



Affordance theory: a framework for graduate students' information behavior

Affordance theory

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Abstract

Purpose – This study seeks to apply ecological psychology's concept of "affordance" to graduate students' information behavior in the academic library, and to explore the extent to which the affordances experienced by graduate students differed from the affordances librarians were attempting to provide.

Design/methodology/approach – In-depth, qualitative interviews with graduate students and academic librarians explored how the students perceived and used the library's various "opportunities for action" (e.g. books, databases, instructional sessions, librarians, physical space, etc.) and compared these perceptions and behavior with librarians' intentions and expectations.

Findings – Findings indicate a disparity between expectations and experience and point to graduate students as an underserved population in this context, especially in terms of the library's outreach efforts. In addition, because graduate students are increasingly teaching introductory undergraduate courses, communication methods that bypass graduate students tend to miss undergraduate students as well.

Practical implications – Practical implications discussed in this paper include possible methods of improving communication channels between graduate students and academic librarians, and considerations for information literacy instruction.

Originality/value – This paper presents a unique perspective by using affordance theory to frame students and librarians' expectations about library services. The findings are particularly valuable for their implications for library-patron communication and information literacy.

Keywords Ecology, Graduates, Academic libraries, Librarians, Information media, Qualitative research

Paper type Research paper

Introduction

Graduate students have various information needs and use many information sources to meet those needs. The academic library is one vital resource as it serves as a central hub for students to access online materials, personal help, and other resources to guide their academic work. Existing research in library and information studies explores graduate students' interactions with e-journals and other internet resources (e.g. Aiken *et al.*, 2003; Liew *et al.*, 2000; Gullikson *et al.*, 1999), library collections (e.g. Smith, 2003),

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and other relevant topics. However, few studies examine the holistic role of the academic library – where systems and users interact within a broader social frame. Although digital resources play key roles in students' academic lives, focusing on these to the exclusion of other areas of interaction risks overlooking significant elements of the library experience. In this study, graduate students' information behavior is examined in light of theory from ecological psychology, with a particular focus on the role affordances play in shaping students' informational activities.

An ecological view of information behavior

Rather than focusing attention only on newly introduced technologies, Bonnie Nardi and Vicki O'Day propose using ecological models to examine library use. In *Information Ecologies* (Nardi and O'Day, 1999), they critique the “rhetoric of inevitability” that is often used to frame technological change as uncontrollable and predestined. This view, they argue, makes users feel powerless to influence technology, or to choose between available technologies. An ecological model instead views technology not merely in terms of new features, but as a catalyst in a complex and ever-changing ecosystem. The introduction of e-journals to a library collection, for example, changes more than how users view journals; it may also change which journals users select, how often users visit the library, and the kinds of questions users ask at the reference desk. By adopting holistic views of users' library-based interactions researchers and librarians can best decide what technological changes users require, as well as the potential effects of new technologies on the library environment.

In keeping with these principles, Williamson (1989) has formulated an ecological model of information use. In her studies of the information behavior patterns of elderly people, she found that much of the information gathering people do is spur-of-the-moment, or even accidental in nature. Williamson's ecological model focuses on the individual “in a particular physical, social and cultural environment”, with the understanding that information behavior must be understood in context or not at all (Williamson, 1989, p. 25). Although the scope of the information behavior in Williamson's study extends beyond information retrieval, the central role that context plays in her theories resonate with the literature on relevance (e.g. Park, 1993).

These ecological approaches to the study of information behavior can provide a more holistic, richer understanding of the ways that individuals locate, use and understand the information around them. Many researchers have examined university students' informational activities (e.g. Given, 2002; Heinström, 2005; Saumure and Given, 2003; Whitmire, 2004); while some of these do attend to emotion, social context, and other ecological elements that can affect students' information behavior, few studies use ecological theory to purposefully explore undergraduates or graduates' academic and informational activities.

Ecological psychology as a theoretical framework

In psychology, the idea that an individual's behavior (including information behavior) cannot be studied in isolation from that user's environment was fore-grounded by James Gibson, the principal founder of a school of thought known as Ecological Psychology. The “world”, as defined by Gibson, consists only of those things perceived by an organism in its environment; for example, time is constructed not as a linear

measure of centuries and eras, but as the passing of events directly perceived by an organism (Gibson, 1979, p. 12). Thus, although on paper we measure time numerically, in our lives it is more likely to resemble personal and often deeply contextual measurements like “soon after my grandfather died” or “right before I graduated from university”.

Central to Gibson’s view of the world is the concept of affordance, or the opportunities for action offered by the real world. A reptile in a desert might perceive a large rock as a place to sunbathe or a place to hide; a human might perceive the same rock as a weapon or a building material. There is no “correct” use for the rock, only the affordances perceived by various perceivers. It is this relationship between organisms and the environment that is the crux of the concept of affordance. According to Gibson, “the affordances of the environment are what is offers the animal, what is provides or furnishes, either for good or ill. [An affordance] refers to both the environment and the animal [and] implies the complementarity of the animal and the environment” (Gibson, 1979, p. 127).

Two views of affordance

Ecological psychology and its concept of affordance have been influential in many fields, and the ideas are still evolving. Donald Norman introduced the idea of affordance into the realms of graphic design, human computer interaction (HCI), and even popular consciousness with his book *The Psychology of Everyday Things* (Norman, 1988). Norman sought to address how human beings can interact with tens of thousands of objects, many of which are encountered only once. “When you first see something you have never seen before, how do you know what to do?” he asked. His answer: “The appearance of the device could provide the critical clues required for its proper operation” (Norman, 1999, p. 39). While Gibson’s affordances were rooted in visual perception of the natural world (hence the term ecological psychology), Norman’s idea of affordance has more in common with industrial design. In his book, Norman suggested that “our past knowledge and experience [are] applied to our perception of the things about us” (Norman, 1988, p. 14), an idea that clashed with the accepted wisdom of Gibsonian purists.

According to Norman’s school of thought, in the human world it becomes especially important to recognize both an object’s intended uses (i.e. “real affordances”) and the affordances perceived by the user (or “perceived affordances”). The intended affordances of a designed object constitute only a portion of the affordances a human being might perceive in it (Norman, 1999, p. 17). One illustration of this is Bingham’s (2000) description of a knife:

A knife could provide an opportunity for cutting, hammering, driving a screw, chiseling, scraping, forking, reflecting light, branding, throwing a projectile, drawing a straight edge, measuring a length, picking one’s teeth, cleaning one’s nails, scratching a message, and so on, ad infinitum (Bingham, 2000, p. 34).

While a knife may be designed for cutting, the affordances offered by the knife are not defined by the knife’s designer, but by the person using the knife to meet his or her current needs. However, where Gibson would say that the knife cannot have any affordances on its own, that instead an affordance only comes into being when an object is imbued with meaning by one who can use it for some purpose (Gibson, 1979),

Norman would claim that this does not change the fact that the knife's designer meant for it to cut, (a "real" or intended affordance for the knife). Although debates about the nature of affordances continue in the field of ecological psychology (see, for example, McGrenere and Ho, 2000), the study of the differences and overlaps between intended and perceived affordances also forms an important area of research in the study of usability.

Since their popularization, the concepts of ecological psychology and the design principles they inspire have been applied in many contexts, including software design (e.g. Ruecker, 2003; Baerentsen and Trettvik, 2002), analysis of work team organization (e.g. Birchall and Rada, 1995), and Nardi and O'Day's (1999) examination of libraries as information ecologies, which also added social values and context to the discussion of affordances.

Research questions

This study explores whether viewing the academic library through an ecological lens allows libraries to better understand patrons' needs, and be better able to meet those needs in ways that fit well with users' established patterns of interaction in the library context. In any designed environment, the affordances envisioned by designers and the affordances perceived by users may differ. This happens, for example, when library patrons see opportunities that were not envisioned by the creators of a tool or a service, or when patrons overlook potential opportunities that librarians have intentionally placed in their paths. This study examined two questions:

RQ1. What affordances do graduate students perceive in the academic library context?

RQ2. To what extent do these differ from the affordances envisioned by academic librarians?

Research design

The project used a qualitative methodology to examine how eight University of Alberta graduate students used the academic library. "Use" was defined in the context of library resources, including the library building itself, physical books and journals, communications with librarians, and online services provided by the library system. Of the students, six were full-time doctoral students, and two were full-time masters students. Participants' ages ranged from 28 to 47, with six males and two females, and they were studying in the academic disciplines of anthropology, economics, education, political science, psychology, and sociology. Social science disciplines were chosen because it was expected that graduate students in these disciplines would make use of a wide range of library resources, and also because of the researchers' familiarity with the resources typically used in these disciplines.

Of the doctoral students, four were in the process of writing their dissertations and two were completing courses. Of the Masters students, one was writing a masters thesis and the other was completing his first year of coursework. All six doctoral students had served as the primary instructor for a course, and all eight participants had worked as teaching assistants; two students were teaching courses at the time of the interview. Of the participants, seven had worked as research assistants, although only one was employed in that capacity during the study.

To compare the affordances perceived by the students with the expectations set by the library, three academic librarians from the University of Alberta were also interviewed. Each of these librarians was responsible for designing and evaluating on-line and/or in-person services in the library system.

Participants were recruited through invitations emailed to departmental lists and through snowball sampling. Interviewees were selected using maximum variation sampling to achieve a broad representation of gender, age, academic discipline, and topic of study (e.g. although two sociology students were included in the study, their areas of research were very different).

Data collection and analysis

Data were collected in the fall and winter of 2004/2005 using in-depth, semi-structured qualitative interviews and task-based computer explorations. Each session lasted approximately ninety minutes, and was audio-recorded using a digital *iPod* recorder. All interviews were fully transcribed for analysis. In-depth interviews are recommended when a researcher wishes to understand a situation from another's point of view. The aim is not only to understand what the participant does in a given situation, but also to explore their attitudes and feelings, as well as the broader context in which a behavior takes place. (see Mellon, 1990; Lincoln and Guba, 1985; Seidman, 1998). Interview guides were used in the interviews to guide the conversation (see Appendix 1 and 2); however, the dialogue with each participant was allowed to flow naturally, in order to explore each participant's course work, research activities, teaching, and overall information behavior related to their academic work. When individuals mentioned activities that could be perceived as opportunities for action (e.g. talking with librarians, studying in the library, putting resources on the reserve list for a course), additional follow-up questions were asked to explore the affordances involved. In addition, the library's reference linking service was examined in detail. This allowed for examination of a case study regarding a specific affordance the library was attempting to provide, and how it was being perceived by its intended users.

The data analysis used a grounded theory approach, with emergent themes coded into TamsAnalyzer. TamsAnalyzer (Weinstein, 2004), an open-source tool for qualitative analysis, was used to create transcripts and codebooks, and to tag the transcriptions for analysis. This allowed the data, created in digital format, to stay in a digital format throughout the transcription and analysis process. Major themes to emerge from the student interviews included anxiety about dependence on technology, anxiety about time pressure, and a lack of awareness of library services. Major themes to emerge from the librarian interviews included a reliance on web-based communication and information literacy classes for communication with graduate students. These themes are discussed in more detail in the sections that follow.

Findings and discussion: an overview

Each affordance discussed was assigned to one of three categories, according to whether it was intended by the library's service designers, and whether it was perceived by the students (i.e. there can be no affordance that was neither intended nor perceived). Figure 1 provides a summary of these three affordance categories and the most significant findings for each; a more thorough discussion of each category follows.

		Intended by library	
		yes	no
Perceived by Users	yes	Intended and Perceived -online catalogue -reference librarians -journal databases -inter-library loan	Perceived but not Intended -unauthorized distribution of journal articles to friends -students' fear of technology dependance
	no	Intended but not Perceived -students unaware of information literacy instruction -students do not see new icons or announcements	

Figure 1.
Summary of findings for intended vs. perceived affordance categories

Affordances perceived by users, whether anticipated by the library or not, provide those users with some opportunity for action. Examples of perceived affordances that emerged in this research include the ability to find books using a library catalogue (a use both intended by librarians and perceived by users), and the use of journal databases to locate articles for friends who do not have legal access to that material (a use never intended by the library, but perceived by some users).

An “affordance gap” occurs when the designers of a tool or a service believe they are providing an opportunity for action, but this opportunity is not recognized by users. Examples of affordance gaps discussed in this paper include a lack of awareness of information literacy instruction programs (i.e. where librarians intend to provide useful instruction, but study participants were unaware of this service), and using the library web page to announce new services (i.e. where librarians intend to provide information, but study participants did not see these announcements).

Affordances that were both intended and perceived

One class of affordances consists of those affordances that were both intended by librarians and perceived by users. Figure 2 highlights this category. Graduate students in this study made use of many library resources in exactly the ways the library intended. The catalogue was often cited as a tool students used to find information, as were journal databases, the internet, the library web site, and librarians themselves. Alice, a doctoral student in sociology, described some of the library resources she uses for her dissertation:

I use the library catalogue, and the internet, and database searching all the time. [. . .]

Journal articles, either like MLA, the Philosopher’s Index, Academic Search Premiere, some of the art history stuff, humanities abstracts, yeah, all kinds of things.

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Figure 2.
Summary of findings for affordances both intended and perceived

There was a high degree of satisfaction with many of these services, especially the catalogue, reserving books, and interlibrary loan (ILL). David mentioned the library's ILL agreements as an impressive service:

If I don't find a book or journal I need I'll go to the [University of Toronto library online catalogue] and then I'll order it through interlibrary loan. [...] I just put the call number in my interlibrary loan request and I get it immediately.

Interviewees also cited on-campus library branch transfers as a useful service. Cassandra, who has a small library in her department, is an especially heavy user of this service. "I'm constantly bringing books in through [on-campus] interlibrary loan. I have books shipped here [to the department library]. All the books I request I just have them brought over here." She was especially pleased with the time and effort this saved her, particularly in the winter, when trekking across campus could be uncomfortable and time consuming.

Librarians as formal sources of information

Although there was unanimous awareness that librarians could be used as a resource, some users were reluctant to do so. David, a sociology PhD student, said he "[doesn't] use reference librarians very often" and Bernard, though a frequent and enthusiastic user of the library, echoed a frequently cited point of anxiety: "You're afraid to go up to the resource person and ask a dumb question." This finding echoes studies of library anxiety, which point to the perception that library staff members are unapproachable as a major reason for library anxiety among university students (see, for example, Mellon, 1986; Van Kampen, 2004).

Alice, who usually works from home, was willing to consult a librarian, but was frustrated by the online reference system. Here, she describes her attempt to use the "Ask Us a Question" chat reference service:

There was some problem. I got online and I was talking to a librarian from Michigan or something like that. They were helpful, but we got cut off. The connection went. So I logged back on and someone else picked me up and there is no mechanism for getting back to the same person. It was frustrating because we had been chatting, she knew my problems, [and I had] to start all over again.

As more students become remote users of the library they face additional technical hurdles; not only must they overcome their hesitancy to speak to librarians, they also must struggle with technological barriers in order to be able to speak with a librarian. Technological barriers are also significant contributing factors to library anxiety – so much so that a recent re-writing of the *Library Anxiety Scale* added a new category just for technology (Van Kampen, 2004).

When users did consult librarians, however, the results were favorable. Cassandra, who is on a first name basis with the librarians in her departmental library, spoke glowingly of the many ways they help her:

The librarians here are really helpful. In terms of if I'm looking for something specific, they're the people I would go to first. [...] These two in particular are really... I wouldn't even just say sympathetic. They're very proactive about the stuff that we do here.

It bears noting, however, that the librarians in Cassandra's departmental library are not strangers to her. She has no anxiety about approaching them because she talks to them every day, often in informal conversations when she happens to see them in the hallway. This has moved Cassandra's interactions with these librarians from a formal information-seeking behavior to a more serendipitous activity, the kind of information gathering preferred by most people to meet their everyday information needs (Williamson, 1989). Cassandra's relationship with her departmental librarians was a case study in what user-librarian relationships can be, at their best. It will be discussed in more detail later in this paper.

The library as a place to work

All the participants recognized that the library offered them a physical space in which to work. There was also consensus that the aesthetics of a library play an important role in how likely students are to use the space, and how much time they want to spend there. Several students indicated that the aesthetic pleasure of certain libraries made them choose to work there instead of somewhere else. For example, Alice described the library at another university, where she had completed her undergraduate degree, fondly:

I loved the reserve room. It was in this beautiful old building. On the top floor of this building were beautiful study areas, dark wood, you know, like sequestered carrels and really nice direct lighting, stained glass overhead. It was just this really beautiful environment to study in, so I spent hours there actually.

Stan Ruecker (2003) has theorized that aesthetic pleasure is one of the factors determining whether an affordance will be perceived or used by a particular person. The findings here seem to confirm that view, as do numerous studies in library and information studies that cite comfort as a factor in lowering levels of anxiety (e.g. Van Kampen, 2004). Even when the interviewees embraced the move toward virtual library use, the words they used to describe the experience (e.g. "faster," "easier") were a striking contrast to those they used to describe library buildings and physical

collections they have loved (e.g. “beautiful,” “joyful,” “immersive”). There was a feeling of ambivalence in the interviews, a nostalgia for the days of purely paper collections, but also a recognition that time pressures make the convenience of new technologies seductive.

Aesthetic appreciation versus utilitarian functionality was also raised as an issue in the use of information technology in libraries. Although Alice seemed to have adjusted well to the library’s shift toward digital information resources, Bernard felt that something had been lost, and that those who would prefer to use the library as a physical space are being left behind:

The browsing experience in a library, with the physicality of the other books in front of you is very different from the browsing experience on a computer. It’s not a pleasurable activity that I find I can immerse myself in. . . My pet peeve with the library is that it is easier to find things, it is easier in some senses to get articles, but the experience of using the library as a place of learning and as a place of community of learning is markedly diminished.

He was also disturbed by his recent inability to physically browse through journal articles, which had previously been one of his favorite library activities:

The computer interface, especially with periodicals, it really reduces. . . the experience and the joy of using the library. It becomes much more utilitarian and instrumental and it’s just a chore to use the computer interface rather than the pleasure of going up to the periodicals and flipping through them. And. . . I go up to the periodicals room and they’re diminished. So many fewer of them. I’ll think “Well, I’ll go and look and see what’s up there”, and you know the library has a subscription to it because it’s on their catalogue, but it’s not in the room. You can’t just go up to that room and take it off the shelf because it’s now in fact internet access only.

Bernard’s objections extended beyond the aesthetic. With his limited budget and limited access to technology, working from home was not an option:

The browsing experience on a computer . . . it’s impossible if I don’t have high-speed access. I think that’s an extraordinary assumption on the part of the library that people do [have high speed internet at home].

While e-journals and other online resources are encouraging some students to work from home, other newly introduced technologies, such as wireless networks, are encouraging other students to work at the library, sometimes for the first time. David, for example, seemed pleased by his newfound ability to study at the library:

I’ve never worked well in a library. I think I just find it sort of distracting. But it’s changing a bit now because I never had a laptop before and now I have a laptop, so technically I can actually go to the library and write in the library, and now you’ve got wireless in the library which makes it even easier to do a lot of the different tasks that need doing.

However, Bernard’s point about the uneven technology access among graduate students holds true here; many graduate students cannot afford the laptop that would make this service useful.

Affordances that are perceived but were unintended

A second class of affordance consists of those that are perceived by users but were never intended by a tool’s designers (Figure 3). Nardi and O’Day (1999, p. 29) use refrigerator magnets to describe this category; although refrigerators were designed to

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Figure 3.
Summary of findings for affordances perceived that were not intended

keep food cold, they also happen to provide a convenient place to hang decorative magnets, and with them photographs, grocery lists, and children’s drawings. In a similar way, although Amazon.com was designed for people wishing to purchase books online, it has become a recommendation service and a database for finding bibliographic information, which is sometimes then taken and used to find the referenced books at the library.

Librarians as informal information carriers

While librarians are sometimes perceived by users as “friendly”, librarians may not realize that their personal relationships can serve as unintentional conduits for information transfer. Indeed, several people in this study cited friendships or informal relationships with librarians as a source of new information. David, who is very involved with computers and studies the social effects of technology in his graduate work, reminisced about how he first was introduced to computers:

One of the best things I remember is my friend’s dad was a librarian at the University of Winnipeg, and they had a modem hooked up to their Mac. [...] and so that’s when I first... this is in the eighties, right, when the internet didn’t exist. Well it sort of existed... we started getting onto these BBSs [Electronic Bulletin Board Systems] and stuff and it was just this really neat thing.

Also, in a general discussion of libraries and how he has used them in the past, he several times cited a friend who works as a librarian as a source of information about libraries:

And then my friend was telling me about a library in San Francisco that has a tool library. This is my friend who is a librarian. She was saying you can become a member and you can borrow tools for whatever projects you’re working on. That’s pretty neat.

Even knowing a library school student seems to have this effect. Alice mentioned that having a friend in the Master of Library and Information Studies (MLIS) program was

changing the way she thought about libraries and librarians. When asked what she would do if she needed help with the library databases she said that she would ask a reference librarian, and attributed this decision to her MLIS-student friend:

Since I've been friends with Helen I feel kind of chagrined or sheepish with myself for not having [talked to a reference librarian] before. My thinking is changing. . . It's evolving into "the library can be my friend."

Librarians also provide information to people they are not intentionally helping. Of the graduate students interviewed in this study, Cassandra was by far the best informed about the library and its services and resources. For example, the University of Alberta had recently launched SFX's citation linking software (which they have called Get It) into their journal database. Reference (or citation) linking software gives users of a digital citation the ability to link directly to other information about the work cited, often including the full digital text. This ability can be found in the references list of a work, or in databases of journal articles or abstracts. The software is designed to save users time and effort in tracking down digital versions of scholarly journal articles (see Caplan, 2001; Grogg, 2002). Of the eight students interviewed for this study, Cassandra was one of only three students who were aware of this service. However, she insisted she did not go out of her way to learn about the library; rather, she got her information through a variety of informal channels, including casual conversations with her departmental librarian, and in the presentations this librarian gives at the start of each term to the classes Cassandra teaches. In describing how she knew about the Get It service and how to use it, Cassandra said:

Deanna, the librarian, mentioned it in class when she did her orientation in the fall. . . The first or second week of classes I have her come in and give them the overview. And I said "Oh, that's what that is". I was going to ask, but you know I go down there and I forget.

It is clear from these interviews that regular informal contact with librarians increases the serendipitous information gathering described by Patrick Wilson (1977), and more recently, by Nigel Ford and Allen Foster (Foster and Ford, 2003), Sanda Erdelez and Kevin Rioux (Erdelez and Rioux, 2000) and other scholars; in this case, the focus of serendipitous seeking is on information about libraries and information services. Information "is also found where it is not specifically sought, as an accidental concomitant of routine activities with other purposes", Wilson explains, and this friendly contact with librarians seems a perfect example (Wilson, 1977, pp. 36-37). Cassandra expressed the effortlessness of this information transfer when asked how new instructors were expected to find out about library services: "[The librarians] would say, 'You know what? We have this service!' Because they're talking to you every day." However, her experience is unusual, given the few departmental libraries on campus. For instructors without such personal relationships with librarians, a similar type of serendipitous information gathering may not be possible.

Unsanctioned use of library resources

Although most unintended affordances that users perceive are harmless or purely beneficial, some have the potential to violate established library policies. One student, who spent a year doing field research in another country, found that he was able to make friends and build good will by using his remote access to University of Alberta

journal databases to locate articles for colleagues in need. He felt no qualms about this; on the contrary, he was pleased that he was able to provide help:

There was one girl, she was doing research on Kant. And it was hard to find materials in [that country] because the libraries there are not computerized and the databases are quite limited and small, and they're much more of a hassle. And I would go to the cyber café where they had a high-speed connection and go to the U of A web site and download articles for her and put them on a disk and she could read them on her computer, and that was neat. That was neat to be able to do for someone else.

Although this participant's sense of helpfulness is admirable, he clearly had no conception of the legal implications of his actions. The library could face penalties if it were discovered that this kind of behavior was widespread. For example, many libraries sign agreements with commercial vendors that limit database access to specific, approved users (e.g. the institution's students and faculty); violating such agreements could result in a loss of privileges for that institution.

Dependence on technology

Just as some affordances can be harmful to the library, some can be harmful to users as well. In the case of information technology in libraries, some of the study participants saw the many conveniences offered them by the library as also offering a dark side. For example, some students expressed fears of becoming dependent on technology; they worried that technology would make them lazy, or that they would leave university not knowing how to conduct research in a library with fewer digital resources. David was especially worried about this; in discussing locating journal articles in a database, he said:

I fear it's making me weaker. . . I've lost all my old hardened skills and I don't know how to find things. . . Every time you introduce a new level of software, a new level of technology, you're further disempowering people to do the work themselves, that maybe a previous generation of researchers could have done. It's a weird thing because often it's framed as empowering people to do better research, yet you're disempowering them in a way, by controlling the basic technological foundations of the research itself.

There was also a perception among the interviewees that increased use of technology diminishes the serendipitous information gathering associated with physically browsing materials. Bernard was especially concerned, in this case:

In a way it was easier for me and more comfortable, and it still is, to go to the physical book or journal and photocopy it. I just like the books. . . [The library is] no longer a place where you physically go to get books off the shelf or to flip through journals, but it's something that is mediated, kept distant through the databases. So while often [in a database] you can go to a journal issue and see all the issues, you see them only in title. You see the title, author, and will sometimes see an abstract, if they have that function, but you can't sort of flip through the book, and say oh this looks interesting. . . The things that stick out for you in the library are the things that you're thinking about, and it often seems to feed what you're thinking about in interesting ways. I find a computer interface doesn't.

The importance of serendipity to the library research process has been echoed frequently in studies of academic libraries. Serendipity is increasingly thought to play an important role in the information seeking behavior of all kinds of scholars (e.g. Foster and Ford, 2003; Foster, 2004; Delgadillo and Lynch, 1999; Cobbledick, 1996).

The results of this study may also point to differences in the attitudes of social sciences graduate students toward e-journals versus their peers in the sciences and engineering. Although studies of science and engineering graduate students have found libraries' shift towards e-journals to be overwhelmingly positive (e.g. Liew *et al.*, 2000), the students in this study found the technology convenient, but also problematic. Their fears of dependence on digital resources, or their resentment of imposed mediation between themselves and the library materials may point to disciplinary differences that require additional research.

Time sinks

Another unexpected and negative affordance perceived by students was the belief that using library resources would waste precious time. Study participants universally expressed concern for their time and a constant fear of missing deadlines, which affected their attitudes towards many library services. In the case of library technology this often made them afraid to try a new technological tool or service. Here, Alice explained her reluctance to click on new buttons:

Sometimes clicking on links gets you into trouble. You never know. Computers freeze, they get hung up. If I don't know where I'm going then I'll just not. . . Sometimes I'm afraid to click on things. . . especially when your time is at a premium you're hesitant to click on something new which might waste more of your time.

This worry had not only to do with a mistrust of the technology, but also with the loss of productive time resulting from a computer malfunction. David also expressed a hesitancy to try new features on the University of Alberta Libraries web site, or even to search databases with which he was familiar:

You can sink so much time into doing searches. In a way I almost do a lot less searches now because I've wasted so much time in the past digging around. I've become conservative with my searches.

This fear of wasting time was exacerbated by his fear that he was not performing effective searches. David, although comfortable with technology and computers, still had some concerns about his ability to search journal databases:

I don't think I use database searches very well. It's one of those things where I tend to get advanced and then miss out on some of the basics, so either I've learned this and forgotten it or else I never really learned it.

However, David felt that his uncertainty and avoidance of the journal databases were problematic "because there could be articles coming out that I don't know about, and I'm not checking up on them. And there could be things that could be really useful for my own research and I just haven't heard about them". Interestingly, he had never taken any formal steps to address this. He stated several times that he does not consult with reference librarians, and when asked whether he had ever taken any of the information literacy instruction offered by the library, the answer was:

No. No, I haven't. I've taken courses on campus before though. . . what is that called? . . . like computing courses. So I took a course in Flash [programming language]. But not through the library. I do take courses outside of my normal program, but I've never taken any library courses.

Alice, who also has never taken library instruction courses, believed that concern with time pressures was also keeping graduate students away from librarians and from information literacy instruction:

I know that they offer the instruction here but I don't know anyone who has taken advantage of it [because]...I think...well...I think it's too bad, really. I think probably people are very busy and very stressed out. And they don't think that taking an hour or so to [take a library instruction session] will cut down on their research time. I think it's one of those things that gets...it's so abstract – the concept of research – that I don't know if people know that research can actually be facilitated by knowing how to orient yourself.

A lack of awareness among graduate students about information literacy instruction may also play a major role in their avoidance of it. This will be addressed specifically as one of the major affordance gaps uncovered in this study.

Affordance gaps

The most problematic category related to the concept of affordances is non-affordances, or “affordance gaps” (Figure 4). This term refers to the gap in understanding created when the users of a system do not see or do not understand the opportunities for action that the designer of the system intended. As Norman notes, “Affordances specify the range of possible activities, but affordances are of little use if they are not visible to the users. Hence, the art of the designer is to ensure that the desired, relevant actions are readily perceivable” (Norman, 1999, p. 41).

In the library, affordance gaps can take many forms. For example, the use of library jargon in public spaces can lead to confusion and can create affordance gaps. David ran into trouble, for example, when he mistook the term MARC (Machine Readable Cataloguing) for the word “mark”, which is used to select a particular article for later printing or emailing by the user. When asked during the interview to talk through the

		Intended by library	
		yes	no
Perceived by Users	yes	Intended and Perceived -online catalogue -reference librarians -journal databases -inter-library loan	Perceived but not Intended -unauthorized distribution of journal articles to friends -students' fear of technology dependence
	no	Intended but not Perceived -students unaware of information literacy instruction -students do not see new icons or announcements	

Figure 4.
Summary of findings of affordance gaps

process he used to find resources for a research paper, he described how he used the catalogue to search for records and then e-mail them to himself:

David: So I can request or hold this item. I can mark it, and I think from mark I can e-mail it to myself. [long pause] How do I e-mail this? Am I missing it? Do you see it anywhere on there? How can I e-mail this? . . . That's weird because I was just at . . . I went to MARC display after I had marked it. I went to MARC display.

Interviewer: Okay, so you think that the MARC display is going to give you something to do with your having marked the record, but it doesn't do that.

David: No, it's just showing me that [indicating a MARC record, which to him looks quite confusing].

The intention of the catalogue designer in including a MARC record display was to provide this information for librarians and library cataloguing staff, a purpose quite removed from David's attempted use.

Reference linking software: the "Get It" service

Although David's experience is an example of a relatively minor affordance gap, many other examples in the interviews reflect major gaps between the services that the library intends to provide and users' ability to comprehend those services. One service in particular that this study examined was the SFX reference linking software, called Get It. The University of Alberta implemented the SFX reference linking software product in the summer of 2004, and according to Albert, one of the librarians interviewed for this study, the Get It name was chosen because librarians thought it "expressed better the distinction between [citation linking] and a search service, which is not what this is. This is locating a known item." The software works well technically, and the respondents who used it spoke highly of it. Ernst, a doctoral student in psychology, enjoyed using it so much he changed his patterns of journal usage according to which e-journals are Get It compatible. He expressed a newfound favor for one journal in particular, "because there I can use Get It, so I don't have to go through all those other steps to find the actual article that I want."

In at least some circumstances, then, the service is meeting the goals of saving users time and effort; however, the majority of interviewees did not know that this service existed or did not understand what it would do for them when searching the library's databases. Although librarians were excited about the new service, there were no press releases or major announcements when the service was launched. Knowledge of Get It was expected to follow "natural channels", in the words of one librarian, to find students in the course of their everyday information behavior. The designers of the service did not anticipate that this would be problematic. Albert described the library's expectations for how users would find out about this new service:

When it works you don't really need to know much about it. When you see that button, click it, and then deal with the menu. My guess is that 80 percent of our users discovered it when they saw that button in a database they were using and wondered what it was and clicked it. . . It's not something you have to promote because it is in users' faces as soon as you turn it on.

Unfortunately, this was not the case for the participants in this study. While the Get It service was liked by the students who used it, only three of the eight graduate students

interviewed for this study had heard of it before participating in this study. Of these, only two had found out about it by the methods expected by the library.

While Cassandra learned about it through her department librarian, Ernst and Fred were the only participants who actually saw the button and clicked on it to see what it did. In contrast to Alice's fear of clicking on unknown buttons, these individuals seemed to be fearless explorers of new digital opportunities, frequently searching out new software packages to download and try. It may be significant, however, that both Ernst and Fred had relatively new computers to use, which had been provided to them by the university. Also, they both had either the technical knowledge to fix their computers themselves, or a technical support team they could call on without cost, should problems arise.

Given the nature of the fears cited by Alice and other study participants who were reluctant to try new digital services, it may be that these kinds of technology supports can make a difference in how willing graduate students are to take risks with new digital opportunities. If a student is putting his or her own equipment at risk, along with the risk of paying out-of-pocket for any repairs, that student may be less likely to take a risk than one who works with a university machine that can be fixed or replaced with no personal financial consequences.

The other five study participants, despite daily usage of databases enabled with the Get It software, had never clicked the button, and in one case seemed never to have seen it. David, when explicitly shown the Get It button, responded, "I've never seen it before. Is that new?" Bernard had noticed the button, but said he had "Never used it". After some discussion of what the service did, he explained that he had never used it before because "Until now I thought... that it will tell me what the call number is". Alice also said that she had "never used it before." When asked to guess what it did, she speculated that "it might link me to similar things". Clearly, the button is not as self-explanatory as the librarians who designed it had hoped.

Unfortunately, graduate students were omitted from those outreach efforts that were used to let students know about this new service. Aside from the button itself, the library informed users about the Get It service by placing ads in the student newspaper, putting an insert into orientation materials for new undergraduate students, placing a link on the front page of the library web site, and designing new information literacy instruction sessions around the service. Although some graduate students undoubtedly read the student newspaper, the ad had no effect on the participants in this study. Since these students were all continuing graduate students, and orientation packages are mainly designed for first year undergraduate students, the orientation materials missed them entirely. One might expect that such heavy users of the library web site would notice an announcement on the library's front page, but all of the students indicated that they rarely paid attention to the front page; rather, they said that they came to the library web site with a task in mind and rarely deviated from that task to explore new features.

Information literacy instruction

By far, the most significant affordance gap discovered in this study was the difference between the ways librarians perceived information literacy instruction (ILI) and the ways it was perceived (or not perceived) by graduate students. This gap was significant because of the high importance placed on ILI by librarians, who viewed it as

their primary channel of communication with students, and the low importance placed on ILI by students, who were sometimes unaware of its existence.

Again and again, when describing problems users had with understanding or using library services, the librarians in the study supposed that “Maybe we didn’t get things pitched properly in the [ILI] sessions”. ILI sessions were where librarians assumed that user education about new services was taking place. Unfortunately, this study found that at least some graduate students were missing out on this instructional process. None of the graduate student participants had ever participated in an ILI session. Some were not aware that the library offered instruction at all, apart from orientation sessions for new students. Ernst, when shown the listing for upcoming information literacy instruction workshops, expressed confusion:

I don’t know anything about these [courses], I don’t know if these cost money, or what these are. Like actual courses that they take? I don’t know, I’ve never seen courses from the library.

This was significant, because throughout the interview Ernst had been expressing frustration with the low levels of information literacy shown by the students in the classes he taught. He felt he was wasting class time explaining ILI topics, such as how to find a journal article. He clearly had a need for instruction, and his students clearly had a need, but even when he saw an ILI session designed to teach students how to navigate the library, he did not recognize it as a solution to his in-class frustrations. Later, during a discussion of some of the basic facts about ILI sessions, he reflected on this:

Ernst: They’re free? Oh, yeah, had I known that... Wow, that’s a great resource to send students to. When I think of “course” I think of a full term course where students have to pay money and go and sit and commit themselves to an entire three months. That was what I thought, with that other thing that I was looking at, the “learn to use the humanities library.” When it said course details, I thought, well no, I probably wouldn’t want to recommend to them to take an entire course because it really wouldn’t help me in this class.

Interviewer: Yes, but that class is just for one hour.

Ernst: (laughing) Yeah, it actually says that right there, but I just read the top and stopped... I just looked at “course details” and then my own biases said, “Oh it’s a ‘course’. Never mind.”

We see another example here of the confusion terminology can cause, as well as this user’s lack of awareness about the nature of ILI.

At the end of the interview, Ernst noted that he was excited to be able to tell his classes about ILI sessions; however, the library must also make it easy for students to know what sessions are offered, and make it easy for them to register. Alice, for example, wanted to take an ILI course about using *ProCite* to manage the citations for her dissertation. A friend had recommended an ILI session that was offered by the library, but Alice encountered problems when she went to the library web site to register. She could not find a listing for it on the “upcoming instruction” portion of the library web site. Instead, she found that the only sessions advertised were for classes being offered within the coming few weeks, and *ProCite* was not among them. There was no way to be notified the next time a *ProCite* course was being offered, and no section of the site listed all the courses offered by the library. Alice expressed her frustration with this service:

The upcoming instruction only tells you the classes that are happening right away. So you wouldn't know from that list that there even are courses on *ProCite*. I would like a lot more information on [library instruction courses]. . . This can still be "upcoming," but they should have another section for courses offered through the library services.

These examples demonstrate several affordance gaps. First, librarians assume that students who need ILI know about it. This implies that, second, the library's channels of communication about ILI are effective. Third, there is an assumption that students who know about and need ILI will be able to sign up for it. In this study, none of these assumptions played out.

Inattentional blindness

This failure in communication is not due to lack of trying on the part of the library. The three librarians interviewed in the study were dedicated, thoughtful people who devoted energy and effort to the services they designed, which they genuinely hoped would help users. However, this study found an over-emphasis on the use of technology alone for communication with library patrons. Again and again, the primary method of communication about library services was to place announcements on the library's web site, or to put a new button on an existing web-based service. When a button was found not to be working (i.e. when web statistics showed that no one was clicking on it), the button was changed; for example, the "Ask Us a Question" button on the front page of the library web site was changed to better reflect the nature of this online reference service, resulting in a dramatic increase in the numbers of users accessing the service. Unfortunately, while this approach was useful in that case, different approaches may need to be used depending on the nature of the service and users' perceptions of that service. In addition, designers should remember that web statistics are notoriously difficult to interpret. As Ben, another University of Alberta librarian, noted: "We can tell you the number of clicks on a button, but not whether those are unique visits, or return visits, or even whether the total number is high or low." So, while web statistics are useful in diagnosing obvious problems (e.g. when no one is using a service), they cannot diagnose more subtle or complicated communications problems.

Another problem with relying on the library web site for communication with users is that users often (quite literally) do not see much of the web site. This is true both for pages that users never visit, and for pages they visit frequently. For example, Alice did not know prior to participating in this study that she could recommend a book for purchase by the library. There is a link on the main page of the library web site (a page she visits several times each day), yet she has never noticed this link. This same pattern, of looking at something daily and yet never seeing it, was echoed in several of the interviews. Sometimes a potential affordance is missed because the labeling is not what the user expects. David, for example, when asked to explicitly inventory every item on the main library web page, found several new items he had never seen before, including a faster method of reaching his favorite search screen, and the ability to request an interlibrary loan. He notes:

Oh, that's cool. I never saw that there. "Request an interlibrary loan" under quick links. I've always gone around looking for request ILL.

Of particular relevance to the discussion at hand, very few of the participants had ever seen the “upcoming instruction” portion of the library’s web site, even though it is on the front page. This is partly due to the fact that this information is on the bottom portion of the page, which on most computer monitors requires that users scroll down the page in order to see it. Some users did not even realize there was a bottom portion to the web page; they had never scrolled down before. When these users were asked to perform the exercise of explicitly naming every item on the web page, they stopped about half way through the page, believing that they were done. Cassandra was one of these users. When asked to scroll down, she saw the “upcoming instruction” links for the first time:

Interviewer: “Do you see that ‘upcoming instruction’ section? Do you ever look at that?”

Cassandra: (laughs) No! I’ve never seen it before.

However, even users with large monitors did not notice the “upcoming instruction” links. All of these examples can be referred to as “inattentive blindness”, or the inability to see things one is not expecting, especially when focused on another task. While the term “tunnel vision” has long been used to describe a state of excessive focus in which peripheral stimuli may be missed (Norman, 1988, p. 164), it is only recently that researchers have known just how true this is; when a person is paying close attention to a task, unexpected objects fail to capture attention, even when the object in question would otherwise be noticed (Simons, 2000, p. 147). In other words, the web site of an academic library is the perfect place for users to overlook new services. Graduate students visiting the page do so with specific tasks in mind; they know where they are going (or believe they do), and their attention is focused intensely on the task at hand.

There was some recognition among the students in this study that they do not notice library services that are outside their immediate frames of attention. For example, David was not surprised that he had never seen the “quick start guides” before:

Interviewer: Do you ever use these quick start guides over here?

David: No, I don’t even know what they are. I’ve never. . . by the time I get here [on the web site] I’m sort of on my path to find what I’m looking for.

Ernst expressed the same kind of tunnel vision. Here, he is looking at the bottom half of the library web site, possibly for the first time:

Interviewer: How about upcoming library instruction? Do you ever look at that?

Ernst: No, I’ve never seen that. Oh, look, APA style. I never even noticed it! I’ll be brutally honest, I see the databases and the catalogue. That’s it.

The librarians at this university also know (from focus groups and server logs), that visitors to the library web page are not visiting many areas of the site outside of their favorite destinations: in effect, the databases, the catalogue, and a few other areas like “my account” and interlibrary loan. The librarians interviewed in this project seemed frustrated by users’ lack of diverse use of library services, but did not know how else to communicate with users or promote new services.

A different approach: the personal touch

A major theme to emerge from this research was that for every affordance gap, there were also instances of communication that personally touched and/or informed library users. In almost every case, these moments sprang from human contact, not from a well-designed web page. Alice did not know about or participate in information literacy courses until a friend recommended one to her. She also had never consulted reference librarians until her friend in the MLIS program talked her into it.

During the interview, David several times asked for information about a service called *RefWorks*, which was not examined specifically in this study. *RefWorks* is an online citation manager, similar to *ProCite* or *EndNote*, that library patrons can use to save, organize, and format citations found in the library catalogue or in *RefWorks*-enabled databases. When asked what he thought Get It was, David immediately assumed it was *RefWorks*, and he also mentioned that *RefWorks* was something he would like to take an ILI course to learn how to use. Two other students, Alice and Bernard, also showed a great deal of knowledge about *RefWorks*.

The librarians in this study were surprised that students knew about *RefWorks*, as it had not been publicized in any way at that time. There were not even any links on the library web site to this service. In the course of the interviews, it emerged that one of the liaison librarians was putting paper flyers in students' mailboxes, telling them about a new library service called *RefWorks* that they should try, because the librarian thought it might be helpful.

And, finally, there is the case of Cassandra and her departmental library. The importance of Cassandra's relationship with the librarians who work there, and the effect on her teaching and research, cannot be overstated. Cassandra believes that the undergraduate students she teaches are more likely to approach the librarians because they have met them before, both in class and in informal settings such as department parties, and so are not intimidated by them.

It is also illuminating to contrast the experiences of Ernst and Cassandra, for example, if each wanted to have a librarian give an ILI session in their class. After learning about ILI courses, Ernst wanted to bring a librarian into his class to give instruction, but did not know whom to approach. When asked how he might arrange such a visit, he had this to say:

I would probably talk to someone who had somebody in their class already and find out who they used in order to do that. If that didn't work then I would probably just go to the nearest library, probably [the Science and Technology library], and go to the desk and ask one of the people at the reference desk how I would go about doing that.

Ernst mentioned several times that he never goes to the library, but does all his work remotely from his office or from home. Also, he never speaks to reference librarians. So while he might actually venture over to the library to ask someone how to get a librarian to visit his class, it would be a departure from his usual behavior.

On the other hand, for Cassandra, the task of finding a librarian was almost effortless. She regularly asked librarians to teach information literacy skills to her classes, unlike other graduate students interviewed here, who were unaware of this service:

Interviewer: What gave you the idea to have [librarians] come into your classes?

Cassandra: Actually, they do it for everyone... Well, they offer it. And then you can invite them or not. They would say "You know what? We have this service!" Because they're talking

to you every day. And they make it clear to everyone, and everyone gets an e-mail from them. They just basically let everyone know that “We would like to do this, the library is here, we want the students to use the library, and you know there are some very specific things that they can’t get anywhere else.”

Conclusions

Overall, the affordances that graduate students perceive in the academic library context are varied and support a range of information activities. Students discussed a number of intended affordances, for example, including:

- Opportunities for finding and retrieving information resources (e.g. online catalogues; shelf-browsing; electronic and print journals; library web site; interlibrary loan); and
- The use of physical and remote spaces that facilitated research and teaching (e.g. study spaces; wireless networks; remote access to library resources; information literacy instruction for their students);

Students also described a number of unintended affordances, including:

- Dependence on technology, and the fear that digital library services were causing their paper-based library research skills to atrophy or that their skills would not transfer to other library environments; and
- Unauthorized distribution of library resources to friends, including downloading e-journal articles for colleagues unaffiliated with the university.

While many of the students’ perceived affordances did not differ dramatically from those intended by librarians, it is notable that this was primarily the case for traditional library services (e.g. reference services; book browsing). There were remarkable shifts, however, between students’ perceived affordances and those of librarians for newer, digital technologies and for some specific services (e.g. information literacy instruction (ILI)). Two of the most striking differences that emerged in this study, between students’ and librarians’ perceived affordances, were related to ILI and to communication with patrons about new library services. In this university, librarians were using ILI and the library’s web site almost exclusively for their communication with graduate students, yet the participants in this study were not aware of ILI services and did not read notices on the library web site, even with repeated visits.

One of the most powerful themes to emerge in this study is that personal contact with librarians is an effective communication tool, possibly the most effective tool the academic library has at its disposal. Building effective communication channels between the library and its patrons is vital (and yet, perhaps, more difficult) as new technologies and services continue to be added to the academic library’s repertoire. If the library is to ensure a high profile for existing affordances, and examine patron-defined affordances that librarians have not yet considered, academic librarians must focus their energies on promotional dialogue with faculty and students. The results of this study show that relying too heavily on one channel (namely, the library’s web site) is ineffectual; rather, librarians must use various channels, including personal contact, to assess patrons’ needs and guide their information behavior. Further, relying

on web “hit” statistics as markers of users’ needs and preferences is insufficient; librarians must use methods such as interviews, focus groups, or questionnaires to talk directly to users and assess their needs and knowledge of existing services. By taking an ecological approach to the study and implementation of library tools and services, researchers and librarians can apply an holistic frame to patrons’ complex information behavior and gain a more complete view of the role of the library in supporting academic activities.

Limitations and future research

This study examined the information behavior of a small group of students at a single university. Although the results seem clear in this specific context, further research is needed to examine the applicability of these findings to other contexts. This study was designed as an exploratory study, in part, to investigate the viability of ecological theory (and affordance theory, more specifically) in the context of the academic library environment. Expanding this project to other institutions, to other academic library patron groups (e.g. undergraduates), and across disciplines, will extend the usefulness of these findings, particularly as they relate to recommendations for library practice. This study, in documenting the rich and context-bound experiences of graduate students at this institution, serves as a baseline for more advanced, different, and larger-scale qualitative studies that use an ecological framework. With additional research, a more complete ecological model of graduate students’ information behavior (where perceived affordances reflect one, of many, elements in students’ academic achievement) could be drawn. This type of modeling would be particularly helpful for library practitioners, in designing services that best meet students’ academic needs, and would also extend researchers’ general knowledge about the decisions students make in locating and selecting information resources to complete their academic work.

In particular, there are a number of areas of further research indicated by the results of this study. First, there appear to be significant disciplinary differences among graduate students in their attitudes toward digital library services, like e-journals. The graduate students in this study had significant concerns with digital library services that have not surfaced in previous studies (the majority of which have focused on students in the sciences). Also, there appears to be a relationship between the level of technical support a student is receiving and their willingness to explore new digital affordances. Further research is needed to determine the significance of this relationship and implications for library practice.

Further research is also indicated in the area of examining graduate students as an underserved population. Given that most graduate students change universities between their undergraduate and graduate years, and given that many graduate students may not begin graduate programs directly after receiving their undergraduate degrees, the widespread assumption that graduate students already know how to use the university library, and thus do not require library orientation classes of their own, seems unwarranted. Given the large numbers of graduate students teaching undergraduate courses, outreach to graduate students might be expected to be doubly efficacious, reaching not only the graduate students themselves, but also, by extension, their undergraduate students. Many libraries make special efforts to assist faculty with their teaching and research needs, but do not extend the

same outreach to graduate students, even though the graduate students are often engaged in similar teaching and research behavior.

Finally, further use of an ecological lens to study library services and information behavior seems warranted. In this study, many aspects of graduate students' information behavior were examined which had not been brought to light by library-sponsored usability studies. Perhaps this is because many usability studies focus too narrowly on a particular service, without attempting to examine the role it plays in the larger context of the library information ecosystem. By examining students – and other patrons' – library activities within the context of the broader environment, an holistic picture of individuals' information behavior can emerge.

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Appendix 1. Interview guide for graduate student interviews

The interview will consist of three sections. In the first part, demographic information will be collected about the participant. In the second part, the user will be asked about their favorite tools available on the library web site. In the third part, the user will be directed to the "Get It" reference linking software and will be asked some questions about how they use it, or how they think they might use it.

Over the course of the interview, it is expected that various opportunities for action will be discussed. Whenever one of these features is encountered in the conversation, some or all of the following questions will be asked:

- (1) Do you remember how you first became aware of this feature? (Prompt: Did someone recommend it? Did you read about it somewhere?)
- (2) How well would you say this feature works? Does it behave the way you expect it to?
- (3) How easy would you say it is to access? How easy is it to use? Do you need any special knowledge to use it?
- (4) How strongly would you be motivated to use it? Do you think it is useful? Is it worth the effort?
- (5) How would you rate yourself as a user of this kind of tool? Are you a beginner, or do you feel like you know it very well?
- (6) Do you feel you have the support you need to use this it? (Prompt: Technical support? Training? Documentation?) Is there anything that would keep you from using this tool?

Section 1: Demographic questions

- (1) Tell me about yourself: Where did you grow up? How old are you? What were your experiences of libraries like where you grew up?
- (2) How comfortable are you using computers? When were you introduced to computers? Do you remember when you started using computers in libraries?
- (3) I would like to know more about your academic background. Where did you do your undergraduate degree? What did you major in?
- (4) And what degree are you working on now? In what department? What stage of your degree are you currently working on (e.g. coursework, thesis, dissertation)? What areas do you like the best? Do you have a specialty?
- (5) Do you currently have other work in your academic area? Are you someone's research assistant? Do you teach?

Note: Questions about affordance were developed, in part, with the guidance of Dr Stan Ruecker, Humanities Computing Program, University of Alberta.

Section 2: Information seeking preferences

- (1) How often do you use library resources? Which kinds of resources do you use the most (e.g. books, journals, reference librarian, computer labs, study space).
- (2) How often do you use the library web site to find resources for your coursework/thesis? (Prompt: All the time? Only for unfamiliar topics?)
- (3) Has there ever been a time, either in the physical library or on the library web site, when you couldn't find what you were looking for? Could you tell me about that?
- (4) Has there ever been a time when something didn't work the way you thought it would? Could you tell me about it?
- (5) What is one tool available on the library web site that you couldn't live without? (Prompt: A "tool" could be a list of resources, or a search feature, or a subject database. . . almost anything that lets you do something.)
- (6) Ask affordance questions about any tools the user identifies.
- (7) Where do you go off of the main page of the library web site? Could you point at places you remember going, and places you go regularly?

Section 3: Reference linking software

- (1) Have you ever used the journal databases? If so, how do you use them? What are they good for? What are they not good for?
- (2) I'm going to use one of the databases available through the library web site to search for journal articles about a certain subject. [Let user pick database and subject, if they have a preference. If not, have sample ready.] Now, when you look at this article that we've found, do you see this button that says "Get it"? What do you think that does? (Prompt: Does it always get full text? What happens if the library doesn't have the full text in a digital format? What happens if the library doesn't have the full text even in paper?)
- (3) If I wanted to make sure I was looking at all the relevant journal articles on this subject, what should I do next? (Prompt: Do I need to search other databases, or have I searched them already?)
- (4) Ask general affordance questions outlined above.

Appendix 2. Interview guide for librarian interviews

The interviews with librarians will also consist of three sections. In the first part, the librarian will be asked questions related to the nature of their job and the decision making processes that go into the design of the library web site. In the second part, the librarian will be asked questions about specific tools that have been identified by users as being of particular interest or use. In the third part, the librarian will be asked questions related to the implementation of the SFX reference linking software which constitutes the "Get It" tool on the library web site.

Section 1: Job questions

- (1) Please tell me about your position. What is your title? What do you do in a typical day? What kinds of decisions do you make?
- (2) When a decision is made about making a major change to the library web site, please describe for me how that decision is made. Is it a group process? Is one person or a certain committee in charge?
- (3) What kind of information do you want to make sure you have about a new piece of software, or a new kind of feature, before you make it available to users?
- (4) Is there any evaluation of new web site features after they are made public? What kind of shape does that take?

Section 2: Specific tools

- (1) Several people identified [insert tool description here] as being very important to their use of the library. Could you tell me about how your group made the decision to implement it, or the software package of which this feature is a part?
- (2) What do you think people like so much about it? Why do you think people identified that tool as being especially useful?

Section 3: Reference linking

- (1) Could you walk me through the reasons why the library wanted to implement reference linking?
- (2) What were the reasons the library decided to go with SFX over other software packages?

- (3) What about evaluation? How do you think the software is working? What sort of sense do you have of how well people are using it and liking it?
- (4) What are some of the issues and challenges the library faced, either during the implementation of the SFX software, or in the time since it has been available for public use?

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