Designing the Academic Library Catalog:  
A Review of Relevant Literature and Projects

By Nancy Fried Foster and Ryan Randall

The University of Rochester River Campus Libraries has completed the planning year of a project to develop the eXtensible Catalog (XC). Generously funded by the Andrew W. Mellon Foundation, the planning year allowed us to do research and planning to ensure that in building the system we would take full advantage of work that has already been done by other researchers and developers.

We believe that there is a great need for XC because of what it will do for individuals who use libraries and for libraries as institutions. XC will help research library users at any level of proficiency get more out of diverse library collections through a simple yet powerful interface that provides comprehensive results sorted into useful categories. For libraries, XC will provide an extensible metadata platform supporting multiple schemas that can be searched simultaneously to support FRBR-like functionality and navigation. XC will integrate easily with functionality from other library applications, such as metasearch. And XC will search across digital and legacy content.

XC software will be a set of open-source applications that provide libraries with an alternative way to reveal their collections to library users. Our goal is to provide a system to function alongside a library’s existing systems (ILS, digital repositories, web server, etc.) to simplify user access to all library resources, both digital and non-digital.

Much of our planning year was devoted to research on software applications and architecture and on metadata standards and harvesting. We also reviewed studies of how people do research in the library or using resources and technology provided by the library. We did this because we want to understand how people make use of a variety of current tools and resources and how well these tools and resources support their work. Our aim is that XC will provide better tools than the ones people are currently using. Beyond this, we want to build XC specifically to meet identified work practices and preferences, so that it will be both intuitive and innovative in ways that meet current and emerging needs.

We reviewed existing studies to see whether further studies were required. Thus, we reviewed a wide variety of publications, research websites, research reports, and personal communications about proposed and current research. We wanted to learn what we could from research that has already been conducted. We also wanted to determine whether our proposed research is really necessary.

We have concluded that there is a need for additional research, and we hope to conduct a four-site study of faculty and student researchers, to understand how they learn about the existence of scholarly resources, how they obtain those resources for their own use, and how the disseminate information about those resources to others.

In this report, we review a number of different kinds of relevant research studies and describe their value to our project.

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Usability Testing

Many libraries test the usability of their websites. To test whether a piece of technology is usable is to ask whether it works well, supports people in their work, and works as promised. It is also to ask whether the technology is easy to understand, use, and change.

Generally speaking, in a usability test, the people who use the technology are the people who are asked to test it. By observing, documenting, and analyzing people during the test, we can figure out what works, what does not work, and whether and even how the technology should be changed.

Usability testing can be exploratory and open-ended or it can be highly structured and focused. It can be conducted from the early phases of a design and development process through initial implementation to ongoing testing of the technology in use. One of the most commonly used types of test is an assessment in which expected users of a piece of technology are given a series of tasks to complete with a prototype while usability testers observe and document the test. In a library, the task might be to use the OPAC to find the *Journal of Fish Biology*.

The results of a usability test may include such numerical data as the ratio of errors to “correct” results of the time it takes to find the target item. There are obvious flaws in these measures. For example, the most accomplished researchers often need to linger, browse, and follow leads, rather than conduct quick, focused searches (cf. Fister 1992).

However, usability testing yields compelling qualitative results. For example, it provides clear evidence when a website is simply not working for its target audience. At the University of Rochester’s River Campus Libraries and many other institutions, usability testing provides the criteria by which developers determine whether a website works or not. This approach, called user-centered design, differs from more traditional design approaches in which the designers or the people who sponsor or commission the technology make final decisions (Khoo and Ribes, 2005; Melican, 2004).

Test results often pinpoint the problems and suggest ways to fix them (cf. Anderson and Choudhury n.d.). In recent years, the River Campus Libraries’ usability team has worked with the design team to create an issues list of problems with our interfaces and the technology that drives them. These issues are similar to the ones discovered by research teams at other institutions, such as the one that worked on the faceted catalog for the North Carolina State University libraries (Antelman et al. 2006) or numerous other individuals and teams that participate in the Usability4Lib list.¹

We would provide enormously improved services to large numbers of faculty members and students who use academic library websites if we simply addressed the issues that we have already identified (see Appendix I for examples). However, we can address few of these issues with the proprietary ILS that is currently in use, because our manipulation of what is inside the proprietary ILS is limited. In fact, one of our major goals for XC is to make it possible to extract metadata from the ILS, combine them with metadata extracted from other repositories and databases, and to create new tools for mining the data to identify and sort the most relevant resources and present results in a more integrated and robust fashion.

¹ http://www.lib.rochester.edu/index.cfm?PAGE=652

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If we succeed in this, we will create an outstanding and advanced version of the current-generation catalog. Between our own usability testing program and what we learn from formal and informal communication with people in other organizations, we have no need to conduct extra usability testing for XC.

However, to create a true “next-generation catalog” we must go beyond usability and discover more about how people do their research and how they use catalogs and libraries incidentally along with other resources and technologies. We plan to pursue this research by conducting work-practice studies of faculty members and students who are actively engaged in research.

The remainder of this review is devoted to the literature and studies that serve as the foundation for our ongoing work. As we review the work that has already been done, we ask, “Does this work tell us enough about the fine details of how people do their research using library resources?”

**Catalog and Related Library Technology Research and Development**

Many qualitative studies have focused on how researchers – primarily students – use catalogs or other tools to identify and acquire resources. These studies have been done specifically to inform the conceptualization and development of particular catalogs. They do something different than usability testing: they pay attention to general behavior and are not focused only on how researchers use prototypes or developed technologies.

Two good examples are one done at the State and University Library of Denmark in conjunction with the development of the Summa system (Akselbo et al., 2006) and another by RLG in connection with RedLightGreen (Arcolio, 2005; Bailey and Spiro, 2005). In both cases, the studies make significant methodological contributions as well as identify major issues related to the use of library finding tools and related technology.

Specifically, the RedLightGreen study found that students are well organized in their work and that they use their time well, although many students work on two or three projects at a time. Students use “workarounds” to compensate both for the shortcomings of catalog, publishing, and text editing technology and for their lack of proficiency in using them. Few students ask their librarians for help, preferring to start their research with Google for background and orientation. Students use only those web-based resources that they find credible or that they believe their instructors will find acceptable. Students have difficulty locating resources with finding tools and use subject or title keyword in search engines.

The Summa study, though conducted in Denmark, found some similar results. Students and instructors do not understand the role of librarians and do not take advantage of reference services, preferring to work through their academic networks for advice and support. Students think of the physical library as a place to work on-schedule and without distraction. Students often use the library for working with their own materials as opposed to library materials. With regard to finding and selecting library resources, study participants need more information about relevance when they use online finding tools. They often use known resources to find new materials, for example by consulting the bibliographies of works that they have already read. Students may use Google and Amazon to figure out better keywords.
A study of students at the Massachusetts Institute of Technology used a “photo diary” method to learn how to improve online library tools (Hennig et al., 2006). The study authors found that most graduate students seek information to support their research while most undergraduates seek information to help them complete course assignments. Graduate students stick to known methods and contacts in searching for information, even when those methods and contacts are not effective. Undergraduates have difficulty finding resources that are at the level of generality and accessibility that they need. Students like to use Google because it is fast and easy. The authors speculate that it would be helpful to connect students to staff on the basis of Google searches and results. Relatedly, the report recommends bringing library tools into the non-library pages that students use. Students value the materials they find when they browse, and the authors believe that serendipity is as desirable for browsing online collections as physical ones.

Libraries as Physical Spaces

A great deal of research has been done on libraries as physical spaces, regardless of their use. This includes studies of public and academic libraries as well as library spaces that are used for studying, doing homework, doing research, reading, relaxing with friends, and engaging in other activities both academic and social.

One value of this research is in its methods, for example the work of Maya Design on the renovation of the Carnegie Library of Pittsburg (Goel, 2005) demonstrates the value of annotated photography and other methods as well as a participatory approach with librarians brainstorming solutions to patron problems. Numerous other examples of how this work has been done in libraries are available in *Learning Spaces*, a book that presents more than a dozen case studies and discusses student practices, the incorporation of technology into learning spaces, the psychology of learning spaces, student-centered design, and multi-use space (Oblinger, 2006).

A particularly interesting study, by Richard O’Connor (O’Connor, n.d.), characterizes collegiate, academic, and campus cultures and shows how student preferences and practices take form in this cultural mix, as an assimilation in successive stages to college, academic culture, the major, and the workplace. O’Connor conducted several surveys about student study practices and it appears that “studying” included completion of assignments in addition to preparing for examinations, although not the actual writing of research papers. The study provides numerous insights on the range of students’ needs and preferences, such as the different ways that students deal with distraction, whether by sitting alone in a quiet place or with friends where there is a low-level hum of activity, or some other combination. Beyond that, it provides a valuable, research-based description of one particular context of student assimilation or socialization into new academic roles.

Other studies of how students work in library spaces provide additional useful information, for example about how students can easily feel overwhelmed and confused by the library (Kracker and Pollio, 2003) and how students may give up on the OPAC and resort to browsing the stacks by the time they are juniors (Whitmire, 2001). Interestingly, one study found that just being in the library makes students aware of electronic resources (Waldman, 2003). We know that heavy users of digital

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2 Local studies at the University of Rochester indicate that students use the word “study” to refer to test preparation and that they use other descriptive terms, such as “doing homework” or “writing a paper” to refer to other activities. We are most interested in how students write their research papers but information about “studying” is also very valuable.
resources are also heavy users of print resources (cf. Twait, 2005; Abbott, 2006), and this study gives us one insight on how that happens.

**Conceptual Models of Searching**

There are several large, overlapping literatures on searching: conceptual models, inside-the-head studies, studies of the searching process, and so on. These studies constitute a large proportion of the library research and have many insights to contribute to technology design, however they do not provide the qualitative information we need for understanding the step-by-step, nitty gritty of the research process, especially the resource discovery process as it happens in the wild.

A useful study posits that a degree of uncertainty aids information seeking insofar as it supports the mental process of defining and understanding the research object (Anderson, 2006). Discovering, evaluating, and accepting or rejecting resources are activities that XC or any finding technology should support, perhaps with bookmarking, ranking, tagging or other tools. The study also supports the idea that researchers could benefit from a personal work surface within which to use online library tools. Such a work surface could allow space for notes, journaling, drafts or other means for holding resources during evaluation.

A cognitive psychology study proposes a two-stage model of the information retrieval process, “problem recognition” and “running the search” (Macpherson, 2004). The author posits that researchers go through successive iterations of the process, rethinking each step until the results are satisfactory. This is one example of the cognitive search models that appear in the literature, as is another in which subject knowledge is found not to be an assurance of successful searching for resources (Pennanen and Vakkari, 2003). The findings of the latter study support research that shows that experts in scholarly fields are not necessarily competent users of new library technologies and therefore not always able to help their students either gain technological proficiency or master the literature in their disciplines (cf. Washington-Hoagland and Clougherty, 2002). And helping students become better researchers by addressing psychological and other search-related issues is itself a research topic. For example, one study proposes to help faculty members improve the student research process through logging and reflection (Hinchliffe, 2000).

**Authoritative Information and Peer Review**

One important strand of research concerns the means researchers use to identify warranted information, that is, to select from among a wide range of possible resources the ones that are most likely to meet scholarly standards. For faculty members and other professionals, much is at stake. For one thing, the researcher wants to use and cite respected sources. For another, and this is especially the case for rising faculty members, researchers want their own work to be seen as warranted, preferably by passing through a peer-review process (King et al., 2006).

Students develop the ability to discern authoritative information sources during their college careers (Whitmire, 2004). For them, too, much is at stake, including their own learning and development as well as how well they meet their instructors’ expectations when they complete research-based assignments.

This research strand has clear implications for libraries and library catalogs, among them that institutional repositories and local online journals must attend to the need for some sort of review or
vetting if they are to attract faculty support. Another lesson of this research is that all researchers, at every level, need access to information that enables them to make judgments about resources, especially if integrated searching yields hit lists that combine warranted information from scholarly collections with all sorts of documents coming in from the Web.

**Qualitative and Ethnographic Research in Higher Education**

Anthropologists have done some of the most valuable research for technology design purposes by discovering and documenting the lives of students.

Important texts in this field are Michael Moffatt's *Coming of Age in New Jersey: College and American Culture* (Moffatt, 1989; see also Moffatt 1991) and Dorothy Holland and Margaret Eisenhart’s *Educated in Romance: Women, Achievement, and College Culture* (Holland and Eisenhart, 1990). These books, which are now achieving the status of classic ethnographic studies in education, use minute observations of student life to understand how historical, social, and cultural forces play out with individual habits and practices in shared collegiate cultural spaces. The Moffatt book in particular seeks to ground discussions of student life in such historical studies as Helen Lefkowitz Horowitz’s *Campus Life: Undergraduate Cultures from the End of the Eighteenth Century to the Present* (Horowitz, 1988).

A recent addition to the literature is *My Freshman Year: What a Professor Learned by Becoming a Student*, by the anthropologist Cathy Small (writing as Rebekah Nathan; Nathan, 2005). It provides limited ethnographic detail but adds a geographically different case that discusses increased demands on students’ time, especially from employment.

While this literature does not always speak directly to the research process, it provides the broader context of collegiate life. Furthermore, the theoretical discussions raise some of the same challenges of interpretation that we encounter and must address in our own research, such as how to situate learning, research, and writing processes in broader contexts or how to deal with pieces of technology, published works, and other objects and artifacts in our studies of how people work and why they work the ways they do.3

Many researchers have used qualitative methods to probe library-related questions. A major study was conducted at the University of Minnesota Libraries using interview and survey methods to describe the practices of faculty members and graduate students in order to understand and meet their research-related needs (University of Minnesota, 2004). The study, which focused on the humanities and social sciences, provides a range of useful findings, if not detailed descriptions of the actual research process. Among the findings of the study: that the library as a place is still highly valued, although used more by graduate students than faculty members (p. 34), although, interestingly, 80 percent of the faculty members in the study valued browsing the shelves (p. 40). The use of digital resources is growing among both humanities and social science researchers but proficiency with digital tools is weak and, especially in the case of the humanities, researchers do not readily seek assistance (pp. 35-36). The study also noted that collaborative work across institutions is

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3 This literature is reviewed by Wesley Shumar, who situates it in an emerging, more general literature on higher education that does not provide detailed studies of how people conduct research in the academy (Shumar, 2004). Also, there is a literature on science and technology studies that includes fine-grained studies of research labs that in particular offers theoretical perspectives on how library catalogs and resources, as things, are active in scientific networks (Latour, 1987).
so common that their institution – and, we infer, most institutions – will have to develop tools that permit cross-institution sharing (p. 18).

**Qualitative and Ethnographic Research in Libraries**

We have conducted several studies with faculty members, graduate students, undergraduates, and library staff at the University of Rochester’s River Campus Libraries. Our research on faculty members led to the development of Researcher Pages and other enhancements to our institutional repository, UR Research, based on our finding that the two top motivators for faculty members to submit scholarship into institutional repositories are preservation and personal showcasing. The repository platform supported preservation, although not fully, which led to our development of additional tools. The platform did not provide a way for individual researchers to present their scholarship in their own way, and this is what Researcher Pages do. As part of the study, we were able to develop storyboards of individual research projects, however this was not a focus of the study and our data are limited.

In research on undergraduates, we focused on the question of “what undergraduates really do when they write their research papers.” To get answers, we used a variety of qualitative methods, including observation, interviewing, student map-making and photographing, and other activities, many of which are described in an edited volume that comprises chapters written by the editors and the library staff who participated in the project (Foster and Gibbons, forthcoming). As part of this study, we conducted “retrospective interviews” in which we asked students to draw us the story of how they completed their most recent research papers.

The sociologist Andrew Abbot has made major contributions to this literature, through his ongoing scholarly work and as chair of his university’s library task force (Abbott, 2006; all of the following quotations are from this unpaginated, online report). Abbott oversaw a large survey of students and faculty members in connection with a project to determine a direction for the social science and humanities library as places in which researchers consult collections. However, the findings of the research are more general, especially as they bear on the digital tools that researchers can and sometimes must use if they are to work with those collections.

Abbott sees evidence “that electronic and physical use of the library are synergistic, not antagonistic,” which suggests that we should consider XC or any other catalog or related tool as fully integrated with physical and digital resources. However, it raises issues about the metaphors we use in online catalogs and finding tools: should they come from the legacy physical library or other sources? This is an important question because while we want to maintain the integration of all collections and the synergy of research in the library and from remote locations, we also want to use metaphors that people understand easily. Abbott’s concern is the “heavy users” — the people who “take out 100 or more books a year” and who presumably have a correspondingly high rate of use of electronic resources. These are the researchers and avid readers, comprising mainly doctoral students, with faculty members, master’s students, undergraduates, and an assortment of alumni, staff, and others also included. While we are determined to develop XC to meet the needs of heavy

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users, we must also make it work for the large numbers of students who use the library mainly as a study hall but who need a book or article from time to time to complete a paper or an assignment.

Abbot talks about browsing and its “two requirements. First, the materials being browsed must already themselves be highly ordered either by virtue of their internal structure or by their places in an indexing or cataloguing or classification system. Otherwise, adjacency has no meaning and browsing can't work. Second, the browsers must have broad knowledge that primes them to recognize likely connections. This is the rationale for general exams, for example. (Note that by this argument, one can even think of conversation with other scholars as a form of mutual browsing.)” In Abbott we find support not for developing an application that does one’s browsing for him/her but for creating a system that supports researcher-driven browsing. And such a system might work best if it supported the conversations with other scholars that Abbott calls “mutual browsing,” although this is no substitute for the slow, reflective, circuitous research process (cf. Abbott, 2004a, 2004b).

This is underscored by Abbott when he writes, “That we now can retrieve known sources extremely quickly is important only to the extent that retrieving known sources is an important or essential part of the research process. In fact, while focused retrieval is important, any library researcher knows that it is nowhere near as important as is figuring out what are the things that we want to retrieve in the first place.”

With reference specifically to digital library technologies, Abbott adds that, “[undergraduates] do not have the passive socialization by which earlier generations have come to identify the organization of knowledge with the organization of libraries. Quite the contrary, the average new student envisions knowledge to be what the internet is: dynamic, disorganized, networked, varying widely in quality, in interest, and in utility, but uniformly available.”

The challenge in creating innovative library technology is to capture the benefits of the internet and harness them to the research process, not the other way around.

References


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Appendix I. Sample Issue List

The following list is from a document maintained by the Digital Initiatives Unit at the University of Rochester's River Campus Libraries. It gives a sense of the common problems that faculty members and students encounter when they use the OPAC. It is important to note that most of these issues cannot possibly be resolved with the proprietary product that is currently in use.

<table>
<thead>
<tr>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sort Results should show one of the options, not a blank box. This is not consistent with different searches. Title blank, keyword=relevance</td>
</tr>
<tr>
<td>URL graphic shows up in results list when there is no electronic version available but a link to donor information</td>
</tr>
<tr>
<td>When you limit to location, URLs show up that are not in the location chosen (ex: Dante as author and Loc=Rare Books)</td>
</tr>
<tr>
<td>Date limits not clear- choices not clear and how to enter them or enter a range.</td>
</tr>
<tr>
<td>On main search page Voyager - University of Rochester Libraries' Catalog, Voyager Catalog - redundant - not consistent naming</td>
</tr>
<tr>
<td>Inconsistencies with omit initial a, an, the - does/doesn't find depending. Sometimes you can get hits with title beginning with a (a time on earth). Why different?</td>
</tr>
<tr>
<td>All links at top of page (Place Requests, My BookBag, etc) go to the same place.</td>
</tr>
<tr>
<td>Would prefer something like “My Voyager Profile” and all those choses underneath the heading with ONE login only (like Science Direct)</td>
</tr>
<tr>
<td>No related link to stack directory from location</td>
</tr>
<tr>
<td>The print/save/e-mail options at the bottom of title lists=8 or 9 buttons, 2 boxes or 3 and 2 radio buttons. Too crowded.</td>
</tr>
<tr>
<td>In Custom Search the drop down menus shouldn't have to be scrolled too! All choices should be visible when you drop them down.</td>
</tr>
<tr>
<td>Print/save/e-mail options on individual record simpler, but buttons still too big &amp; crowded and eye has to scan all over the section to pick out relevant segments to pay attention to.</td>
</tr>
<tr>
<td>More information button on Subject Headings search results display page ugly; is it necessary?</td>
</tr>
<tr>
<td>In the Set Limits screen the way the Year: limits are displayed. Confusing with radio buttons</td>
</tr>
<tr>
<td>The way one requests a photocopy. That you have to get all the way into the record in Voyager, then click Requests, log in, blah de blah de blah... I think it would actually be much easier for them to somehow do it thru ILLiad, or make some new form - a link like ILLiad, “Request a photocopy”. I don’t think people would baulk at filling out the info. Or maybe the form could somehow interface with Voyager to suck in information, going into Voyager and looking at the record of the journal containing the article you want a copy of... doesn’t compute for people at all.</td>
</tr>
<tr>
<td>And faculty and staff don’t run around with their ID’s at the ready like students do, so all that “input your bar code” stuff is awful for them. (The ILLiad username and login is actually better).</td>
</tr>
<tr>
<td>Allow search string to stay when changing “search by” options and when selecting limits</td>
</tr>
<tr>
<td>Change “set limits” to “limit” and display more prominently</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Eliminate need to eliminate initial articles</td>
</tr>
<tr>
<td>Make number searching work whether it’s spelled out or numerical</td>
</tr>
<tr>
<td>Offer Google-like box that says “Did you mean xxx” when a search produces no results, etc.</td>
</tr>
<tr>
<td>Offer Amazon-like suggestions for further titles instead of just linking to subject headings</td>
</tr>
<tr>
<td>Continue to work on ERA and find a way to indicate on Voyager that one needs to search this to find articles—or, include ERA within Voyager, indicating the results are articles via particular databases, etc. and not books??</td>
</tr>
</tbody>
</table>

Explanation: Kids/faculty come to desk all the time with citations from other articles, databases, who knows where. Many, many times those citations use journal abbreviations. I know what “Ang Chem” is the abbreviation for, but I've never met an undergraduate or new graduate student who does. Obviously in most cases you have to enter the complete title into Voyager to find out whether we own the journal and where it is. (There are some abbreviations in Voyager, but not many). Actually on rereading this, I realize that it's not an interface problem, the data simply isn't in the voyager database.

Also, the process of marking records to print/email is very frustrating 1) it doesn’t remember that you marked records on page 1 if you move on to page 2 of results 2) with your option to print, the printout has so many blank spaces that you really waste tons of paper if you want to print stuff out.

And, it would be cool to have an “edit search” option. Usually the back button works okay, but sometimes an “edit search” option that would pull up your most recent search would be great.

doesn’t correct for my spelling errors. Just says “nothing found”. I want it to say “Did you mean...?”

I can never remember what Voyager does with punctuation--apostrophes, commas, &

Cross references could be more convenient. Searching, for example, for author Boethius, Hector, one gets the name with a “more information” button. Clicking on the more information button takes you to another name—Boece, Hector—which you then have to click on to get to the author you want.

Searching for videos and other formats is troublesome because of the [media format] inserted between the title and the subtitle.

Initial articles and diacritics, e.g. ü = ue

Sometimes punctuation, particularly colon, and diacritics drives Voyager crazy, especially when you cut and paste or use SFX.

User finds correct record in Voyager but doesn’t recognize it as such because they don’t see the words they searched in the default display

Search terms don’t match what’s in Voyager (different spellings; variant abbreviations; missing words) (example J. Mol. Biol.)

Inclusion of phrase [electronic resource] alters alphabetization of result titles