hosting high-quality content. This idea of trust is also a barrier to the establishment of preprint servers in new fields—whereas some fields are creating new subject-based preprint archives such as *ChemRxiv* and *bioRxiv*, other fields still have concerns that preprints are not peer reviewed. Hartemink (2019), writing as the founding editor of a major soil science journal, expressed continuing concern that some OA formats lacked sufficient peer review. Fuller et al. (2014), writing to fellow conservation biologists, object to preprints because they do not represent the final version of the paper, but they mentioned that preprint servers could still be a possible access solution if enough conservation biologists started to use them (as of November 2021, the new *bioRxiv* server does not list conservation biology in their list of subject areas, although they do list related subject areas such as ecology).

Concerns over copyright included both complying with publisher policies and questioning how OA works will be used. J. Kim (2011) concluded that faculty who worry more about copyright permissions are more likely to contribute to an institutional repository, perhaps because their repository managers gave guidance or assistance with copyright compliance. Rowley et al. (2017) delved into faculty attitudes toward how their OA works will be re-used: faculty objected to their work being re-used for commercial purposes, and humanities and social science authors were particularly uneasy about their work being adapted or re-published in anthologies. Covey (2009) pointed out that complying with copyright policies could amplify reservations about the time and effort required for self-archiving—for example, if publisher policy requires a preprint to be replaced with a postprint once available.

Faculty have many demands on their time, and what might seem like a small amount of effort to self-archive work can be prohibitive. The self-archiving process is described as “time consuming” and “cumbersome” (Charbonneau & McGlone, 2013, p. 23); entering metadata can be “tedious” (Fry et al., 2011, p. 51); and the words “tedious” and “time consuming” were also used to describe the process of checking copyright permissions in Spezi

et al. (2013, p. 12). The time and effort barrier may help explain why a tradition of self-archiving in a particular repository such as *arXiv* does not necessarily translate into a commitment to self-archiving in other locations. For example, Xia (2007) discovered that physicists were no more likely to deposit to the institutional repository than the chemistry department at their institution. Mischo and Schlembach (2011) showed that engineering faculty were more likely to self-archive in a subject repository than the institutional repository because the authors felt that potential readers were more likely to find their work in a subject repository such as *arXiv*, and the time and effort barrier for the institutional repository was too high given the limited potential increase in their audience. This barrier of time and effort is effectively illustrated in articles in which faculty discuss why they use ASNs rather than institutional repositories. ASNs often send “Is this your paper?” emails with the metadata pre-populated, inviting faculty to self-archive their work with the click of a button: Laakso et al. (2017) report that faculty mentioned this convenient workflow as why they chose to self-archive with ASNs. Borrego (2017) looked specifically at *ResearchGate* use, which faculty described as fast and simple, whereas Zhang and Watson (2018) describe ASNs as popular because they are straightforward to use.

METHODS

This study quantitatively analyzed compliance with federal access mandates among DU researchers using data from a multi-institutional project, CHORUS; expanded the analysis by exploring self-archiving behaviors undertaken in addition to mandated archiving; conducted semi-structured interviews with researchers to determine underlying motivations for these behaviors; and finally, leveraged both quantitative and qualitative data to produce “personas” that allow for anonymous, generalizable results.

Quantitative analysis using CHORUS data

CHORUS (<https://www.chorusaccess.org/>) pulls data on publicly funded grants at a specific institution and their resulting research publications from publisher platforms, *CrossRef*, and *Scopus*. The data are then displayed through the CHORUS Dashboard for those institutions to determine how much of their publicly funded research output was openly available through publisher platforms, under a registered reuse license, and archived through services such as CLOCKSS (Controlled Lots of Copies Keeps Stuff Safe; <https://clockss.org/>). It is, then, an attempt to streamline compliance analysis efforts.

DU’s pilot CHORUS dashboard found 51 institutional faculty authors who had published articles based on publicly funded research. Initial data from the dashboard piqued interest about underlying motivations, resulting in the use of persona-driven interviews as a qualitative

approach to exploring motivation—interviewees were recruited from the pool of DU authors identified in the CHORUS dashboard.

Qualitative analysis using personas

The use of personas in designing products, software, services, tools, or infrastructures has become an increasingly common practice across many disciplines for two decades, including everything from health intervention applications for diverse communities (Haldane et al., 2019) to industrial robots (Björndal et al., 2011). In libraries, researchers use personas in a variety of ways, from broad applications to express what motivates users to use library services writ large (Tempelman-Kluit & Pearce, 2014) to more specific uses, such as how library spaces should be designed to facilitate co-working (Bilandzic & Foth, 2013), how receptive scientists are to library assistance in data management (Lage et al., 2011), and how various digital libraries should be designed (Blandford et al., 2004; Maness et al., 2008). The origin of their use is widely attributed to product design research (Cooper, 2004). While some controversy as to their validity is important to note (Chapman & Milham, 2006), studies show that their use helps “designers take time to think about the user that they are designing for” (Dahiya & Kumar, 2018, p. 38), that a variety of benefits abound if they are used regularly (Miaskiewicz & Kozar, 2011), and that improvements to the methodology continue (Miaskiewicz & Luxmoore, 2018; Pichot & Bonnardel, 2019). Using personas in design is a helpful way of keeping users at the forefront of the decision-making processes.

Often (and herein) defined as “fictitious, specific, concrete representations of target users” (Pruitt & Adlin, 2006), personas are derived of mixed-method data-gathering techniques. In this study, as in most, both quantitative and qualitative data were gathered, the purpose in this work being to better understand the specific yet contextualized motivations and behaviors in the self-archiving of research outputs, including papers and data sets. Quantitative data analyzed from the CHORUS project drove an effort to gather qualitative data from semi-structured interviews with 11 researchers.

All interviewees were asked a series of questions (see Appendix A) with relevant follow-up questions being asked in a semi-structured approach to glean better understanding of an individual’s particular motivations and behaviors and underlying context, be it disciplinary, institutional, or relative to a laboratory or department. Detailed notes were gathered during these interviews, and the authors met to share highlights regarding the researchers’ behaviors and other important contextual considerations, including the following questions:

1. Research agenda: What was/is the faculty member's overall research agenda, and if applicable, how has it changed over the course of their career?
2. Experience: How long has the researcher been at DU, and how long have they been conducting research generally?
3. Funding: What work was funded by federal agencies or other sources, and how aware is the faculty member of related public access mandates?
4. Publications: What publications resulted from this work? Were there additional research outputs, such as presentations? Were the publications related to previous work, perhaps funded from different sources?
5. Attitudes toward sharing, etc.: What was the faculty member's general attitude toward sharing research, whether it be underlying data or publications, and how, if at all, did public access mandates factor into their overall perception?

A collaborative whiteboarding exercise involved using colors to identify commonalities among interview highlights. Colors were used to make initial attempts at identifying thematic similarities (see Figure 1).

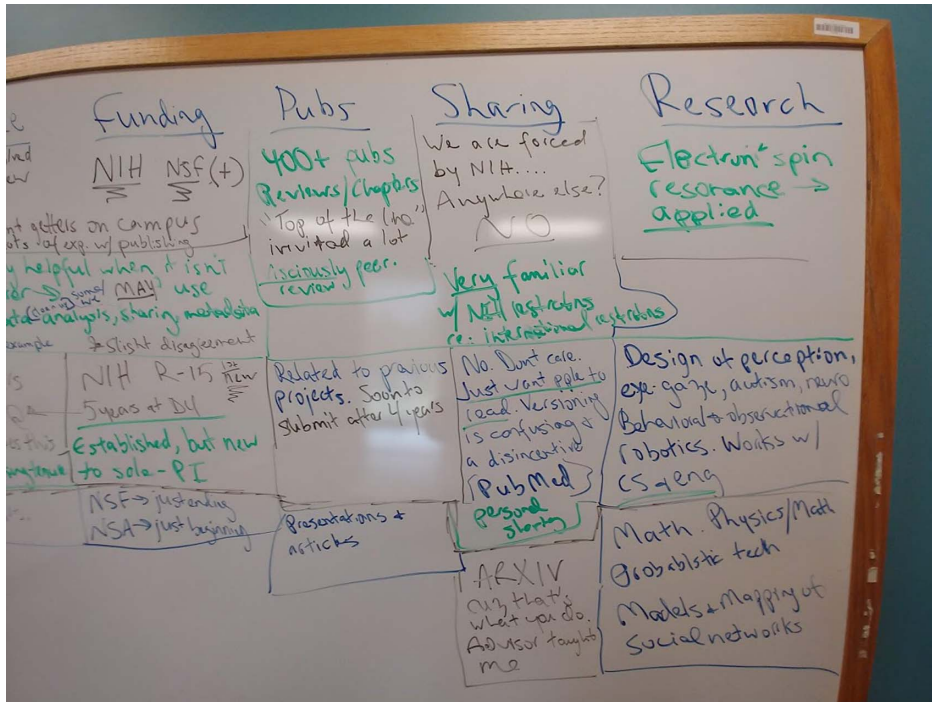


Figure 1. Highlights of interviews being collated and discussed. Color coding helped begin groundwork for themes.

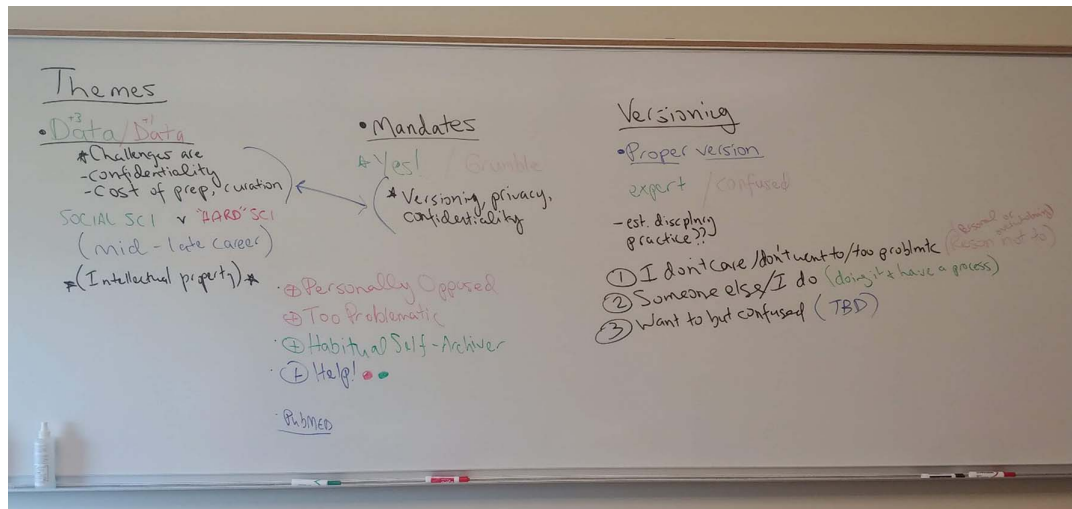


Figure 2. The whiteboarding process identified themes from the interviews.

Once all interviews were discussed and their highlights agreed upon, these colors were used to help determine themes that provided commonalities and differences among the researchers' motivations and behaviors (see Figure 2). Green was used to connote themes including a high degree of understanding and support for self-archiving, red for either confusion or opposition to it, and blue for confusion coupled with a need for support.

These three thematic clusters subsequently drove the design of three distinct personas intended to help librarians at similar universities design research information management services in a manner that aligns with investigator motivations.

RESULTS

Quantitative analysis using CHORUS data

DU's initial CHORUS Dashboard contained data on 51 institutional authors who published 71 publications resulting from publicly funded research, of which only 8 were verified as OA through a publisher platform. Given the small number of openly available publications, additional research determined whether alternative platforms were being used by investigators to provide OA versions, including preprints and postprints. Searches were performed through *Google* and *Google Scholar* for all 71 publications. This analysis revealed that 43 of the publications had OA versions available through *PubMed*, *arXiv*, university websites, *ResearchGate*, *Semantic Scholar*, personal websites, or other ASNs. Additionally, 17 publications were available in multiple locations as OA (see Figure 3).

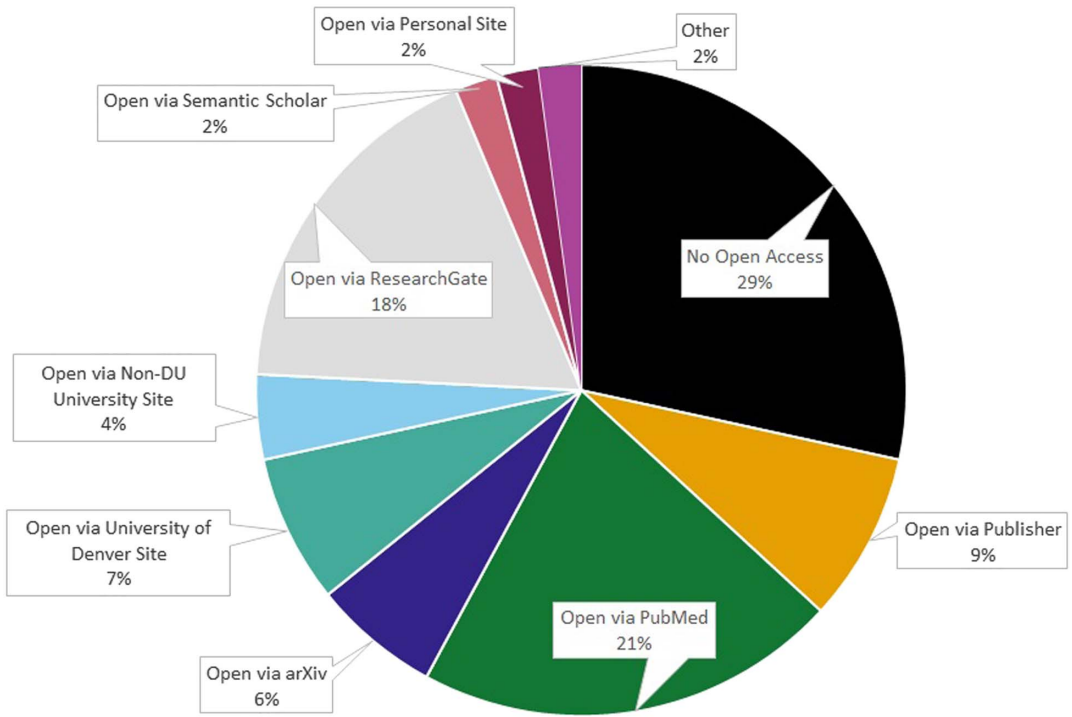


Figure 3. Availability distribution of open access publications.

Further analysis of the 71 publications showed that they had been written by DU authors in 11 different academic departments and units. The authors, when divided into their respective departments, displayed distinct preferences or habits in the platforms through which they choose to disseminate OA versions of their publications (see Figure 4). Biological Sciences, Mechanical and Materials Engineering, Chemistry and Biochemistry, and Psychology departments had a slight preference for *PubMed*. The Mathematics department demonstrated a preference for *arXiv*, followed closely by DU webpages. Electrical and Computer Engineering had an even split of preferences among not sharing, sharing via *ResearchGate*, and sharing via a university website. The Physics and Astronomy department and the Institute for Healthy Aging preferred *ResearchGate*. There was a slight tendency among Computer Science department faculty not to share open works, but they also used multiple platforms when open works were shared. Business Information and Analytics departments and the Graduate School of Social Work tended to not share OA versions. Cross-disciplinary works were credited as being shared by each department to which they were associated.

It should be noted that these tendencies were pulled from a very small sample size and reflect broad motifs in departments and units but do not offer insight into authors' motivations.

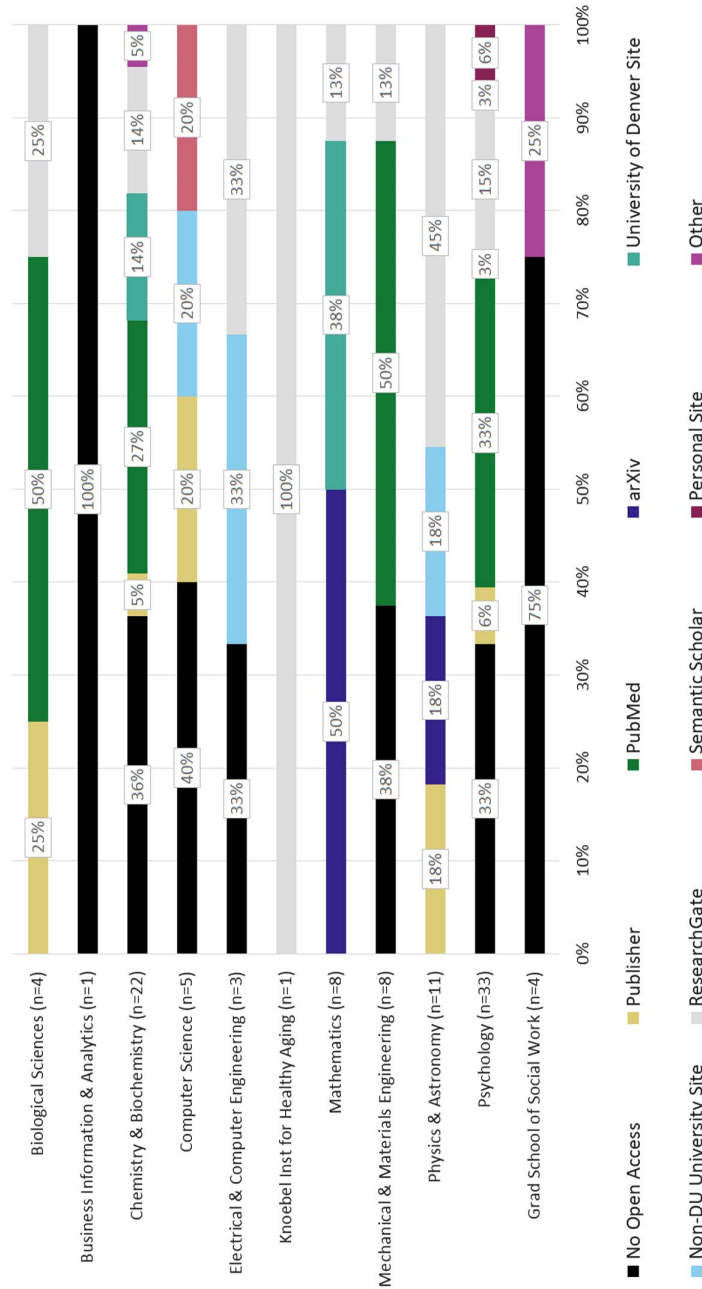


Figure 4. Distribution of open access platforms used by academic department.

In order to better understand the decisions and habits of DU researchers, the use of persona-driven methodology was employed so a generalized view of these self-archiving behaviors could be developed.

Qualitative analysis using personas

Four distinct themes emerged from qualitative analysis of interview data using persona-driven methodology:

1. **Data:** Many researchers spoke at length not about the articles resulting from their research but the underlying data. Some expressed a strong desire to share these data, and others had shared their data if asked to do so by colleagues. Those who were interested in or who had shared data all spoke about the complexities of doing so, including challenges regarding metadata, confidentiality, and intellectual property (IP). Some expressed strong opposition to sharing data, citing the difficulty in reproducibility and concern regarding protecting IP.
2. **Article Versioning:** Eight of the eleven interviewees found issues regarding pre- and postprints versus versions of record either confusing (“I am confused as to which versions I can share”) or problematic for their discipline (“It undermines the replicability of the study if there are more than one version available with inconsistent text”). Two of the interviewees had very strong understandings of the issues and were prolific self-archivers.
3. **Funder Mandates:** All interviewees were funded by federal agencies that require public accessibility of research results. Those who were funded primarily by the NIH felt that the process was clear (though one described it as unnecessary administrative overhead), but those funded by other agencies were generally confused about the requirements and chose to self-archive despite expectations being unclear to them.
4. **Self-Interest and Social Interest:** All interviewees spoke at some length about the value self-archiving provides themselves and their careers. Several indicated that they believe it to be in the public’s interest (“My soul wants open access”) and/or their career (“The more my research is known, the better it is for my career”). Two interviewees felt the integrity of the scholarly record is undermined by self-archiving (“It may advance some faculty members’ careers, but it causes too much confusion and is bad for science”).

These primary themes were then used to create three personas that will help the DU Libraries and perhaps similar institutions design scholarly communications and research information management strategies (see Figures 5, 6, and 7):

Persona One: Mark Evans

“I don’t think self-archiving is good for science. Discrepancies in data or analysis among versions are problematic, and the cost of APCs simply reduces funds that could otherwise be spent on science or be used to bolster publishing, libraries included. I don’t know anyone who actually uses the preprint server in my field.”



Figure 5. Mark Evans Persona. Courtesy of Getty Images. This photograph is excluded from the Creative Commons Attribution license under which this article is distributed.

Professor Evans is an experienced organic chemist who studies primarily pharmaceutical design. He has published well over 100 peer-reviewed articles through the course of a career spanning several decades and has served in administration for several stints. He is an influential member of the university community.

Professor Evans is generally opposed to self-archiving and only does so to comply with funding agency requirements, which he finds unnecessary and contributory to both potential and actual problems. His main concerns are that his research is sometimes funded with rules against sensitive data-sharing, which can conflict with other agency requirements, and that the proliferation of several versions of an article undermines the integrity of the scholarly record. He also posits the readers who can reproduce or validate his research already have access to his articles through traditional journal publication, so there is little to gain and much more to lose.

Professor Evans feels traditional publishing has served the academic community well for many decades, and thereby is in the best interest of society. He believes strongly that libraries should be funded adequately and that the proliferation of new knowledge, and the associated rise in cost to journal access, should not undermine what is otherwise a functional paradigm.

Persona Two: Elizabeth Wheeler

“My group diligently self-archives our papers as a part of our research process. Yeah, it’s a lot of additional effort, but we’re passionate about sharing what we do with the world.”



Figure 6. Elizabeth Wheeler Persona. Courtesy of Getty Images. This photograph is excluded from the Creative Commons Attribution license under which this article is distributed.

Professor Wheeler is a recently tenured Associate Professor of Psychology who studies the effects of poverty on families and urban communities. She is widely considered a rising star in her field, college, and the university and is often asked to advise administration on research initiatives.

Professor Wheeler self-archives her papers on an ASN and elsewhere, driven in part by a recognition that social workers and therapists without a university institutional affiliation do not always have access to relevant literature. She is also motivated by self-interest, as she prefers to publish in any high-impact journal, regardless of its business model, but is careful to understand policies regarding versioning and self-archiving.

Along with a colleague with whom she frequently collaborates, she has become extremely knowledgeable about the IP issues associated with self-archiving. She considers the time it takes to do this necessary to responsible research. She feels strongly that researchers who do not take the time to self-archive do not fully understand the social implications of commercial publishing. She does not necessarily need assistance with self-archiving but would accept it if it reduced her work-load in any way.

Persona Three: Rebecca Brimley

“Most of our papers are public due to NIH mandates. We post others elsewhere sometimes but are unsure about our rights. What seems more valuable would be somehow sharing research data, but confidentiality and the need for additional funding and personnel prevent our doing so. I’d like to do more but I could use some help.”



Figure 7. Rebecca Brimley Persona. Courtesy of Getty Images. This photograph is excluded from the Creative Commons Attribution license under which this article is distributed.

Professor Brimley is a recently promoted full professor in social work who often joins efforts with local health clinics and hospitals to study patient recovery from major health events in at-risk populations. Her research has drawn attention in multiple fields, and she often receives requests from other researchers for both data and articles.

Professor Brimley has found working directly with patients and physicians that much of the literature in her field, including hers, is available via *PubMed Central*. She and several graduate students over the years have self-archived other articles in a variety of places, but she is worried that she may have violated publication agreements, so she has done so inconsistently. She is even more motivated to share the underlying data as she feels they can contribute to greater replicability and validity in her field.

If the Libraries could make this process easier for her without risking the confidentiality of her data or violating any rules, she would be eager to use that service.

These personas encapsulate the four themes and multitude of behaviors seen in the qualitative analysis. They conflate both motivations and barriers to self-archiving in a manner that both honors the complexity of these behaviors and allows for librarians designing scholarly communication and research information management interventions to do so with empathy.

DISCUSSION

Findings in this study build on previously identified themes of altruism, self-promotion, disciplinary culture, and confusion regarding article versioning and how research data should be considered in the larger conversation from previous studies. Taken comprehensively as a pattern of behavior across a single university—ranging from faculty who oppose self-archiving unless compelled by a mandate to faculty who perceive it as necessary to ethical research—a pattern emerges that informs strategic service design. Furthermore, considered alongside concurrent studies on “big deal” packages and transformative agreements, this work suggests that a broad strategy is required to support researchers’ desires in non-R1 university and college libraries, encompassing both support for OA publishing and more traditional collection development.

Quantitative analysis demonstrates that DU research is far more open than automated data tracking across publisher platforms indicates. Our findings also suggest that many researchers are no longer tied to traditional modes of publication—they often take action that disrupts it—but these practices reflect concerns that faculty do so without full appreciation of that disruption. The fact that well over 100 copies of different OA versions of 71 articles were intentionally made available by researchers across nine types of platforms most certainly introduces opportunities for the confusion Professor Evans bemoans.

Qualitative analysis also shows that many researchers do not necessarily share this concern. The Professor Wheeler persona characterizes those who are so informed that they self-archive not only in compliance with mandates but take extra steps to share their work. Others, such as those represented by Professor Brimley, do so haltingly, unsure and at times unaware of the larger context. That two personas choose to self-archive (not because they were required to do so but because they were driven by other motivations) suggests that mandates are not necessarily primary drivers of what has become a more complicated ecosystem. Findings also suggest a complicated pattern of behavior driven by a multitude of motivators, at times co-existing not only within an institution or discipline but within a small team or even within an individual researcher.

What follows are examples of how these personas may be used in empathic service design:

Professor Mark Evans:

- A potentially valuable advocate for an APC fund
- Someone who may support APC funding being applied to “hybrid” journals
- Should “big deal” packages be broken up—due to larger institutions in consortia striking their own transformative agreements—Professor Evans, with his institutional experience and influence, could help champion additional funding to the library, and/or help colleagues understand the larger publishing ecosystem.

Professor Elizabeth Wheeler:

- A potential champion for a campus OA mandate
- A resource for colleagues seeking advice on self-archiving
- The persona who may be willing to accept assistance with negotiating IP rights with publishers
- Someone who may advocate for increased funding to the library to staff scholarly communications services, including both technology and positions
- A voice that may help explain rationale if the library decides to break up a big deal in its own right

Professor Rebecca Brimley:

- First among personas to whom the library might offer self-archiving consultation services
- Can provide a connection to graduate students with whom she has worked sporadically on archiving and to whom workshops on OA publishing can be offered
- A partner in designing and offering data management services, policies, and associated support
- A potential advocate for larger library collection development budgets and an APC fund

It should be noted that all three personas are potential partners to a library’s strategic efforts regarding scholarly communications. While Professor Evans, for example, may be easily perceived as unfriendly to OA publishing, appreciating and accepting his perspective as a matter of broader strategy helps avoid unnecessary challenges to services. He may in fact be helpful in supporting an OA fund. Certainly, the perspectives that this persona represents should not be considered antipathic.

Professor Wheeler can be a strong faculty voice supporting more disruptive approaches, and Professor Brimley represents faculty in need of library support. Taken together, they offer a picture of a campus on the ascendancy as a research enterprise, one that needs a strong library to further its ambitions. Engaging with researchers who resemble these personas, whether through library liaison programs, advisory committees, or strategic planning efforts, in an iterative way, can improve service design and delivery.

CONCLUSION

For small to mid-sized universities that are on inclining research trajectories, a confusing landscape of publishing agreements, OA publications, proliferation of ASNs, funder mandates, and emerging trends in transformative agreements present a unique set of challenges and opportunities to library services. Many of these campuses, like DU, may not have yet dedicated as much sustained collective cognition on OA mandates, centrally funded APCs, or the positions and technologies appropriate to support self-archiving as have large R1 universities. They also do not generally publish enough to directly benefit from transformative agreements as they are currently constructed nor to drive their negotiation, and risks to their researchers as readers abound even as support for their researchers as authors must also grow.

Ultimately, this study allows for a scholarly communication service design that centers the user and considers collection development as a corollary to these services. Faculty who have already archived a publication were motivated to do so; understanding why helps scholarly communication librarians and staff customize offerings to faculty, units, and disciplines in ways that meet their needs, address their unique concerns, and support them as the publication ecosystem continues to change rapidly.

Empathic design facilitates finding common goals, and by replicating the mixed-method approach in this study or simply loosely identifying the personas on a campus (or both), libraries can work with funded researchers and other researchers interested in the benefits of OA who hold a variety of experiences and opinions on publishing to achieve what brings them all together on a campus in the first place: to create and disseminate new knowledge in support of the public good.

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APPENDIX A. INTERVIEW QUESTIONS FOR SEMI-STRUCTURED QUALITATIVE INTERVIEWS

1. Briefly describe your research.
2. How long have you been conducting this type of research?
3. What sorts of funding sources do you have?
4. Can you tell us a little about the publications your research produces?
5. Do you post your article(s) on various online sharing platforms (e.g. arXiv or Research Gate)?
6. Can you tell us a little about why? (follow ups: why that particular platform? What version? Who else is on this platform you want to reach? Do you track citations/downloads, etc.?)
7. Some federal agencies have requirements around sharing publications and/or data produced as a result of projects they fund. How familiar with them are you?
8. Please rate on scale of 1-5 your receptivity to this question: I would like the university to help me with complying with federal public access requirements regarding publications, 1 = least interested, 5 = very interested.