March 8, 2016

A Day in the Life of a (Serious) Researcher Envisioning the Future of the Research Library

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ITHAKA S+R

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Reflections on Cornell University Library's "Day in the Life" Project

In 2014, Kornelia Tancheva and I met to discuss a question of great interest to Cornell University Library: how would you design a research library to respond to the preferences and needs of today's researchers? That is, if you could create a mental space in which you learned from the past without being encumbered by an uncritical acceptance of the *status quo*, what kind of library might you design for the future?

Our conversation occurred shortly after I completed a project with a group of medical libraries in Illinois in which we used a mapping and logging method, originally developed at the University of Rochester, to understand the information-related practices of third-year medical students.[1] That study had led to new insights into how these students work and live and specifically to new ideas about how the participating libraries could provide better resources and services to students in clinical rotations.

The success of the "Day in the Life" method in the Illinois study suggested that it might be a good way to start answering the questions raised at Cornell University Library. Kornelia liked the idea and recruited Gabriela Castro Gessner, Darcy Branchini, Erin Eldemire, Heather Furnas, Gail Steinhart, and Neely Tang to conduct the project with her.

We began with a training session in January, 2015, proceeding to information gathering, and engaging in a second full-group session in May to initiate analysis and interpretation of the data. The team then conducted a series of analytic and interpretive sessions and wrote a preliminary report. Ithaka S+R provided feedback on the report and the team reworked it with additional feedback from Ithaka S+R. We are pleased to make the

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[1] Thanks go to members of the project team for the "Day in the Live" Mapping Project including Andrea Twiss-Brooks (project manager), Barbara Kern, Deb Werner, Ricardo Andrade (University of Chicago), Kathryn Carpenter, Gwen Gregory, Jay Jurek (University of Illinois at Chicago) , Christine Frank, Jonna Peterson, Jeanne Link (Rush University), Gail Hendler, Jean Gudenas, Jeanne Sadlik, Elizabeth Huggins (Loyola University Chicago), Connie Poole (Southern Illinois University), Natalie Reed, Cynthia Snyder, and Katy Lencioni (Midwestern University). Thanks also go to Julia Sollenberger and Lorraine Porcello of the University of Rochester's Edwin G. Miner Library for their contributions to the development of the method. Information can be found at Andrea Twiss-Brooks et al., "A Day in the Life of a Medical Student: Applying Ethnographic Methods in Academic Health Sciences Settings," in *Medical Library Association 2015 Annual Meeting Paper Abstracts* (Medical Library Association 2015 Annual Meeting, Austin, TX: Medical Library Association, 2015), 2–3, www.mlanet.org/d/do/1923. The original mapping method was developed for the project discussed in Nancy Fried Foster and Susan Gibbons, eds., *Studying Students: The Undergraduate Research Project at the University of Rochester* (Association of College and Research Libraries, 2007), http://hdl.handle.net/1802/7520.

resulting document, "A Day in the Life of a (Serious) Researcher: Envisioning the Future of the Research Library," available here.

A Vision Based on Evidence

For years the people who designed new libraries based their plans on older ones. Library buildings had evolved over the years to support the work people did inside them while also conveying the values and aspirations of their institutions.[2] Precedents were reliable and architects and designers could follow them to build successful new libraries as long as they consulted with university leaders and the library director to meet local needs and preferences.

There were, of course, innovations in library design; many libraries had a modern look and supported new work practices, such as the use of microforms or, later, computers. However, since the turn of the century, increasingly rapid and unpredictable change in the way information is created, stored, transmitted, and used has made it very hard to find reliable precedents. The reality is that people work differently now, in vast scholarly communities, with immense bodies of literature and a wide range of new and changing tools. As David Cronrath says, in this complicated and unstable situation, we must look to our communities to participate in our design projects and keep us informed about the nature of their work, in order to better facilitate it.[3]

Thus the engagement of members of the community in the design process itself. The conceptual foundation for this approach is the belief that the people who do the work know best how to do it and that those who build academic technologies and spaces must understand those work practices and preferences in order to provide optimal tools and environments. In this approach, a variety of experts contribute their complementary expertise. Some participants provide expert information about the work to be done, the tools in use, work processes and configurations, desired outcomes, and so on. Others provide expert information about how to support those practices and preferences through the design of technology and spaces, the choice of materials, the flow of people through the space, the placement of individuals and departments, and so on. All participate within their rightful roles, contributing their own expertise, in order that the

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[2] See the discussion of legacy practices and the current unreliability of precedents in Chapter 4 of Patricia A. Steele et al., *The Living Library: An Intellectual Ecosystem* (Chicago, IL: Association of College & Research Libraries, 2015). For a history of library buildings, see James W.P. Campbell, *The Library: A World History* (Chicago, IL: University of Chicago Press, 2013). A discussion of using participatory design in library design appears in Nancy Fried Foster, "Designing Academic Libraries with the People Who Work in Them," in *Studying Students: A Second Look* (Chicago, IL: Association of College and Research Libraries, 2013), 103–21.

[3] David Cronrath, personal communication.

final designs address demonstrated practices and needs rather than being based on assumptions or out-of-date information.

To envision the future research library is to envision a cluster of people and their practices, places and spaces, resources and tools, wires and equipment, paper and screens.

In the case of Cornell University Library, the objective was to envision the future library but not necessarily to build it. Moreover, the library could not be seen as a building alone as it is not possible to disentangle the physical library, its staff, its workspaces, and its tangible collections from the online library. People in the physical library go online and anyone using library resources online must, after all, be in some physical place. Books and journals in paper are found through the use of online catalogs. Electronic resources are held on servers that occupy space and are connected through libraries to readers through physical cables and transmission equipment. To envision the future research library is to envision a cluster of people and their practices, places and spaces, resources and tools, wires and equipment, paper and screens.

Beyond this, the library is not even the best starting point for envisioning the library. A better starting point is to develop an understanding about the lives and information practices of the scholars and students who depend on the library in all its shapes and forms. Therefore, in this Cornell project, we looked at what academic researchers do day-to-day and how they acquire, use, and share information in the course of their daily activities. From our interpretations of these data we imagined new models.

What Research Requires

Research libraries serve their institutions, their individual patrons, and the common good.

Research Libraries and the Common Good

Serving the common good means that libraries contribute to the health of the research environment and to the general welfare through the development of new knowledge. Researchers work within global networks of scholarship and these researchers and the

libraries that serve them are mutually dependent. The benefits of interdependence are enormous, including access to a far greater world of information than any library could contain. There are also burdens, as some individuals and institutions will have to anticipate and bear the costs of new demands, such as preserving information on degrading media. Similarly, the methods and costs of scholarly publishing must be addressed, probably on a global scale through large consortia, to sustain good scholarship and avoid the downsides of unbundling and purchase on demand. If only safe or popular research is published, libraries and research will wither. Scholarly progress requires the publication and dissemination of innovative and even risky research and this, in turn, requires moral and financial support.

These and many other problems transcend the individual and even the institution. Many individuals and institutions ignore them, letting the burden fall on others. But some academic institutions will have to join forces to address these problems so that scholarly work can continue into the future. This is one of the biggest roles and greatest challenges for the research library of the future.

Institutional Responsibilities

Institutions support research libraries but also make demands on them. A university's library system will be expected to support the teaching and research mission by providing resources to meet curricular and research needs. It will also be expected to convey the institution's values, perhaps through its architecture and placement on the campus. And it may be expected to play a role in the recruitment of students and in fundraising campaigns. Many academic libraries provide space for institutional events. Members of the public may be accommodated in a research library, for example, if it provides access to government documents. Beyond this, many institutions expect that their libraries will provide some sort of service to the communities in which they are located.

While some of these institutional responsibilities center on the work of researchers and many others go very far afield, they all exert pressure on library plans and raise questions about the future of the research library. Many of these questions relate to funding and whether there will be enough money in the budget to provide for the extensive and far-ranging needs of researchers. Others relate to the kinds of research that will be done at the institution in the future and how resources will be allocated across competing needs.

The Researcher and the Research Library

With regard to researchers within an institution, the Cornell study uncovered a number of important work characteristics and requirements for academic researchers. This is the area in which the Day in the Life study yielded most value and pointed to possible library futures.

The study provides enormous insight into what research is like for participating researchers. To begin with, the data support the view that research comprises a large and varied group of activities that includes but extends well beyond finding and digesting the work of others, conducting one's own inquiries, working things out conceptually, writing, and sharing work with other scholars. The larger set of activities includes discovering, acquiring and assessing the quality of varied literatures and formulating problems through interaction with these literatures; organizing sources, notes, and other documentation; getting support; managing data, sources, and one's own writing across platforms and formats; collaboration and co-authoring; the cultivation of professional, interpersonal relationships in communities of scholarship; and much, much more.

For participating faculty members, research comprised all of these activities and had no end. Participating graduate students tended to be focused on one major piece of work at a time and did not appear to focus on this larger picture or may not yet have become fully engaged or committed to it. Participating undergraduates seemed (legitimately) peripheral in the world of research; in truth, they have little need to understand or make a commitment to research on this scale.

The researchers who participated in the study worked hard. Many if not most seemed to feel overloaded by information or by the sheer difficulty of the thinking they were doing. They moved rapidly among the many activities that research comprises, sometimes engaging in multiple activities at the same time, particularly reading, thinking, and writing.

They described many approaches to finding resources and each individual's approach appeared highly idiosyncratic. They seemed to make more or less conscious calculations to favor known methods over efficiency and to draw from a variety of tools and approaches depending on need. Members of the project team felt that these researchers might find more or better resources with help or with more facility with search products or with more starting points and most could use digital tools better. However, almost all of the researchers who participated in the study were finding abundant material. A much bigger problem for many of them was that they found much more than they could read.

According to the data, participating researchers were combining legacy and digital tools in their research, preferring paper for activities ranging from scheduling to reading and even writing. They wanted the advantages of digital technologies—speed, searchability, and portability—but had problems when they had to move materials from one format to another or learn complex applications.

One of the most striking patterns in the data was the way the researchers described activities that enabled them to cultivate relationships with people doing interesting or important work in their fields. Many researchers described activities in which they sought or exchanged information. This information sharing included friends and colleagues in related or even in different fields and occurred face to face or using a wide range of legacy and emerging technologies.

Researchers in the study described many obstacles and the ways they strive to overcome them. These obstacles were varied and included:

- Too much to read, from email to monographs

- Too many documents and files to manage

- The grunt work that surrounds the brain work (e.g., preparing manuscripts, getting copyright clearance, working with a variety of paper and electronic formats)

- The difficulty of discovering good literature and the sometimes even greater difficulty of obtaining what one has discovered

- The challenges of finding good work space and having adequate infrastructure (e.g., power, Wi-Fi)

- Juggling work and "life" and managing to work through the endless distractions, whether internal (monkey brain, fatigue, worry) or external (noisy neighbors, ringing phones)

No research library will be able to meet every research need, especially given the additional demands of research writ large and the institutions and communities in which research libraries are located. Decisions must be made.

Through their study of 21 researchers, the team discerned characteristics of the research process and many preferences and needs of participating researchers. However, some research activities and requirements seem more important and central and others seem

more secondary. This raises an important aspect of the process of envisioning a library of the future: the choices that must be made among different possible futures. Researchers need space in which to work, they must avoid distraction, they need access to a broad range of resources and increasingly sophisticated technologies to find and use them, and much, much more. But are all of these needs of the same order? No research library will be able to meet every research need, especially given the additional demands of research writ large and the institutions and communities in which research libraries are located. Decisions must be made.

Toward a Model of the Future Research Library

The trend in academic research is for researchers to spend increasing amounts of time managing the clerical and technological aspects of their work, such as manuscript preparation, document management, and developing and maintaining software skills. We see at least stable and possibly increasing amounts of time devoted to building personal professional networks, finding employment, and securing financial support for research. Accordingly, the amount of time available for the core work of reading, thinking, experimenting, and writing can only be expected to keep shrinking.

Except in limited cases, researchers will spend less time in library buildings using physical collections, relying heavily on resources that can be discovered and obtained online, often by library subscription but also through society memberships, resource sharing with colleagues, and the open web. They will use their own preferred tools, including general-purpose search engines, databases, apps, archival finding aids, online library catalogs, and so on, to discover material. They will use these tools plus interlibrary loan, purchase, browsing, and so on to obtain scholarly materials from servers and also from shelves.

Researchers will also need to "be somewhere" to do their work and some will prefer to be in a library-type environment even if they are not using library materials. Others may prefer spaces that are more or less quiet and isolated, or that enable them to avoid other obligations, at least for a while. Some may avoid distracting environmental factors (such as activity or noise) or battle internal ones (such as an unsettled mind). The research library may choose to provide a variety of spaces for researchers, even when they are not using library materials. They may, at some time in the future, push that responsibility onto other university units or drop it altogether due to resource limitations. We forecast that in the crunch, devoting resources to provide access to scholarly materials will be favored over providing workspace.

The data suggest that the trend in seeking specialist help in the library will continue to drop but that reliance on behind-the-scenes library work will continue to rise. In the latter category we might include traditional activities such as curation, purchase, preservation, and support for discovering and, even more, for gaining access to scholarly materials. Additional demands may emerge for specialist library support in designing better ways for researchers to curate and preserve their own online collections, connect with colleagues, and disseminate their own work.

It is possible to imagine that the research library could occupy a significantly smaller building in the future but have a similar sized staff, albeit in different specialties. These specialties may include expertise in designing and developing new information technologies, curating larger and more diverse and distributed collections, curating data, running publishing platforms, connecting researchers to other sources of support on campus, and even conducting research on academic work practices to support ongoing planning and decision making.

Given the set of work practices that emerged as central to the research endeavor, we see the best research libraries continuing to support the core work practices of researchers, including discovering, acquiring, and assessing the quality of varied literatures and digesting the work of others, formulating problems through interaction with relevant literatures, writing, and sharing work with other scholars and the world at large. Core offerings that we expect will continue to be central to the research library for the foreseeable future include access to books, articles, documents, and other forms of content, all of it systematically organized and findable. We expect that some work will have to be done onsite, such as using physical materials and getting research assistance. Some researchers will need help to broker access to content, collections, and expertise available only in other collections, sometimes in other kinds of institutions or other countries.

As discussed above, we see an emerging role for the research library in publishing. This may include the provision of tools for collaborating or preparing manuscripts, consultative support for copyright and re-use issues, and possibly financial support and certainly expertise for open-access publishing.

Given the idiosyncratic nature of each researcher's own practice and the proliferation of research-related technologies, we see the possibility of a smaller role for the research library in teaching researchers how to use library technologies in the prescribed ways but rather acceptance of the imperfect practices of researchers as reasonable, individual work habits. Research libraries may choose instead of focusing on discovery to put more resources toward helping researchers obtain materials that they have discovered.

The Day in the Life study demonstrated the value to researchers of serendipity in the sense of opportunity combined with wisdom. The research library of the future may provide new ways to help researchers stumble upon information that they have the sagacity to recognize as useful, perhaps through new uses for existing metadata, or through curation of experiences that bring people in new combinations into contact with collected materials.

As the report from the Cornell University Library team amply demonstrates, there may be many possible futures for the research library. It is the development of knowledge about research practices and requirements combined with a thoughtful consideration of the contexts of research and libraries that will enable librarians and their communities to forge the path forward.

A Day in the Life of a (Serious) Researcher: Envisioning the Future of the Research Library

Introduction

Academic researchers work very differently today than they did in the past. They manage increasingly complex work demands, navigate immense and growing bodies of literature, and form scholarly communities remotely across vast geographic areas with an expectation of instant communication. But while the work of researchers has changed fundamentally, the "re-imagining" and "re-invention" of libraries has generally been predicated on current constraints; consequently, any change has only been incremental: evolutionary, rather than revolutionary.

If we could design a research library from scratch, what would it look like? And by envisioning the library of the future, how could we help to improve library services today?

If we could design a research library from scratch, what would it look like? And by envisioning the library of the future, how could we help to improve library services today? In order to answer these questions, our team asked 21 researchers at Cornell University, from undergraduates to senior faculty, to track their movements and activities for one research day from the moment they got up in the morning until they went to bed at night. In our follow-up interviews, we delved into the habits, expectations, and obstacles that researchers face in the current environment.

This report is the culmination of our interviews with these researchers in which we present our recommendations for a library of the future. We organize our findings into two main categories. One includes researcher activities in the areas of research *per se*, activities that support the research process, and activities related to the use of information more generally. The other category relates to library resources and space. We address the question of the future of the academic research library by peeling away

the constraints of the present and looking only at current and emerging research practices of serious researchers to anticipate a possible future. In the process, we reveal possibilities for improvements in how we conduct the business of research libraries that will result in significant gains for our researchers now.

Methods

We conducted 21 in-person interviews with current researchers at Cornell University in the spring of 2015. We selected individuals who were actively engaged in research at the time of the study. We expected faculty to be engaged in research activities by default; we screened graduate students by asking whether their own research was underway at the time of the study, and undergraduates had to be involved in the production of their own senior or honors theses. Interviewees included three senior faculty members, six early-career faculty members, nine graduate students, and three undergraduate students, all known to be actively engaged in research.

Participants represented the following disciplines, and were more or less evenly distributed between humanities, social sciences, and the sciences (see Table 1): History (4), English (4), Latin American Studies (1), Information Science (2), Natural Resources (2), Biological/Biomedical or Veterinary Sciences (4), Anthropology (2), Government (1), and Management (1).

Table 1. Distribution of participants

	Humanities		Social Science		Science		Total
Status	**M**	**F**	**M**	**F**	**M**	**F**	
Sr. Faculty	-	1	1	1	-	-	3
Jr. Faculty	1	1	1	1	-	2	6
Graduate	1	2	-	3	2	1	9
Undergraduate	-	2	-	-	-	1	3
Total	**2**	**6**	**2**	**5**	**2**	**4**	**21**

Our study sample is not random; although a few participants were recruited via LISTSERV announcements to departments, most were personally known to the research team.

A team member met with each interviewee for a 15-minute introductory session, during which they explained the purpose of the study and gave the interviewee a map and a form on which to record their movements and activities for their research day. Follow-up interviews were, in most cases, scheduled the day immediately following the recording day; in a few cases, two days separated the recording day and the interview day. Two team members conducted each interview, either in the library or another agreed-upon location. The interviews were recorded and transcribed.

Interview transcripts were coded using a schema that was developed by the research team working with Nancy Fried Foster, senior anthropologist with Ithaka S+R. Further details on the process for developing the coding schema are provided in the Appendix. Activities were classified and coded as follows:

- *Academic activities*: note-taking, writing (including production, editing, formatting, etc.), managing information (including storing information), field or lab work

- *Seeking information*: information seeking for academic and non-academic purposes, reading

- *Library resources:* use of library resources, with separate codes for online and physical resources

- *Self-discipline/self-management*: tactics employed to manage researchers' own habits, motivation, and distraction (including practices such as turning off wireless, going paperless)

- *Space:* references to work environment—space, setup, location, noise, light, etc.

- *Circum-academic activities*: allied academic activities, professional contacts, networking, use of social media for academic purposes

- *Obstacles*: interruptions in academic/research work, problems, and their workarounds

- *Brainwork:* thinking and sensemaking, generally indicated by the use of words/phrases such as "understand," "translate," "make sense," "figure out"

- *Technology*: its presence or absence, specific hardware or software, social media, access to online resources

To account for the fact that technology and brainwork ran through all the categories, all team members coded for these two items.

Each transcript was manually coded by two independent coders, and where coding differences occurred, we agreed to retain rather than discard codes. When coding was complete, we scanned the coded manuscripts and each member re-read all the transcripts to review or apply assigned codes to ensure consistency, and summarized the results.

Results

We present our findings by major theme: seeking information, academic activities, brainwork, circum-academic activities, library resources, space, and self-management.

1. Seeking Information

Participants described information seeking as fluid, continuous, and occasionally difficult, and drew an important distinction between "search" and "research." Individual practices were idiosyncratic, and varied according to the purpose of the activity and the degree of expertise in the topic at hand.

Participants described different preferences for devices, depending on the nature of the information-seeking activity: for instance, an iPad was good for looking up recipes and phones were used for skimming e-mail, but deeper engagement with e-mail required a computer. The themes that emerged in relation to seeking information include:

Academic and Non-Academic Information Seeking Is Fluid and Constant

Many study participants described nearly continuous consumption of information, driven sometimes by habit, sometimes by the need to occupy themselves during gaps in their day, and sometimes by a deliberate effort to stay current in their field. The first activity many described doing upon waking was checking e-mail, weather, news, and so on; during the day, they engaged with multiple sources of information, be it non-academic, including entertainment (listening to audiobooks or music while walking, watching TV or online shows, listening to voice lessons or rehearsals while waiting for classes to start); or academic (reading notes between classes or while waiting for lab experiments to finish, preparing lectures, and doing academic research in one form or another). At the end of the day, they invariably re-checked their preferred sources of personal or academic information by themselves (e.g., e-mail and social media) or engaged in a group information-seeking activity of some sort, ranging from family book reading to enjoying online entertainment.

Email consumption was virtually continuous, including academic, job-related, administrative, extracurricular, and personal e-mail. As a sciences graduate student explained, "You can just assume I'm kind of checking my e-mail constantly." A senior faculty member in the humanities described their consumption of e-mail as "pretty continuous" and occurring simultaneously with their focused research. Participants also indicated that checking e-mail was a way to "decompress" and "unwind," or something to do when they were "bored" (an undergraduate science student). Strategies for dealing with email included both consolidation (forwarding to a single account or using applications such as Unibox) and segregation (keeping work and personal e-mail separate). We discuss the need expressed to suspend this habit in order to do more focused work later in this report.

Many interviewees discussed the need to skim multiple information sources to stay abreast of developments in their field; they also had a similar tendency to skim current events, news, and entertainment. Several students and faculty referred to a daily routine of scanning headlines and news, balancing limited time with a need to know what is happening in the world. A junior faculty member in the sciences uses an application called theSkimm to receive daily news summaries. They explained, "This is my attempt to know about … bigger world events without having to sit down every night with Brian Williams, … I don't have time to go to Google News." Aggregators, feeds, and TOC alerts were frequently noted as tools to increase efficiency in the daily collection of information. A graduate student in the sciences mentioned using RSS feeds to keep up with relevant literature and see what people are doing in their field.

Using social media to stay current in their fields presented interviewees with the choice of either blending or segregating academic, circum-academic, and non-academic information seeking. Twitter was described as a way to stay abreast of current news within and beyond their fields of study, while most interviewees identified Facebook as an exclusively social medium. A humanities graduate student described Twitter as their professional community comprised of "mostly people I don't know in real life," whereas Facebook reflects their circle of "real life" acquaintances. Interviewees also noted the use of LinkedIn, Tumblr, YouTube, news outlets, and blogs, and some of their use crossed into areas of academia or research, but they were more often referred to as a means to find news, or for social as well as circum-academic purposes, such as a job search or conference.

The use of social applications for current awareness presents some interesting challenges, mainly having to do with keeping track of content, and finding the time to read it. Interviewees' systems for flagging items to read later were fragile, often relying on memory or Twitter (e.g., retweeting something so it was in their own feed as a

"bookmark"). Even then, when researchers successfully marked the information they wished to read later, many simply did not have the time to read it.

Search Is Different from Research

Most study participants explicitly distinguished between search and research. This difference was clearly expressed by a senior faculty member in the social sciences who explicitly corrected the interviewer who referred to their searching as "research," by saying, "This is search, not research. Research is different." Although not always in those words, many of our participants noted the inherent "messiness" of searching for information, the effort it takes, and the fact that it is an iterative process with no clear closure. In this respect, only search emerged as a systematic endeavor, in contrast to research, which we feel has an interesting implications for the future of library.

Search Is Idiosyncratic

For all its comprehensiveness, the search process, we found, is also highly idiosyncratic. Interviewees were often simultaneously comfortable with the efficiency of their search methods, and self-conscious or dissatisfied that search remained messy and labor-intensive. Because search is only a starting point, not a final objective, their systems are often good enough for them: "I have systems in place that work pretty well for me by and large," said a graduate student in the humanities. Many interviewees expressed pride in their workflows and selection of tools, while also voicing doubts that they were doing their work as effectively as they could: "I feel like the librarians must be like, 'This is the worst thing I've ever heard'" (graduate student, humanities). It is worth considering whether such doubts were artifacts of the interview setting; perhaps researchers would not have voiced these concerns in a similar conversation with peers (as opposed to librarians).

An important finding for libraries is that when a researcher is unable to accomplish a particular search task, they are quite likely to abandon their current approach (or tool or technology) rather than figure out how to make it work.

An important finding for libraries is that when a researcher is unable to accomplish a particular search task, they are quite likely to abandon their current approach (or tool or technology) rather than figure out how to make it work: "I used to use Web of

Science a lot and then I found that it was for some reason difficult for me to access it, and I kind of stopped using it because of that" (graduate student, sciences). Interviewees described this behavior in a wide variety of contexts, from finding ways to listen to music to managing information and writing. Another important point is that the format of information sources can encourage or discourage use: interviewees expressed a common preference for online sources, particularly for reference works such as dictionaries.

Below is a brief summary of the various search tools and methods our interviewees described.

Search tools

Several search engines and tools were identified as portals for searching, including Google (for either personal interests or broad topical searches on academic topics); Wikipedia, Flickr, and Google Images for photographs; Google Scholar, Web of Science, PubMed, and the library website for journal articles; and the library website and Amazon for books. Zotero, Mendeley, and other reference management and academic networking applications were also noted as ways to find relevant work. A graduate student in the sciences explained that they "googled a speaker" from a conference, found their Zotero library, and scanned it for articles related to their own research.

Search methods

Students and faculty described different search procedures depending on whether they were conducting a broad, topical search or a known item search. A junior faculty member in the sciences described their process as going from broad to more specific, as well as using particular tools to search for certain formats or types of documents: starting with a broad search term on Google to discover relevant government documents, repeating the same search terms on Google Scholar to find "more specific experimental journal articles," then moving to the library website to search specifically for books to gain a broader overview of the subject. At that point, they discovered that the library search also returns articles that are somewhat different from the ones on Google Scholar, and are from international or "more obscure" journals. Once the initial search was exhausted, they modified the search terms and continued to look for books and articles on the library website. Another strategy was using citation patterns. A junior faculty member in the sciences described their approach to finding newer work on a particular topic: "I find my favorite papers and see who cited them."

Dealing with a very large number of search results was a common frustration for researchers: "I get into this … I don't think this is the best way to do it, but it's how I end up doing it. I get into a place where I have … four Chrome windows open, and each one

has … 14 tabs. And then at some point I stop clicking because either I've started referencing back to things I'd already clicked on or … I think I'm just losing time now rather than actually gaining information" (graduate student, social sciences).

Once users found promising results in their searches, access to specific items was challenging. Interviewees sometimes did not know whether the library provided access to the materials they needed: "Unfortunately, I couldn't get those through the library in an electronic form" (referring to engineering standards documents, graduate student in the sciences). Even when they do attempt to get a library-supplied copy, they may find the process difficult: "Actually that is very irritating, I'm not joking about it, but it is extremely irritating, that e-journal thing" (senior faculty member, social sciences).

With all the information we gathered about unmediated information-seeking practices, it is worth noting how often interviewees referred to "asking the expert," both in academic and non-academic information seeking. A junior faculty member in the sciences described providing advice to a student from another university, ultimately saying, "You need a [Cornell librarian by name] to help you out." A graduate student in the sciences described at length a meeting with another Cornell librarian to discuss two projects involving data encoding and archiving, who connected the student with another researcher working on a similar problem and then worked with both to provide the help needed to advance the projects. Asking the expert is ubiquitous in non-academic information seeking as well—friends, family, and colleagues are consistently mentioned as the expert sources on worthwhile information in all areas.

Information Evaluation Is Multi-Tiered

Researchers skim material to evaluate its relevance, and to decide when to engage more deeply—or what materials, documents, and/or parts of documents to download or print and what books to borrow from the library. As a sciences graduate student explained, "I skimmed [the lengthy document] online to figure out what was relevant, then printed three [relevant] chapters." Another sciences graduate student described using Google Scholar to find information, and then scanning the results for highly cited papers.

Several participants noted a difference in their information seeking in terms of teaching (or learning) vs. research, or class-work vs. research. A senior faculty member in the social sciences noted that "classic" texts (books, in this case) are only good for teaching, but are of no interest in research.

Several faculty members, in describing lecture preparation (one of them on an unfamiliar topic), referred to using Google or Google images much more often than Google Scholar or library databases to collect information on general trends, rules and regulations,

educational requirements, or even something interesting or attention grabbing, rather than looking for the latest research on a topic.

Undergraduate students in the sciences noted deeper engagement with a limited number of information sources that have been pre-selected by their instructors and made available through course management platforms, as well as with experiment protocols and their personal lecture notes than with current research literature.

Interviewees judged information quality in two primary ways: authority and currency. Authority was universally important among researchers, encompassing source, vetting by peers, and citation patterns. Techniques for evaluating the quality of information ranged from judgment based on prior experience to multiple checks of online claims (confirming professional affiliations, for example), and eventually consulting the original document to verify that it had been cited properly. In one researcher's evaluation, international and government organizations' websites tend to provide trustworthy statistics while non-profit organizations tend to be more biased. The importance of relying on the most up-to-date information was also universally present in our interviews regardless of discipline or career stage. Just as a graduate student in the social sciences insisted, "I just wanted to make sure that I had the most up-to-date [information]," a senior faculty member described a lengthy and iterative process of checking for the latest references in their research.

The importance of evaluating information before consuming additional sources came through in our subjects' use of citation patterns (both backward and forward). They meticulously checked lists of references and followed cited-by links, not only to verify the authority of the source, but also to aid their own comprehension. As a graduate student in the social sciences put it, "If they [the articles they are retrieving in their search] reference some of the people I've referenced, good sign. If they are talking about people I have not heard of, bad sign."

Issues of quality cited by interviewees also included comprehensiveness and the importance of peer-reviewed content. "I don't know if I'm missing anything" (graduate student in the sciences) was a commonly expressed feeling. Finding information representing diverse points of view was also an issue, either because the sources themselves may be biased, or because exploring a range of points of view is time-consuming: "I sort of try to read the same explanation of (the same topic) from several different books. … And then … I lost, like, [nearly two hours] I think looking online, which was sort of a black hole of trying to find more information" (graduate student, social sciences).

2. Academic Activities

The academic activities surrounding the process of research are broad and varied; for the purposes of this summary, we limit academic activities to three primary areas:

- *Writing*—editing, formatting, writing an article or grant, preparing a lecture, etc.;

- *Note-taking*—including writing (electronically or by hand) but in a more informal sense, as in the kind of information retained for one's own personal reference; and

- *Managing information*—including keeping track of articles and books and notes about them for research purposes, and managing the inflow and consumption of information.

Our interviews showed that these activities are intertwined and fluid. Researchers do not commonly think about them separately, but they are all driven by the need to write— write a thesis, write a lecture, write an article, write an assignment, and adapt their note-taking and information management strategies to support their writing. We identified four areas that we will explore further: connectivity (between devices, between sources, personal libraries, and writing projects, and between locations), flexibility and fluidity in work strategies (in tools and technology, in schedules, in places, but most of all, in collaboration), note-taking preferences, and personal information management practices. Connectivity and flexibility/fluidity are closely related in that connectivity supports flexibility, but it was so significant in interviewees' comments that it warrants its own section.

The major themes that emerged in this section included:

Connectivity Is Imperative

Writing, despite being one of the main objectives of a researcher, is an interrupted activity. For many, time and space for writing must be carved out between other tasks; connectivity allows researchers to work in different spaces by choice or by circumstance. At the same time, connectivity allows for distraction—we discuss how participants cope with this as an aspect of self-management later in this report.

Connectivity supports the ability to work in any location. A senior faculty member in applied social sciences described working from home to produce a book: "I tell you I spent several years writing this book ... And that's what I did for ... for the last several years when I went home." Another junior faculty member in the social sciences defined "remote" as "across the room": "I'm working from my futon ... I have a desktop [on my

desk in the same room that I'm working in] that I would just key in remotely from my laptop".

Connectivity and rapid switching between tasks, information, tools, and applications were nearly universal. Keeping physical and/or electronic sources close at hand supported this fluid movement between activities, and most researchers worked either with physical sources spread out around them (printed articles or books), or online sources (of their own collection or available online) at the same time: "And at this point … piles of books [are] filling my family room. And the hard copy printouts of every chapter of my dissertation [are] on the coffee table. And I'm sort of working with the computer on my lap …" (graduate student, humanities).

Mobile devices were ubiquitous and supported working in disparate locations. Most researchers talked about checking e-mail or Facebook or their calendar between writing or reading, and while none used mobile devices to type formal pieces of work, they remained important tools. A senior faculty member in the humanities described their novel approach to transcription: "I use my cellphone [to] photograph the page that I want to transcribe. And then I open the photo, and I type from it because it enables me to type more accurately."

Connectivity of devices and applications allowed researchers to move information around, to mark or save it for later use, and to have a "scratchpad" for very short-term needs. A graduate student in the sciences read Twitter on their phone in the morning before getting to the office, and used it to flag items for later: "Occasionally I'll retweet things so I'll notice them later or I just e-mail them to myself." Others described e-mailing or texting themselves information about books, or book call numbers.

One of the most interesting aspects of connectivity is its impact on how researchers build personal collections. Many citation management applications (Endnote, RefWorks, Zotero, Mendeley, etc.) now allow users to save copies, annotate, tag, and mark up items relevant to their work. As more material is online and information-seeking platforms become easier to use, remote storage allows for greater flexibility and reusability of information. "[Mendeley] just allowed me to keep everything organized without keeping it in 10 different folders" (junior faculty member, sciences).

These new affordances do not always simplify researchers' lives, however: "I do use Zotero but I don't use it … I've tried many different kinds throughout my time in researching and I found I'm never really that consistent because Zotero, I find, it doesn't save things that well" (graduate student, sciences). Others did not use these tools at all: "Will my life suck when I actually have to make a bibliography for my dissertation? Maybe" (graduate student, humanities).

Technological Flexibility Is Key When Working with Others

Working with others was continuously mentioned by interviewees, and was almost always referred to in the context of writing. As new technologies and software evolve, the way in which researchers connect and collaborate on writing projects changes, at times driving choices in technology: "So [I use different software for] different targets. One is I'm trying to keep it for myself, but sync between different places, or it's not supported for collaboration on Google Docs, and that's Box. And then for Google Docs or Google Drive, that's where I'm trying to collaborate with other people" (graduate student, sciences).

Multiple interviewees reported favoring specific software because of its formatting or organizing capabilities (e.g., LaTeX and Scrivener). We also noticed a trend of moving away from Microsoft Word. In spite of the benefits researchers perceive in their personal software choices, these choices sometimes incur a cost in terms of effort when it comes to reformatting content in order to work with others: "When I'm ready for it to be pretty, I will compile directly from Scrivener into a Rich Text file, and then convert it to Word, and then do final formatting. … And even though you can compile directly into DOC formats for Scrivener, they say everything plays better if you compile it for a Rich Text file, and then open the RTF in Word and re-save it as a DOC file. So, a friend of mine was saying that's the limiting factor. She couldn't figure out how to do that transition" (graduate student, humanities). And while researchers expressed strong software preferences for formatting their own writing, they also noted that they spent significant time trying to learn how to accomplish specific tasks using their chosen tools.

With the number of choices in how to work with others increasing, there is rarely any one application or system that is adequate for the tasks at hand, for all team members. Instead, researchers often use a mash-up of whichever systems they know will work best for them.

Note-Taking Is Idiosyncratic

In our interviews, note-taking emerged as a highly individual and personalized activity, dependent on location, purpose, and context. When researchers were away from their office or other established workspaces, taking notes by hand (in a notebook or on a scrap of paper, or directly in the margins of physical materials) was common. While consulting with a librarian, a graduate student in the sciences, who had a well-established electronic note-taking system (Evernote and Papers for Mac), took notes by hand in a notebook. Some researchers transferred hand-written notes to an electronic file later on (e.g., in a Microsoft Word document) or would scan the hand-written notes to add to a note management system.

The acts of taking notes, managing notes, and transferring information revealed new insights about interviewees' work. For example, while going back through old hand-written notes, a graduate student in the humanities said: "Sometimes in the past I've discovered, oh, that poem is sort of not bad and it doesn't exist in my digital space. I should get it there so that I can edit it later."

Many systems for note-taking were very simple, and researchers could be quite disciplined in using them. A graduate student in the humanities had one notebook for each class. A junior faculty member in the social sciences kept track of analyses by copying and pasting recent analysis codes into a temporary TextEdit file. Others would open up a Microsoft Word document to type in basic thoughts while listening to a practice job talk or while reading through a book for thesis research.

Others had less developed systems of managing the information they collected in notes, not knowing what to do with it. This graduate student in the sciences commented: "And I don't really have a great note system as a result; it's all kind of up here which probably doesn't work out that well but that is what it is."

Taking notes by hand offered the advantages of quickly and easily including symbols or drawings, and facilitating thinking (see "Brainwork" for more on this), while notes in digital form were readily searched and reused in writing projects. Regardless of method, note-taking for research was a part of the personal method by which people distilled what they encountered in their environment and how they translated that into their research and mode of thinking. It was an integral part of the writing and the general academic process.

E-mail Is an Essential Information Management Tool

E-mail is used by everyone, everywhere. It is familiar and flexible, can be searched, can serve as an archive of sorts, and works across a multitude of devices and platforms. Several people interviewed reported having at least two accounts—one for academic and one for personal use. In addition to using e-mail for communication, researchers also described using e-mail as a simple and reliable backup system for collecting information they have found, and for writing or managing versions of files and notes.

We noted earlier the challenges researchers faced in marking and saving information they found in order to read it later. E-mail proved to be a common solution: "Yesterday I sent two things where someone had posted an interesting article related to data visualization and I just e-mailed it to myself so I could find it easier" (graduate student, sciences). Researchers also used e-mail to move content to their preferred device: "Maybe I'll actually e-mail them to myself so that I can open them on the bigger

computer, and look" (graduate student, humanities), and as a personal archive: "I back it up by sending all my drafts, after I finish them, to myself, and then I download them onto my computer, and then I print them" (undergraduate student, humanities).

Finally and perhaps closer to its intended use, e-mail supplemented the use of social networking applications as a way to request and share information: "Sometimes [people] post they have a new article in this; but often they ask questions: does anybody know any references for this or does anybody you know have the full reference for this, does anybody have the PDF for this ... so, I always look at those and say, 'Is that something I'm interested in?'" (faculty member, social sciences).

[E-mail] was, in some ways, a no-frills, easy-to-use, path-of-least-resistance method for managing academic work.

E-mail was often used in combination with other tools, and functionality often overlapped. The difference was that e-mail was a well-established part of the workflow of researchers, could serve both personal and academic needs, and did not require the user to learn to do something new. It was, in some ways, a no-frills, easy-to-use, path-of-least-resistance method for managing academic work.

3. Brainwork

In our analysis of the data, we were struck time and time again by the explicit difference between search and research that our subjects made. Research included what we labeled "brainwork"—thinking, making sense, and ultimately, producing new knowledge. Themes that emerged regarding brainwork included the relationship between writing longhand and deep thinking, strategies that interviewees used to enhance motivation or avoid cognitive depletion, different environmental or time-of-day preferences for "mindless" work and work that requires real thought (we explore this further in "Space"), and the need to eliminate technology to focus (more about this in "Self-Management").

Even the most technologically savvy researchers often preferred writing by hand rather than on a computer when thinking was an important part of what they were doing: "When I am really thinking, I take all of my notes longhand" (graduate student, social sciences); "I'm moving towards being able to write directly on the computer, but sometimes ... I can't, my thoughts flow when I write, with my handwriting. ... I write in cursive and I don't know, I really feel a connection between, I guess, my brain and my

hand when I'm handwriting, and that doesn't happen when I type into a computer" (junior faculty member, humanities).

In order to help maintain focus to do more intellectually demanding work, interviewees employed a variety of strategies. One strategy was tackling problems in "targeted chunks" (grouping similar activities together to avoid having to switch gears, or having "dissertation days"). Another was mapping the week out in advance so that one could mentally prep on the way to work and get started immediately upon arrival: "Once I map it out at the beginning of the week ... I have a pretty good sense of what's coming up first thing in the morning or at the end of the day. ... And so I can get in and just right away start on it rather than having to check and say okay, what was it that I'm doing, and it's sort of like the context is already there and I can just sit down and go" (junior faculty member, sciences).

Others tried to eliminate everyday decision-making and planning as a way to conserve mental energy. For example, a faculty member in the sciences used meal services, such as Blue Apron, to take meal planning out of the equation. Perhaps the simplest approach was knowing when one is most productive, and planning work accordingly. A junior faculty member in the sciences planned their most challenging brainwork for the morning, as that was their most productive time.

Many interviewees found the need for occasional "mental breaks" or "distractions," and frequently turned to social media or internet browsing, or household tasks like laundry. Computer work required more frequent breaks, and participants also needed to switch tasks in order to keep from going "stir crazy." "Losing steam" leads to more distractions, and these mental breaks were viewed as attempts to alleviate a kind of "mental stuckness." At the end of the day, interviewees often sought strategies to help shut down the brain before sleep, such as listening to music in bed or not doing anything right before bed, in order to relax mentally.

4. Circum-Academic Activities

We describe as circum-academic the activities that surround the academic life of the interviewees, but are not strictly research. The distinction is fluid, as academic and circum-academic activities are often difficult to separate, but generally, these activities may include information seeking and sharing, and academic discourse and networking, either virtually or in person. We also briefly discuss some administrative circum-academic activities, such as copyright clearance and seeking grant funding, associated with being an academic.

Virtual Interactions

There were multiple instances of interviewees who used several methods to stay up to date on what is going on in their field and in the world, and some form of circum-academic information seeking/sharing was mentioned in every transcript. While in-person networking (talks over meals with speakers, classes, reading groups, recommendations from colleagues and fellow students, lab meetings, lectures, conversation with a librarian, or talks at other universities) was important, a significant amount of circum-academic network takes place online (via email, Mendeley, Twitter, Facebook, Academia.edu, Research Gate, and other applications).

A graduate student described their use of social media, and how they segregate circum-academic information seeking from personal information seeking: "I more heavily use Twitter for research, so I'll … tweet a news article about something that I study …" and "I only follow people on Twitter who are in my discipline, so I separate. I like to use Facebook for personal stuff and Twitter for professional stuff" (graduate student, sciences). Another humanities graduate student didn't segregate their personal and academic use of social media when it came to Twitter: "I definitely participate in I think what folks on Twitter call academic Twitter. … I mostly follow other academics, but I'm just as likely to post about pouring my coffee as I am to retweet an article that seems really relevant." A graduate student in the sciences described a more casual, but still professionally focused use of Twitter: "Even if I'm not really reading it, [I am] just seeing what people are doing." Interviewees also used RSS feeds to monitor the publication of new papers in their field, and "followed" people who do similar work and share their work via social media or academic networking platforms such as Academia.edu and ResearchGate.

Social media can facilitate the development of professional connections at a distance: "I'm between three different countries … now. So Facebook helps me not only to keep in touch with my friends but also to keep touch with friendly academics that I got more and more friendly with because we exchange not only academic stuff through Facebook but also personal notes and so, it kind of feels that you get to know them better and better" (graduate student, social sciences).

In-Person Interactions

Face-to-face conversation can also be valuable for obtaining new information: "So I'm doing a literature review on logistics in [subject]. These articles were references that I had been given by a colleague in New York. I was in New York last weekend … I was talking to her that I was doing this literature review and she's like, 'Oh, I read these two pieces that I think you might like,' so I found those" (graduate student, sciences). In-

person interactions also occur within research groups and academic units (such as departments or schools). One junior faculty member in the sciences described the multiple roles (e.g., information sharing, and peer mentoring for job seekers and for publishing) lab meetings play in academic discourse:

> *Sometimes it's just a simple everyone go around the table and update about where you are on the projects on which you're working, what papers are you working on, what data are you analyzing, what studies are you running, that sort of stuff. Sometimes we'll have a particular task, so this week I said I'm in the process of applying for jobs, I think it would be really valuable for me to give a practice job talk. ... Other times if someone is preparing a submission to a conference or a journal, they'll send it out a couple days before, everyone will read it, bring comments to the lab meeting, and then we'll discuss it.*

Meals were mentioned frequently by interviewees as opportunities for collegial interaction. These are sometimes welcomed as opportunities to meet with academic visitors, but may also be time-consuming administrative chores for organizers. In each instance, it is clear that an exchange of academic information is taking place, and benefits may include academic support, opportunities to stay up to date on what is happening, the exchange of ideas, and opportunities to share the frustrations of academic life.

Copyright / Permissions / Fair Use

Although mentioned by only two researchers, understanding their own rights to share their own work and to use the work of others was a significant challenge.

One senior faculty member in the social sciences expressed the difficulty in knowing whether they are allowed to share their own work via platforms like ResearchGate and Academia.edu and referred to "dragging out my copyright agreements [to see] if I can figure it out."

As noted above, professional networks can be important sources of information. While much of our interview time was focused on information seeking, some of the

researchers we spoke with also described their wish to share their own work. One senior faculty member in the social sciences expressed the difficulty in knowing whether they are allowed to share their own work via platforms like ResearchGate and Academia.edu and referred to "dragging out my copyright agreements [to see] if I can figure it out."

Incorporating the work of others into publications is also difficult, both in terms of understanding copyright and fair use, and in terms of the effort involved to obtain permission to reuse materials. As a junior faculty member in the humanities said:

> So my press, my editor gave me some general instructions which were full of language that I actually was not understanding. So ... about 2 months ago I started sort of learning about this. Learning about how to define fair use, learning about what constitutes Creative Commons and things like that ... in order to be able to determine for which images and epigraphs I actually needed to ask for permission. Then I had to learn about a specific language of asking for permissions, right, because I was ready to send an email saying, "Hey, would you grant me permission?" And it turns out that you actually have to ask for it, and I forgot the wording. Non-exclusive worldwide permission.

Employment and Funding

Opportunities related to employment and to obtaining research funding came up multiple times as circum-academic activities. As noted above, meetings can be devoted to practice job talks, and researchers use social media to cultivate their professional networks. Grants were mentioned frequently: an undergraduate in the humanities was the grants manager of their extracurricular organization; a graduate student in the humanities referred to being on a call with funders; another graduate student in the sciences described collaboratively writing a grant on Google Docs; and a senior faculty member (social sciences) talked about a big data grant they were asked to comment on by a reporter, as well as dealing with grant paperwork.

5. Library Resources

References to the library and library resources occurred throughout our interviews; they generally fall into the following categories: online resources (databases, e-journals, e-books), online tools (Passkey, text a call number, citation export, the library website and discovery interface), physical collections, librarians, and library space.

Interviewees named many specific online resources that they use heavily: Web of Science, Medline, arXiv, JSTOR, and more. While some interviewees reported using

physical collections, there was also a strong preference for digital, nicely illustrated in the case of a senior faculty member in the social sciences who was in the process of digitizing their own personal collection: "I ... see if I already have a digital copy; if not, can I find a digital copy online, and consequently this has engendered a number of inquiries to the library about how come I can't get the back files on these anymore that I used to. We just lost them to antiquity, which is massively annoying. And you know, if I can't track it down one way or another then I go and scan it."

Others reported intensive use of a limited number of library resources or even a single resource that can meet their needs: "I'm on ECCO [Eighteenth Century Collections Online] this whole morning ... [because] it's got all printed books from 1700 to 1800" (senior faculty member, humanities). A humanities undergraduate student made extensive use of JSTOR: "I've been using JSTOR for two years pretty intensively. I took the 2100 writing class ... and since then I've been addicted to JSTOR. I love JSTOR. And it's been really, really helpful, especially for [my discipline]. It has tons of articles on there."

Tools that researchers found helpful included Passkey ("I wish I had discovered it earlier," [junior faculty member, sciences]) and text a call number. One interviewee reported being pleasantly surprised by the functionality of the Library's discovery interface: "I went to the library website and also typed in ['topic phrase'] just in the front page. And mainly I was looking for if there were any books. And I don't use the library site very often to search for things except for books, and so I didn't realize that you also got a bunch of journal articles, as well" (junior faculty member, sciences). The same researcher reported being pleased with subsequent access to resources discovered via the library: "All of the links for articles I clicked on from the library site, they took me to full text, which was really nice."

Several researchers mentioned using or checking out physical resources from the library (books, DVDs), while browsing was only mentioned in one interview: "I actually came to the library on Saturday and just wandered the section on [topic A] history because one person on my committee was like, 'I know you're focusing on [topic A], but it might be useful to have a really smart footnote about how [topic B] historians think about some of these moments that you're looking at" (graduate student, humanities).

The library as a place that is conducive to serious work was often noted. Facilities and amenities that interviewees reported making use of included workshops, scanners, photocopiers, consultations with specific librarians, printers, computer peripherals, and food and coffee. Document delivery services also came up multiple times.

Finally, a few researchers made references to using libraries other than Cornell, both for research and for personal use (such as access to e-books or audiobooks for recreational reading).

6. Space

When relating their day of research, interviewees often focused on their choice of work locations, the characteristics of those spaces, and finding the environment conducive to getting work done. Choice of location was often based on whether or not the task required sustained and focused attention, and researchers selected or configured their environment on that basis. The library was often the choice for focused work, while offices on campus were used for other activities. Workspaces in labs and campus offices were rife with interruptions, or easily caught up in administrative duties.

Many participants used off-campus workspaces, and sometimes specifically avoided campus in order to avoid running into colleagues. Those who performed focused work at home often did so because of creature comforts like dogs and couches. Several graduate students worked in coffee shops; the motivation for this seemed to be as a way to force themselves to leave the house to interact with others, or to just get started for the day, rather than specific characteristics of the locations (although coffee certainly seemed to help). The camaraderie of having others doing similar work at the same time, even strangers, appeared to be a psychological benefit.

Library spaces were often cited as locations of refuge.

Library spaces were often cited as locations of refuge: "There's a little room in the fourth floor stacks of Uris and it's super nice, super quiet. I initially started going there because there was no Wi-Fi. They have since changed that, but it was nice because it was like there were no distractions, you couldn't even get on the internet if you wanted to. And actually it'd be nice to have Wi-Fi blackout spots. I think that would really help people focus" (undergraduate student, humanities). A junior faculty member in the humanities observed: "I'm working on a review of a book and I wanted to get some quiet reading done. Olin Library, where I have a research space on the sixth floor, works for that because … it provides a place without distractions, and I don't have colleagues and friends to chat with. … I go there into my research space on the sixth floor and I just breathe or write. It's a very good hiding place and I need hiding places." A humanities undergrad expressed a desire that zones in the library be marked for their purposes, especially quiet areas, to facilitate focused work.

In addition to managing social interaction and noise, other needs related to physical workspaces included being able to eat in research spaces, as well as manage personal possessions while moving from one space to another. Technology, and specifically screen size and the availability of a keyboard, can govern researchers' choice of tools, and by extension, location. Specific issues related to library study spaces included hours that are not aligned with an individual's preferences, and not being allowed to use certain spaces because they are assigned to other people (carrels in Olin Library).

7. Self-Management

We use "self-management" to describe the choices and practices of researchers that enable them to manage their time, focus on the task at hand, prioritize multiple demands on their attention, and attain their desired work–life balance. Common work-related tasks that drew attention away from research included e-mail, teaching, and circum-academic activities (such as attending seminars, meeting with visitors, and editorial responsibilities). Other personal research interruptions and setbacks could be attributed to balancing family demands, illness (one's own or a family member's) or fatigue, and juggling non–work-related tasks and errands. Researchers described how they dealt with distractions in work locations, the temptation to turn to other activities, their strategies for sustaining attention and motivation. Many of their processes depended on a complicated relationship with technology and the ways it can simultaneously improve and deter productivity.

Some interviewees reported a concern for work–life balance, or a desire to maintain a separation between their professional and personal lives, even though workloads or technology often made that difficult. In order to maintain work–life separation, one faculty member in the sciences attempted to separate their e-mail accounts, and did not check personal e-mail during the day or install work e-mail on their phone. An undergraduate student in the humanities identified the library as a good space to work partly because it helped keep work and personal life separate. Graduate students seemed to express the most anxiety around ways to manage their time. A humanities graduate student discussed a tool as "part of my saga on how to organize my life." A social sciences graduate student remarked that they needed "more control," which they tried to handle via a planning system that they referred to as "day and life tracking." The planning system was updated each night before going to bed. Other graduate students even procrastinated by scrolling online for productivity and organizational tools.

Generally speaking, it seemed to us that graduate students were most anxious about productivity, while work–life balance appeared to be of greater concern to faculty and undergraduate students.

Shorter-term time management challenges and strategies have to do with minimizing distraction and sustaining attention on the task at hand. Often the very technology that is meant to help make users more productive can distract them from focused work. "When technology is around, I can't focus on other things. So I try to leave my computer closed when possible. I often leave my phone at home ... [or] in my backpack and try to turn it to silent or something, not always, but I try. Because I have no self-control" (graduate student, social sciences). A humanities undergraduate had a faulty laptop with no internet access, but considered that to be an asset: "But it's actually really nice because then I can't get onto the internet and I can just work undistracted." A faculty member in the sciences used an iPad to take notes at a job talk because the iPad's ability to run just a single application at one time was an advantage for sustaining focus. Other tactics included not installing distracting apps (such as Facebook) on mobile devices, putting devices in airplane mode, reading in print to avoid online distractions, and dedicating devices for work and leisure purposes.

Several interviewees mentioned organizing their digital workspaces to help them focus. A junior faculty member in the humanities always kept a project open on the desktop of their computer so that they would not go too long without working on it: "Lately I've been always keeping open the Word file with the chapter of my book that I'm currently revising. Because I want to think, that is the thing that I am doing even in a day like yesterday where I knew I had all this logistical stuff to do and I think it actually works because I can't stand the thought of having that Word thing open and not having even checked it in two days, so when that happens, the day after I'm like, 'Okay, I don't care about anything else, I'm doing my book.'"

Because technology can be hard to avoid, a common tactic among interviewees was to use workflow and productivity tools that prompt users to work for a predetermined length of time; some of these tools also block internet access for that time period so that they can continue to use their computers. One humanities graduate student used a workflow management system called Kanban Flow, with a built-in Pomodoro timer. A social sciences graduate student used a combination of internet blockers, a Pomodoro-style blocker that cut off the internet for 25 minutes and then allowed a 5-minute break, along with the application StayFocusd, that limited their social media to 20 minutes a couple of times a day. Two graduate students used specific writing environments to help them stay focused and avoid psychological blocks. One used WriteRoom: "It's like a dark screen and it kind of cuts out any distractions from your writing so ... you don't have the highlights where you made a misspelling. You don't see the internet bar. It just kind of forces you to just go and write and not care about anything ..." (graduate student, social sciences). A humanities graduate student used Scrivener because it "never presents you with a blank screen. There's always some of your work on it and I find it easier to type in;

it seems like a less formal space. I use it a lot for note-taking as well, and so sitting down to write, to write, right, which is a psychological block for many people, myself included."

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One of the most surprising observations from our study was the continued dependence on analog tools for researchers to manage their time and goals (e.g., calendars and task lists) even among the technologically savvy and despite a general trend towards digital tools for most other aspects of their process. Many participants used paper to-do lists and calendars for long-term time management (days to weeks), and most cited a need for the physicality and the ability to see further ahead quickly. A humanities grad student who used elaborate technological workarounds for writing still depended on a Moleskin calendar and Post-It note system to map the day: "I do a lot of things digitally, but I still like to do the physically embodied crossing off of tasks. It's more satisfying." The same student also noted that they needed "the act of writing it down." Another undergraduate student in the humanities stated that using a physical calendar helped them plan ahead better.

Nevertheless, digital planning tools were still important. A few of the interviewees used digital calendars exclusively, especially Google calendar, or in combination with paper calendars. The mobility of the smartphone made even those analog users adapt for some purposes; many interviewees mentioned that they liked the "reminders" feature on their phones, and even those who used a paper to-do list might use Google calendar on their phones.

What We Have Learned

We embarked on this study with the objective of exploring research practices in order to inform a vision for the library of the future, developed free of any legacy constraints, and to identify improvements to library services that could be made now. What have we

learned? Even though what we have described may be based on limited data, it still gives us insight into the various ways in which 21st-century researchers attempt to meet their academic goals of knowledge consumption and production. And even though none of our findings is so astonishing by itself, the value of what we have learned resides in a better understanding of the connections between the process of research, the academic networking world, and the characteristic ways in which scholars manage themselves to achieve their academic goals. Our way of organizing the wealth of information into seven granular categories (seeking information, academic activities, brainwork, circum-academic activities, library resources, space and self-management) provided us with a corpus of detail that richly illustrates the nuances, similarities, and differences in achieving academic research goals by all our researchers. A more cohesive way of studying the relationships between these seven categories is perhaps subsuming them into three main spheres of practice:

- The process of research - all the academic activities in support of this endeavor, such as seeking information by using search strategies for both general and academic library resources (the search vs. research), thinking about the search and the research (brainwork, reading, note-taking), and expressing those ideas (writing).

- Academic networking - the circum-academic activities of any scholar, such as attending conferences, lunches, collaborating with others, maintaining and/or establishing connections with others in various disciplines virtually and in person, and developing a disciplinary cohort of collaborators.

- Managing self - the various ways and means by which scholars adapt and adjust their own skills, preferences, and habits to work with technology, and the ways they locate and/or adapt spaces (physical or virtual) that allow them to maximize their productivity in fulfilling the process of research and academic goals.

Considering the findings of our study as three overlapping spheres has the advantage of taking familiar library inquiry away from the search and seeking process (usually on or about library resource use), and putting that and allied academic pursuits in the context of other components that we (librarians) normally do not see or know about. Taking into account the overlap between research, networking, and managing one's own abilities is a key way of thinking about the role of libraries and services that need to continue and/or be developed to support current and future researchers. In other words, for libraries, the context in which academic goals are undertaken is crucial.

Library of the Present, Library of the Future

Taking stock of this varied academic research context and trying to propose current and potential future improvements or changes to a present or future library has been a challenging exercise. We were overall impressed with the pride with which study participants described their diverse and idiosyncratic research methods, and somewhat surprised by how frequently they made deliberate and informed choices of methods and tools that sometimes made their work more difficult or complicated. And therein lie our challenges and opportunities. Idiosyncratic practices will remain, but the library has a real opportunity to facilitate the *connections* between those overlapping spheres of academic work. While we selected serious researchers for this study, any recommendations we proposed would benefit all library users.

Improving Current Library Services

Process of Research

In support of the academic activities that comprise the process of research (searching, thinking, reading, writing, etc.) and the fact that researchers make use of multiple physical locations in the overlapping spheres of research and academic networking, we envision positioning the library as a focal point, or hub, for these activities on campus.

> In order to become the hub of an academic's work, the library needs to provide connections—between activities, and between people.

In order to become the hub of an academic's work, the library needs to provide connections—between activities, and between people. We could consider branding the library as the academics' home base, or as their academic center, no matter where they are physically located or what phase of their academic life they are engaged in.

One area of realizing connections between activities is that between teaching and research. Proposed services here could include the ability to share syllabi in a "library of syllabi," or creating curated sources specifically for teaching or research (i.e., classic texts in a field that can easily be integrated into a course management system). Another connection between activities that academic libraries can focus on in a more deliberate way is that between research and its dissemination. The connections can be realized

through organizing symposia for graduate students, or providing opportunities to practice conference presentations and job talks.

As the data above indicated, scholars seek other experts not just as a form of networking, but also as a crucial element in their research processes. They seek other experts both virtually (e.g., by looking for their bibliographies online, following them on Twitter, or connecting through list-serves) and through traditional academic means (e.g., guest speaker lunches, attendance at conferences). Considering what an important part "seeking the expert" in one's own research plays, according to our interviewees, enabling connections between experts is another role that academic libraries can focus on. Creating communities of practice around topics of interest researchers already have, or connecting academics in different fields and allowing them to discover shared interests that might lead to interesting research opportunities are two areas of possible focus. A virtual joint-library conversation space that connects academics in the same discipline or across disciplines at various institutions is a role that libraries can choose to emphasize,

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Anything libraries can currently do to make tools and resources easier to use, and anything they can do to connect users easily and quickly to help, is worth exploring.

On a more practical, and perhaps obvious, level, and to go with our findings that "search is messy," anything libraries can currently do to make tools and resources easier to use, and anything they can do to connect users easily and quickly to help, is worth exploring. This might include making discovery systems more intuitive, as even the slightest barrier can result in abandoning that particular route.

Another way of looking at the problem of the messiness of search is to flip the direction of the flow of information. Instead of providing the information in an abstract way by building comprehensive collections and relying on them to discover it, the library can be the active conduit of information to researchers. Following what one of our interviewees told us—"I try to get other people to tell me the good information"—we can channel individualized relevant information to them that serves their current and prospective future projects by not only pushing to them what they need now, but by mining related fields for future connections as well.

On a somewhat different, but related, note, the latter point is also connected to the importance of expertise and authoritativeness of information. There seems to be a need

for instant/obvious display of authoritativeness/reputation of information that goes beyond pure citation patterns. Thus, it may be possible, and desirable, for libraries to embed displays of alt-metrics indicators in addition to cited-by links.

Last, but not least, researchers use myriad tools and processes to accomplish their work and connectivity and flexibility to facilitate the seamless movement of information from one format, medium, platform, or location to another, cannot be overemphasized. While continuous online access is standard and part of what allows the three spheres of academic activities to overlap so substantially, flexibility in tools and format in current library services can improve considerably. Possible services here include instant non-mediated conversion of digital to analog, visualization tools, mobile device transfer, and so on.

Academic Networking

Many of the points made in the Research section above relate to academic networking, too, because our interviewees viewed the ways in which they keep abreast of the experts in their field and keep connected to those in their discipline or collaborate with them as a continuum. One other important aspect of the circum-academic network that the library could facilitate is training.

Considering how often using somebody else's advice on methods and tools was mentioned, fostering peer-to-peer education and support, especially for graduate students, on workflow and time management seems like a good way to foster community and support. Graduate students may also benefit from writing and technological support integrated into the search process, which may result in co-location of these services or at least easy access to these support services.

Self-Management

Our data revealed an almost constant preoccupation with self-management and achieving a balance between the various academic and circum-academic activities, as well as those that can best be described as part of one's personal life. Keeping focused or allowing time to relax was an important thread throughout our conversations with our "serious researchers." The main reason behind the search for self-discipline was the need to carve out thinking time, or "brainwork."

At all levels of the academic journey, scholars talked about adapting their own preferences of self-discipline to achieve their academic goals, such as turning Wi-Fi off, choosing to work in a cafe, or writing academic papers on their couch. The techniques

varied considerably, but one way the library could cater to the need for focused attention is by establishing "thinking spaces."

Many researchers are looking for ways to limit distractions, usually from technology, and seeking spaces for isolated work rather than group work. Contemplative spaces in the library would provide such opportunities.

Many researchers are looking for ways to limit distractions, usually from technology, and seeking spaces for isolated work rather than group work. Contemplative spaces in the library would provide such opportunities. The library might consider ways to provide distraction-free zones, such as Wi-Fi blackout areas, or locations to "check in" laptops and phones, such as small day-use lockers, as a way to help reduce distraction. Another option is to check out laptops with interruption-free environments, such as laptops with internet blockers or applications with focused writing environments such as WriteRoom.

The Library of the Future

When we first embarked on this project, our most important research question was: "If we were building a research library from scratch today, what would it look like?" The answers can take different forms and our hope is that we have provided enough data to enable a multitude of paths toward the future informed by specific contexts and interests.

What stood out most for us, though, is the role of technology in enabling idiosyncrasies in the research process. Technological innovation has increased the extent to which individuals can adjust available tools to suit their personal preferences. Think of the portable and non-portable computing devices with a multitude of software choices that allow us to carry weather information, airport maps, or stock exchange results in our pockets. Our interviews revealed that the academic world is no different, and serious researchers pick and choose the writing programs, search tools, or citation managers that suit their abilities and situations best.

If we consider that these common practices are only at the beginning of a much larger trend, the library of the future will have to be exponentially more customizable than its current offerings. As the de facto academic hub in a research institution, libraries will have to play a greater role in making available their resources in customizable platforms

that would allow individual preferences in searching, storing, tagging, citing, writing, and sharing with respect to knowledge consumption, production, and dissemination.

Simultaneously, as scholarship becomes more interdisciplinary, collaborative tools and applications will shift from clunky, non-interoperable tools to seamless, nimble structures that facilitate collective work. The library of the future, as we see it, lies at the juncture of customization and collaboration in support of the overlapping spheres of the research process, academic networking, and self-management.

As part of the process of research, our interviewees made an explicit distinction between searching for things/resources that are part of a larger research process, but not necessarily the same thing as doing research. This is an important distinction, not often considered, and provides a change in the focus of how library services could be conceived.

Before we present our vision, here are the major themes that informed it:

- **Search is idiosyncratic and is not important**. Consequently, library services will be organized around research, not around search. They will revolve not so much around organizing information, but around making sense of the information.

- **Research has no closure**. It is ubiquitous. Consequently, library services will be ubiquitous.

- **Note-taking is idiosyncratic**. Therefore, it is difficult to imagine how the library of the future might integrate with the note-taking processes for researchers. Although this is an important part of the research process, the individual nature of note-taking suggests that the library of the future should bypass much investment in this area of academic activity.

- **Experts rule**. Serious researchers have "good enough" systems that work for them in information seeking and knowledge production. When they fail them, they seek the expert. Consequently, library services will be expert, smart services: personalized, flexible, and portable.

- **Research is collaboration**. Although each individual is often working on their own project, they typically have at least one other individual who they are working closely with on that project, and they are not always co-located. In supporting research, the library of the future can support and/or facilitate the collaborative research and writing process.

If the Future Were Here Today

If we were building a research library from scratch today, we would think of it in two ways—as an academic hub and as an application store.

The academic hub idea also appears in the section regarding improvement of current library services, and we believe it will carry into the future. In this scenario, it may take on even more of a social media aspect, as professionals continue to communicate increasingly through virtual spaces. Providing a space for sharing personalized collections (whether they be articles, books, or other research artifacts), and the extent to which they are shared (how private a researcher wants to be), should be easily accomplished for the academic through this library hub. Others should be able to find these collections and add them to their own with just as much facility.

The idea of the library as an app store stems from the finding that research is individualized and highly customized. We envision the library as an on-demand app store, an open source platform that provides the option to suggest features for customization and shortcuts to build personal collections. The library will employ developers that could create these modules quickly. The most popular app downloads will be displayed by function or discipline. The library will take a leadership role in ensuring vendor platforms can be integrated easily for the benefit of the user. All library resources will "speak" easily to whatever platform (writing, note-taking, etc.) the researchers are using. The importance of the individualized user is a significant conclusion of this study. Therefore, the library of the future will need to focus on individualized services, apps, and integrations as opposed to a one-size-fits-all approach.

We are not providing these value-added propositions in the portfolio of library services currently offered simply to improve service, but rather to address core library responsibilities as indicated by the needs of current serious researchers. Technology is clearly at the center of the suggestions we are making for the library of the future. Though libraries are avid technology adopters, which technologies to invest in for a real ROI is not always clear. Our observations provide us with some guidance to effectively direct our investments, monetarily, as well as in human capital. We can at once address the idiosyncratic nature of individual research practices, while simultaneously connecting researchers to an international academic community. By focusing our efforts in these areas, we will not only be delivering upon expectations, but also ensuring our relevance and continued central role in an academic research institution.

Appendix: Coding Schema Development and Testing

We developed our codes using an iterative process. We started with a set of codes developed by Nancy Foster of Ithaka S+R and we refined the codes over four more cycles of coding, meeting, refining, and re-coding.

Our final schema and codes included:

- **Academic Activities**: with 4 sub-codes.
    - Note-taking (NT, includes annotations, margin notes, sticky notes, etc.)
    - Writing (W, includes production, editing, formatting, etc.)
    - Managing info (MG, includes storage)
    - Fieldwork/labwork (FW)

- **Seeking Info:** became its own category with the understanding that it is either part of the academic activities/research process (A) or is non-academic (NA). Academic Seeking information includes reading. We coded only for Seeking Info, and added the NA sub-code when it was clearly non-academic information (e.g., finding recipes, dog treats, movies, reading non-academic news, or any other kind of non-academic reading, listening, watching, etc.). We assumed that most of the information seeking would be academic.

- **Library Resources:** became its own category. To distinguish online from physical use of library resources we added a red asterisk (star).

- **Self-Discipline/Self-Management:** Tactics employed to manage their own habits. Evidence of things they do to self-control or motivate (e,g, going paperless, turning off wireless).

- **Space:** Work environment (space, setup, location, noise, light, etc.).

- **Circum-Academic Activities:** Allied academic activities; professional contacts, networking, newsletters, use of social media for academic purposes. EXCLUDE: news sites, news alerts; work on reviewer feedback

- **Obstacles:** Interruptions in workflow in terms of their academic activities; workarounds employed to circumvent problems; EXCLUDE: weather, etc.

- **Brainwork:** Keywords: understand, translate, make sense, figure out

- **Technology:** presence, absence, hardware, software, social media, access to online resources

Once this final coding schema was agreed upon, all seven members of the team coded the same transcript with it to test each member's understanding and iron out any potential misunderstandings. At this point we felt confident that we all had a similar understanding of all the codes and the logistics of coding. The actual process of coding took place over two weeks—each team member coded 3 primary and 3 secondary transcripts.

Transcript Coding Table

Name	Primary Transcript #	Secondary Transcript #
Team Member 1	1, 2, 3	4, 5, 6
Team Member 2	4, 5, 6	7, 8, 9
Team Member 3	7, 8, 9	10, 11, 12
Team Member 4	10, 11, 12	13, 14, 15
Team Member 5	13, 14, 15	16, 17, 18
Team Member 6	16, 17, 18	19, 20, 21
Team Member 7	19, 20, 21	1, 2, 3

This process allowed for each transcript to be coded by two independent coders. Pairs of coders then compared the three transcripts they had coded in common.