

Making Unmediated Access to E-Resources a Reality

Creating a Usable ERM Interface

During fiscal year 2006, the University of Connecticut Libraries spent almost two-thirds of its collection budget on electronic resources, making it essential that students, faculty, and staff can find and access these resources without assistance from librarians. To address ease-of-use issues, a cross-functional task team spent a year assessing the libraries' database locator and worked to create a more functional system. This iterative process of usability testing and design included three sets of usability tests, several design sessions, and revision of database descriptions. The new design now enables users to successfully and quickly find databases without mediation.

Libraries spend an increasing amount of their collections budgets on online resources: In fiscal year 2005, libraries in the Association of Research Libraries spent more than 35 percent of their collection budget on electronic resources, while public libraries allocated 8.75 percent of their collection budget to electronic materials in fiscal year 2004.¹ The University of Connecticut Libraries (UConn Libraries) spent approximately 62 percent of its collection budget on electronic resources in fiscal year 2006. Libraries now subscribe to dozens, if not hundreds, of research databases, yet patrons usually stick with the research

resources they know: For undergraduates, these are Google and Wikipedia; for faculty, these are the few databases they learned while in graduate school. To support their substantial investment in electronic resources, it is imperative libraries make them easily available to patrons. Unfortunately, there is often a disconnect between the existence of libraries' electronic resources and patrons' knowledge of them. How can libraries best showcase the electronic databases available to patrons? A task team at the UConn Libraries recently spent a year working to resolve this problem; the result is a usable, functional solution that improves the resource discovery process for librarians and patrons alike.

THE DATABASE LOCATOR: OPPORTUNITY FOR IMPROVEMENT

As at most academic libraries, the UConn Libraries invest heavily in electronic resources in both dollars and staff time. For this reason, it has become more central to the UConn Libraries' mission to increase awareness and usability of electronic products. In 2000, the UConn Libraries began delivering electronic resources to end users through a database that became known

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as the Research Database Locator (RDL). Newly acquired databases were added to the resource with elements such as the database name and access URL, a one to two paragraph description of each resource, licensing and access information, and a list of subjects to which the database was relevant. Patrons and librarians both used the RDL to find databases relevant to their research.

However, the database locator did not include a component for managing the administrative aspects of these resources. In early 2005, the UConn Libraries began to develop a more formal electronic resource management (ERM) system based on the Digital Library Federation (DLF) Electronic Resources Management Initiative (ERMI). This new system combined the public resource discovery tool with modules for managing electronic resource elements. This ERM tracks a variety of information, including all of the UConn Libraries' licensed database resources, most of the journal packages, individual journals when license information is required, and a handful of freely available Web resources such as AGRICOLA and MedlinePlus. Altogether, there are currently more than 450 resources in the ERM.²

As work was completed on the back end of the ERM in 2006, an ERM public interface team (PERM), assembled to discuss the design of the system for end users. The team wanted to look at the ERM from the users' perspective with the goal of redesigning the Web interface to enable students, faculty, and staff to use the system without assistance from a librarian. The team spent approximately one year on this project and approached the problem from several different angles. Early work began with a literature review of website usability testing in libraries and continued by scouring the Web for examples of library database locators that met usability heuristics and used simple, clear language to describe databases. The team conducted a preliminary evaluation of the ERM from the patron's perspective, assessing the site on the basis of common Web design and usability principles and evaluating query logs and usage data for the ERM.

Finally, the group began a several-month iterative process of usability testing and design, beginning with a test of the ERM public interface and continuing with an initial redesign. Database descriptions were rewritten to provide key information in a succinct format. The new design was tested with faculty and students, redesigned accordingly, and retested until the team was satisfied that the new system enabled users to successfully and quickly find useful databases without mediation.

EXAMINATION OF DATABASE ACCESS TOOLS

There is an abundance of books and articles that describe the value and methods of usability testing. Of note is a guide by Jeffrey Rubin, which discusses the methods and materials needed for testing.³ This practical, start-to-finish guide to testing documents (as well as a primer on the setting, materials, and methods for conducting and analyzing tests) is well known and well referenced. Also well recognized within the field are the strategies of usability expert Jakob Nielsen. In columns on his Alertbox website, Nielsen recommends conducting an initial heuristic evaluation of a website followed by iterative usability testing.⁴ His studies show that testing with five users will reveal 85 percent of usability problems, and he advocates conducting three rounds of tests with five users each so that a site can be continually tested and improved. Darlene Fichter, a librarian whose interests include human-computer interaction, reinforces the value of rapid iterative testing. She recommends using a casual, try-and-see approach as opposed to the often slow-moving "next major release" approach. According to Fichter, the former "drives creativity and new ideas" and gives designers a chance to try changing different elements on the basis of user testing.⁵

A number of libraries have successfully conducted usability testing and redesign of library websites and have documented their endeavors in case studies. Cobus, Dent, and Ondrusek provide a detailed, step-by-step discussion of how usability testing was conducted on the Hunter College Library website and how testing evolved as librarians determined problems with their own testing strategies.⁶ Battleson, Booth, and Weintrop, from the University at Buffalo Library, provide a quality introduction to usability engineering and human-computer interaction in their case study report.⁷ Additionally, Manzari and Trinidad-Christensen write about their noniterative usability study of the Library and Information Science Library website at Long Island University.⁸ Other case studies are published that provide additional frameworks for testing in libraries.⁹

We conducted a wide-ranging examination of other libraries' database access pages. During our scan, we took note of interface features we found to be effective; however, we were particularly interested in identifying database locator tools that exemplified use of best practices. In defining these best practices, we used as our guide the principles that Jakob Nielsen has defined in his usability research.¹⁰ In addition, when we were examining

specifically the use of particular terminology, we were guided by John Kupersmith's seminal article, "Terms that Library Users Understand."¹¹ We view the usability research of Nielsen and Kupersmith as comprehensive and complementary; therefore, when we examined other libraries' tools, we evaluated the search functionality, navigation, and icon design in terms of their learnability, efficiency, memorability, errors, and satisfaction. We evaluated the database locator tools' terminology with the following practices in mind: avoiding words that users often misunderstand, using natural language equivalents, enhancing or explaining confusing terms, providing intermediate pages, providing alternate paths, and consistency. The following are websites we found worthy of note (many of these websites have been redesigned since our initial examination):

- **North Carolina State University's Databases page** (www.lib.ncsu.edu/searchcollection/findarticles). *What we liked:* The streamlined approach. NC State's "Find Articles" page does not have a keyword search option, but rather offers a subject drop-down menu and a "databases by title" option. The site provides help at the point of need; for example, a "Tips" box is displayed prominently in the upper-right corner of the search screen that says "not sure where to start?" directing users to general databases. This is a good use of providing alternate paths. On the results screen, there are usually only three to five databases displayed; as a result, these results appear "above the fold" so users don't have to scroll. On these pages, there is another "Tips" box, which contains helpful links on topics, such as how to find newspaper articles, something that often stymies users. All of these features fall in line with Nielsen's principles.
- **University at Buffalo Libraries Resources by Subject page** (<http://ublib.buffalo.edu/libraries/e-resources/subject.html>). *What we liked:* The unique ways to access databases. These include a "Best Basic Resources" page that suggests databases on the basis of eight typical student search needs (e.g., finding statistics). On the databases results screen, the "top resources" on the subject are listed first, using very clear icons that show whether a database is restricted to University at Buffalo or is accessible to the public. On the right side of the screen, the librarian responsible for the subject area is listed prominently, with an e-mail link.
- **University of Toronto Libraries homepage** (<http://main.library.utoronto.ca>). *What we*

liked: The user-friendly language. The "best research resources" pages address a common problem many library users have—making the leap from a specific research topic to a broad subject—by giving a tip beneath the subject drop-down box ("For example, are you writing a paper on 'panic attacks'? Choose psychology." This is a good example of using natural language to describe how to search.) The results page employs the wording "best article databases" and includes only three to five results so the user is not overwhelmed and scrolling is kept to a minimum.

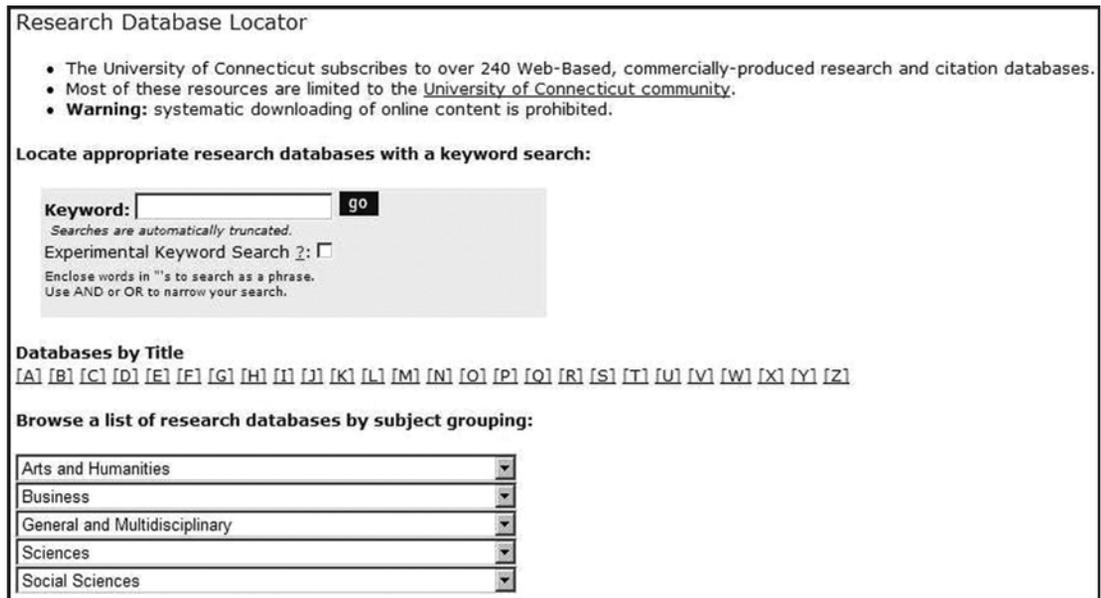
After examining other library's research database locator tools, we selected features that reflected best practices, as we had defined them, for user search interface design. It was clear that avoiding jargon, providing hints, limiting the number of results, and predicting common user problems—such as searching for topical rather than broad subject keywords—were important factors in the design of these exceptional existing database locator tools. We would later take these design elements into consideration when improving the design of our own database locator. But before we could begin to redesign the site, we needed to test the existing interface to determine where users encountered the most difficulty.

EVALUATION OF THE EXISTING UCONN INTERFACE

Our evaluation of the existing interface took two forms: an informal heuristic review—such as we had applied to other libraries' sites—and an analysis of query logs for keyword subject and title searches. We again consulted the well-regarded Web usability principles laid out in Jakob Nielsen's lists of top ten ways to improve (or diminish) usability when we examined the effectiveness of the research database locator in its current form.¹² In addition to Nielsen's general guidelines and standards, we made use of evaluation principles unique to library websites such as those considered in John Kupersmith's encompassing analysis of user comprehension of common librarian terms such as *database*, *e-journals*, and *index*.¹³

It was immediately apparent that the existing RDL interface (see figure 1) failed on several fronts with regard to usability. The interface offered users three means of accessing databases: a keyword search, a "database by title" option (letters of the alphabet linking to all titles beginning with a particular letter), and browse-by-subject pull-down menus broken up into five umbrella subjects: Arts

Figure 1. Existing Research Database Locator, the Public Electronic Resource Management Interface



and Humanities, Business, General and Multidisciplinary, Sciences, and Social Sciences. As our usability testing would soon confirm, only one of these means of access—the keyword search—was inviting to most users. The existing design rested on several assumptions: that users would know what they were looking for and be able to correctly type in a title keyword or navigate by first letter, that users who didn't know titles could accurately choose a correct umbrella subject (and then choose the correct subject from the drop-down menu), and that users who chose the keyword search option would use effective search terms (such as title or broad subject keywords).

The page was also very jargon heavy, relying in particular on the word “database,” which was repeated several times on the page without explanation or direction. By way of instruction, only the keyword search option offered any—and only in the form of advice to use exact phrases or “and/or” to narrow searches. Further into the site, things only got worse. Rather than connecting directly to databases, users were led to text-heavy descriptions that had little consistency from description to description and links into databases that weren't visually outstanding.

These early visual assessments of the interface helped frame our understanding of the site's weaknesses. At this stage, we spent some time creating working prototypes for a revised interface. Although the final redesign came out of our assimilation of query log data and several rounds of usability testing, these early conceptual rede-

signs helped bring into focus our understanding of problem areas and helped us formulate the content of the usability testing that followed.

Our informal heuristic observations were borne out dramatically by an analysis of usage logs from three months: February, March, and May 2006. We gathered data on usage of the three main areas of access: keyword searching, letter (title) browsing, and subject menu/category browsing. Of 41,433 total user actions, there were 18,522 category searches (through pull-down menus), 6,650 title-letter searches, and 15,836 total keyword searches—or 5,986 unique keyword searches.¹⁴

Some of this data was encouraging because it suggested user proficiency in the database locator, particularly in the use of title keywords. Users browsed by title about 16 percent of the time, and, of the keyword searches, they searched for database names approximately 5,031 times (32 percent of the total keyword searches). The use of title keyword searching as a means of access seemed to suggest that a statistically relevant number of users did approach the database locator with a clear destination in mind.¹⁵

Less conclusive in terms of how successful users were in finding appropriate databases was what usage data indicated about the use of subject (pull-down) menus. The high use of category browsing (users selected subjects from the pull-down menus more than eighteen thousand times—more than 40 percent of total user actions) suggested that users wanted to search by subject, but whether that led to successful discovery of appropriate

databases could only be assessed during our subsequent usability testing of the site.

The most discouraging results came from patrons' use of the keyword search option when not searching for a database name. Of the more than fifteen thousand keyword searches, 48 percent were unsuccessful because the user attempted what we designated "topic" searches—that is, the user input a narrow research topic rather than a broad subject term. For example, there were multiple searches for topical phrases and words such as "alice walker," "global access," "schizophrenia," "the glass menagerie," "the orange revolution," and "marriage ritual." There were also searches for long book titles—for example: "sex and death in the rational world of defense intellectuals" or "vincent van gogh and a new approach to traditional art practice." There were one or two searches each on a wide range of miscellaneous topics, from "systemic lupus" to "1970s crime." Approximately one-third of all keyword searches yielded no results at all.

A significant number of keyword queries (almost one thousand queries, or 6 percent of all keyword searches) made use of words matching academic disciplines: for example "history," "anthropology," "business." The success of these searches was unpredictable and depended on the language in the database descriptions, language we had already discovered in our heuristic analysis to be very inconsistent.

In addition to the above, we were able to make some further observations related to the query logs for keyword searches: Most search phrases were short (three words or fewer); few searches showed knowledge of Boolean connectors; a number of searches would have been successful in other search mechanisms such as the UConn Libraries' catalog, the eJournal locator, or the SFX Citation Linker; and typos were a significant problem and affected both subject and title searching. Typos in particular were a vexing issue, causing users to retrieve zero results. The logs indicated that users made a wide range of both expected and unexpected typographical errors. It was predictable that PsycINFO would become "PsychINFO" or "Psych Info" and Infotrac would be transformed to "Infotrack," but it was less obvious that Factiva would become "factivia" or "factive" and that JSTOR would become "jistor."

The conclusions we drew from our analysis of the usage logs had three principal strands: (1) users were primarily looking for subject and discipline-based browsing tools; (2) users either needed more direction on keyword searching, or they should be steered away from keyword searching altogether; and (3) users who wanted to navigate

directly to a title (by keyword or title-letter link) should be able to do so simply and without error based on typographic mistakes. Of these, the need for simple subject-based browsing and the importance of preventing unsuccessful topical searches were paramount, and it would be these modes of searching in particular that we would scrutinize in the usability testing phase of our process.

USABILITY TESTING

After examining the design of other libraries' database locators and reviews of current key literature, the team turned to the most important element of the assessment process—usability testing. Usability testing is different from other methods of sociological and ethnographic research; its goal is not to provide a thorough evaluation of user behavior, it is to highlight the majority of difficulties that most users would encounter when interacting with a website. Jakob Nielsen, in his article "Quantitative Studies: How Many Users to Test?" suggests that a qualitative test with a handful of users (i.e., no more than five) will uncover a majority of the problems: "When you see several people being stumped by the same design element, you don't really need to know how much the users are being delayed. If it's hurting users, change it or get rid of it."¹⁶ We wanted to observe users performing real tasks to uncover which parts of the interface worked well for them and which were showstoppers—which features caused frustration and which facilitated their search.

DEVELOPING TASK-BASED QUESTIONS

Based on analysis of query logs, we were certain many users did not understand the purpose of the keyword search box component of the database locator. Preliminary heuristic evaluation also led us to expect usability problems with the other two components available in the existing research database locator: the A–Z list for databases by title and the pull-down menus for subject browsing.

To gather more evidence on our users' experience with the site, we set about the task of conducting iterative usability testing. The purpose of testing would be to assess the database locator and each of its three distinct components for

- effectiveness—were users able to complete tasks successfully and how much effort was required to do so?;
- efficiency—how much time was needed to complete tasks?; and

- satisfaction—what were the users’ perceptions of the site?

To this end, we developed a slate of questions to be used in testing, which included eight preliminary questions, nine session questions, and ten post-evaluation questions (see appendix A). The preliminary questions gathered demographic information regarding university status, home campus, length of time at UConn, age range, library employment, declared major or department, experience level with the UConn Libraries’ website, and participation in any library orientation class. The first session question was intended to capture participants’ definition of the word “databases” and understanding of the purpose of the database locator. The other session questions intended to represent typical research questions that might lead undergraduates to a database locator. Small variations to the questions were created to extend their applicability to graduate students and faculty. These session questions constituted the heart of the testing, being devised as simple, nonleading questions based on realistic tasks a user would perform; each question necessitated that participants experiment with and perform tasks using the site. For instance, users were asked to find articles about diabetes, which required that they translate from the topic diabetes to the subject medicine, find a database in medicine, and connect to that database. The ten post-evaluation questions were designed to gather information about the participants’ experience and satisfaction with the site as well as their posttest understanding of the purpose of the site. When each test was completed, staff administering the test ranked each task by perception of their success—1: “did not complete task;” 2: “completed task, but with difficulty;” and 3: “completed task easily.” In tandem with the questions, an administrator script was developed that included introductory comments and procedural instructions.

Before administering the test with our representative sample of users, we conducted two pretests with undergraduate students to ensure the test and our administration methods were on target. Based on what worked and what did not, the test and procedures were revised.

SELECTION AND RECRUITMENT OF PARTICIPANTS

In 2006, UConn had a total enrollment of 28,481 students over six campuses; nearly 75 percent of that number was undergraduate enrollment. UConn offers 8 undergraduate degrees in 105

majors, 16 graduate degrees for 90 fields of study, and 5 professional degree programs. In addition, UConn employs nearly 4,500 faculty. To be sure we were gathering accurate data, we were careful to use a representative sample of our users rather than a random sample. As often as possible, we would recruit three undergraduate students, one graduate student, and one faculty member for each test, ideally from various academic departments in the humanities and sciences. We also aimed to hold tests at as many of UConn’s six campuses as possible.

The team solicited volunteers through e-mail messages sent to faculty and graduate student distribution lists on campus. The response from graduate students was resounding; faculty were not as responsive, but we still received a sufficient number of volunteers. Undergraduate students were recruited on the fly from the café adjoining the library and from library computer areas just prior to each test. These locations are popular social areas that draw undergraduate students who otherwise do not use library resources or tools. In fact, many of the undergraduate volunteers had never used or seen the database locator before the test.

It was imperative to our goals that library staff be involved in the testing process to see firsthand how users navigated our database locator. Many librarians and staff teach classes using the database locator and are involved in populating the back-end. Watching students and faculty use the tool without librarian mediation would be important to understanding the inherent problems with the existing interface. Volunteers from the library staff were recruited to assist in the test process. One member from the testing team would administer the test and serve as a contact and recruiter for participants. Staff volunteers would record everything the tester said or did (e.g., mouse clicks, keystrokes) during the test, and one person would keep track of the amount of time each task took to complete. As an incentive, \$10 gift certificates to the university bookstore were given to participants.

PERFORMING FORMATIVE EVALUATION

The first test was conducted on the existing research database locator that had been in use for over a year. As illustrated in figure 1, users were presented with a screen that gave them several choices for locating a database. We were interested in observing how users navigated these choices, how (or if) they found an appropriate database

for their topic, and if they were able to expand a specific topic out to a broad subject or format type. We also wanted to ensure that they were able to access the appropriate database once they identified it. This first round of testing was conducted at the Storrs (main) campus with five participants—three undergraduate students, one graduate student, and one faculty member.

Following this first round, we saw several common problems with the interface. The keyword search caused the most confusion and frustration for the majority of the testers, even though this search was the most attractive method for answering the task questions—it appeared first on the page and was highlighted in a colored box. For users unfamiliar with database behavior, specific database titles, or just looking for the quickest and most direct way to retrieve information, the keyword search was the first method attempted, despite its low rate of success in producing useful results. Terms entered in the keyword search box were run against database titles, descriptions, and subjects, but this was not clearly noted; searches on topics or misspelled databases resulted in a completely blank screen. This type of limited keyword search ran counterintuitive to participants' expectations of a broad, Google-like keyword search and resulted in failed searches and palpable frustration. Participants consistently tried to search using keywords directly related to their topic rather than by broad subject, not understanding that a database must be selected before searching. We repeatedly saw them type in "diabetes," "depression," or "apartheid" in the keyword search box to answer the test questions and retrieve no results.

Participants attempted to overcome these problems by using the "subject grouping" option, which consisted of four pull-down menus labeled for broad disciplines. Participants were generally able to expand from the topic (diabetes) to a broader subject (medicine); however, they often had difficulty finding the appropriate subject page from the pull-down menus. One completely missed seeing the link for Medicine, Nursing, and Allied Health due to the way the list of subjects displayed under the Sciences pull-down. A more serious problem was that users were unable to guess which subject grouping their topic would fall under; users did not know if psychology would fall under Science or Social Science. They often perused the lists of two to three subject grouping pull-downs before finding a topic that made sense to them.

Another significant problem was that once participants were successful in navigating to a subject, the number of available databases listed related to that subject was overwhelming. We observed par-

ticipants staring intently at a screen with more than twenty databases displayed, clearly unsure which to choose. In addition, the descriptions of the individual databases included too much text. Users frequently commented that it was too difficult to read the descriptions or that they were scanning for relevant material. Regarding text on the page, one said "cut the words down. I just scan them [the descriptions]. I don't actually read . . . when there are paragraphs to read." The participant commented, "I will say it would be easier to use a different Web. It's not like I have time to figure out where it would be."

Once they had identified a database, users were brought to a description page from which they could access the database itself. Many participants were unaware that this intermediary page was not the database itself and looked fruitlessly for a way to search, or were unsuccessful in finding the access point—a small button at the top of the screen reading "Access this Database." While attempting to find a link to the database, several users scrolled to the bottom of the database description page, where, still looking for the access point to the database, they clicked on links to subject guides. The subject guides were a quagmire, offering the user additional lists of databases related to the subject area.

Overall, testers failed to complete almost half the tasks during this first round. Undergraduates fared the worst with this design, failing to complete the tasks given to them 66 percent of the time; the faculty member missed only one question and the graduate student was able to complete all the tasks during this first round—perhaps because they were familiar with conducting research at the library. However, across the board, 43 percent of the tasks were not completed and 29 percent were completed with difficulty. Only 29 percent were completed easily.

After analyzing the results from the test on the existing interface, we identified several common problems with our database locator:

- The keyword search box was mistakenly being used as a Google-like tool; users typed in specific topics rather than database names or subject categories.
- Typing a database title in the keyword search box often did not bring up that database first (e.g., ERIC appeared nineteenth in the list of databases generated).
- The subject pull-down menus were not intuitive.
- The number of databases listed in many subject results were so long as to be confusing.

Figure 2. The provisional “quick fixes” page kept the same general layout as the existing Research Database Locator, but included successful sample searches, replaced the “Keyword” search label with “Search for Databases,” and increased white space.

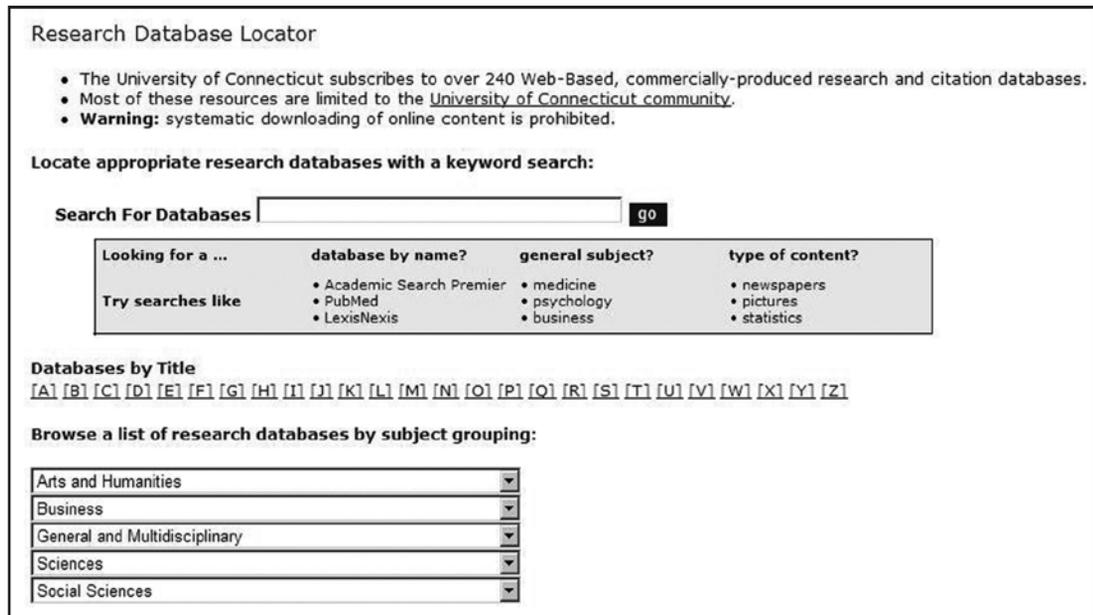
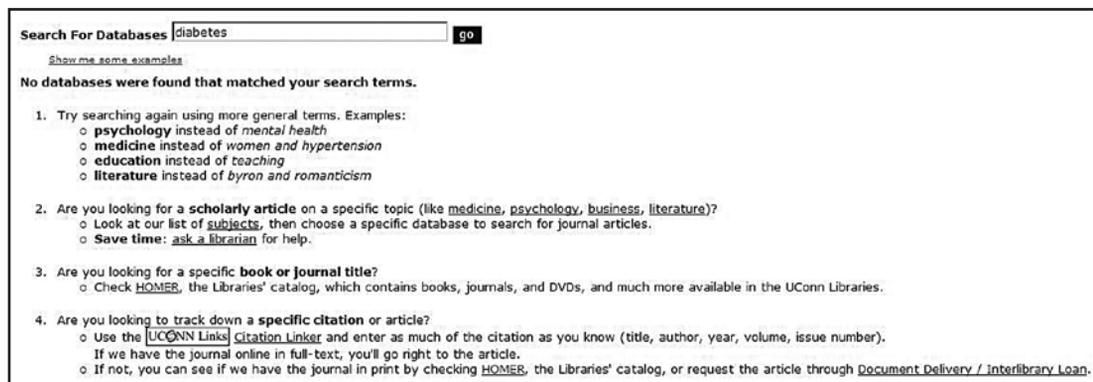


Figure 3. The provisional “quick fixes” page returned a strategy guidance page when a keyword search produced no results.



- Database descriptions were too long for users to easily scan; they weren't easily able to identify a relevant database from skimming text.
- Users did not know how to access the database once they found it.

QUICK FIXES

The rate of failure for the existing database locator interface was so high within the undergraduate testing group that we developed a set of provisional quick fixes (see figures 2 and 3) we hoped to roll out immediately to improve the patron experience until the formal redesign process was

completed. The changes were largely cosmetic because we did not want to make drastic alterations to the functionality of the product without further testing. Many of the common problems detailed in the previous section were addressed:

- General improvements to the visual design were made by removing extraneous marks (borders, lines, icons, colors, etc.) and adjusting whitespace.
- The “Keyword” search label was changed to “Search For Databases.”
- Hyperlinked examples of successful keyword searches were included below the search box.
- A strategy guidance page was created to help

locate resources if a keyword search produced no results.

- “Access this Database” image was replaced with a bright green “GO” button.
- A search box was added at the top of each subject page.

One undergraduate and one graduate student were recruited to test this new interface using an abbreviated list of tasks aimed at discovering if users could find databases that dealt with format (newspapers), two topic searches on diabetes and depression, and an exact database title search. This testing revealed that many of the problems we were seeing did not stem from heuristic problems with design, but rather user expectations of function. The intrinsic problem of the database locator did not reside in its language and layout. Rather, it failed to function because, instead of providing users with a search box for articles, it gave them a series of difficult choices. Although the testers in this “quick wins” round did do slightly better than in the first round, the gains were not significant, and we decided to focus our remaining time on addressing the significant functionality problems without implementing any of the quick fixes.

REDESIGN

Our goals in redesigning the interface were to present users with a simple interface that could be navigated quickly, with few mouse clicks, and with minimal decision making on the part of the user. We wanted to work from the existing platform as much as possible; adjusting features to meet user expectations, or (in cases where that was impossible) eliminating features or otherwise minimizing potential pitfalls. At the same time, we did not want to remove features that had been employed successfully, even if only by a small portion of the population. The section below details the changes made to correct those problems identified through formative evaluation.

Misunderstanding of the Keyword Search Box

It was evident after reviewing query logs and testing users that the largest problem with the database locator stemmed from the keyword search box, which was consistently employed for topic-level searches. Barring installation of a federated search system, it was obvious that a keyword search feature would not be able to meet user expectations. Because users conducted very few keyword searches for broad subject disciplines,

a decision was made to reconstitute the keyword search box as a title-only search box, relegating it to a secondary, tab-accessible page that provided for access to databases by name. This page would host the title-only search box as well as the full A–Z list of database names.

Poor Ranking of Keyword Search Box Results

The keyword search box did not respond with anticipated results, even when used correctly. Typing a database title in the keyword search box, for instance, often did not bring up that database first. The old search algorithm matched partial substrings and often presented search results in a surprising relevancy order. The revised search algorithm, tailored for searching database titles, uses a left anchored, word-delimited search that ranks matches at the start of a title higher than matches within the title.

Unintuitive Subject Pull-Down Menus

The subject grouping option was the most promising method of database identification for novice users or others without knowledge of database titles in their research area. These, we surmised, constituted the largest body of users and therefore “by subject” navigation was chosen to receive prominence in the interface. The pull-down menu display for subjects was not ideal because it worked well only for users who correctly guessed where subjects would exist under the broad subject categories. It was a barrier for those who did not, for example, know whether psychology is considered a science or a social science. The team was able to emphasize and simplify subject browsing by displaying all subjects in an alphabetical list. This change was consistent with Nielsen’s heuristic “recognition rather than recall.” Subjects continued to be based primarily upon UConn’s Programs and Majors in Schools and Colleges, a model familiar to our primary user group and also one that fit on a standard-size monitor without scrolling. Several changes were made in the list of subjects to accommodate cases where licensed databases fell outside of any subject area (in several cases subjects were added for format types) and to remove subjects that had no subject-specific databases.

Overwhelming Lists of Databases

To reduce the complexity of decision making previously required in database selection, we decided to initially only present the top five or fewer “best

bets” databases for the subject area, relevancy ranked. Because all subject descriptions were rewritten, the five “best bets” easily fit on one screen. A more comprehensive list of “all databases in this topic” was linked to from the “best bets” list. To further enhance navigation of databases by subject, we added a new subtopic construct that enabled specialized subsets of databases to be displayed upon request. For instance, the subject Health and Medicine provides four “best bets” databases, with a link to a comprehensive list of twenty databases. It also provides subtopics for Cancer, Consumer Health, Genetics, and Quick Clinical Information. Each subtopic profiles databases specific to the subcategory. The creation of subtopics was driven entirely by availability of databases within subject areas and the need to organize them in manageable portions.

Overly Long Database Descriptions

All iterations of the database locator include both short and long descriptions of databases. The short description is displayed on the list of databases and provides a brief introduction to the content of the database; entries include the coverage dates of the resource when known. Users can also link to a more complete description of the database on a separate page, which conveys additional information about the database, including technical details, license information, and in-depth coverage of the database itself. Initially, the database descriptions were gathered from the vendor and varied greatly in tone, length, and content. For example, the original entry for ABI/Inform read:

ABI/Inform Global: Full-text articles from 1800 journals covering business, finance, management and related functional areas. ABI/INFORM Global indexes a total of 2700 major publications. Subject coverage includes: business and management, including all functional areas.

The team felt this language was repetitive and confusing to users and developed guidelines for rewriting the brief descriptions, which follow two essential elements: The text should be short (limited to 255 characters) and focus on the content of the resource. Coverage dates and technical notes are included on the list of databases, but they are set apart from the brief description. The content should not include the name of the database again, nor should it indicate the number of journals included. Following these guidelines, the ABI/Inform brief description now reads:

ABI/Inform Global: Articles in business, finance, management, accounting, advertising, banking, insurance, marketing, public administration, real estate, and telecommunications. *1991–current (full-text); 1971–current (index & abstracts).*

In the first round of testing, participants frequently said that they would not read database descriptions; in later tests, with better design and textual changes, users made no such comments. While this does not prove that more concise descriptions are better, the PERM team is confident that briefer short descriptions are an improvement in usability.

Lack of Apparent Links to Databases

A surprisingly prevalent problem uncovered during testing was the inability of undergraduates to find the “Access this Database” link on the database description page. Description pages were presented to users after selection of a specific database was made. They included information about content and licensing and, for library purposes, had a click-tracking mechanism used to record database use. Of the twenty-one tasks completed by undergraduates in testing, six failed because users could not find the link to the database from its description page. Our initial assumption was that the access point (a small button at the top of the screen reading “Access this Database”) was visually unapparent to users. However, when the “Access this Database” link was supplemented by an oversized, bright green button in the “quick fixes” design, the problem persisted. It was determined that the failure of the description pages was not as much related to their visual design, but in how users got to these pages in the first place—after selection of a specific database had already been made. Users expected to be taken from their selection into a database, not to a fuller description page. To create an experience more in line with user expectations, we implemented several changes to database lists. The first was to redirect database links to the databases themselves. A zero-second redirect allowed for continued click tracking without requiring users to interact with description pages. The need to offer longer descriptions and licensing information was accommodated by adding two links to each short description: “Details” gave an expanded description and “Terms of Use” offered database-specific license information. General licensing information was also added to the footer of any page that presented links to databases.

Additionally, as a measure to ensure successful use of the database locator, several user-assistance features were added:

- A “Not Sure Where to Start?” page (accessible by tab), which provided links to multidisciplinary databases
- Page headings
- Breadcrumbs (the trail of pages followed to reach the current page)
- Links to database guides, when available, from database descriptions
- Links to subject liaisons and subject guides from subject pages

EVALUATION—ROUNDS TWO AND THREE

Following redesign, two more rounds of usability testing were conducted, with two pretests conducted between rounds. The pretests were used to assess whether changes to the site improved user performance (and therefore warranted a full round of testing) or whether further changes to the site were needed. Round two involved four participants—two undergraduate students, one graduate student, and one faculty member. Results from this round showed a radical improvement in participant performance. The main subject display and the tabular access to “By Database Name” and “Not Sure Where to Start?” were intuitive to users. The pared-down lists of databases by subject area and database descriptions also proved a success, enabling users to select an appropriate database for the given topic most of the time. Additionally, allowing direct access to the database from the subject list was a resounding success. During Round 2, a total of twenty-eight tasks were presented to participants. Only four of those (14 percent) were not completed, and another four were completed with difficulty (14 percent). Twenty (71 percent) were completed easily. In all, twenty-four tasks (86 percent) were completed, whether easily or with difficulty.

We identified a few areas still in need of improvement, which we attempted to correct while being cautious not to make changes that would reduce the efficacy of the components that had tested well:

- **Access to formats.** Several popular nonarticle, multidisciplinary formats had been added to the subject display. We had thought our users would seek out format types within the unified alphabetical arrangement, yet, when asked to find a newspaper article on the use of performance-enhancing drugs in sports, all

four participants looked under an academic subject (i.e., sports, medicine, and nutrition). It may have been possible that users believed newspapers were included in the subject databases, but when questioned posttest, several indicated that newspapers did not fit in with the other subjects. To remedy the situation, we broke out format databases into a horizontal list beneath the academic subjects.

- **“Not Sure Where to Start?” screen.** The “Not Sure Where to Start?” tab was composed primarily of links to a small selection of multidisciplinary databases. Two undergraduate students clicked on this tab. For one, expectations were met while the other lamented, “I didn’t expect this.” The team revised this screen slightly, in part because of the comments of the dissatisfied student, but also because of our own lack of confidence that the screen supplied the necessary support for our user base. A new screen continues to provide access to the general databases, but also provides an overview of what the Research Database Locator is and how users could get research support from library staff.
- **Links to subtopics.** As an affordance to users, links to subtopics were provided within the subject display and were repeated in a sidebar on the databases by subject pages. The sidebar also included links to subject liaisons and guides. In both places, links to subtopics and the sidebar lacked visibility. As a corrective measure, we made graphical design changes that gave them more visual force.

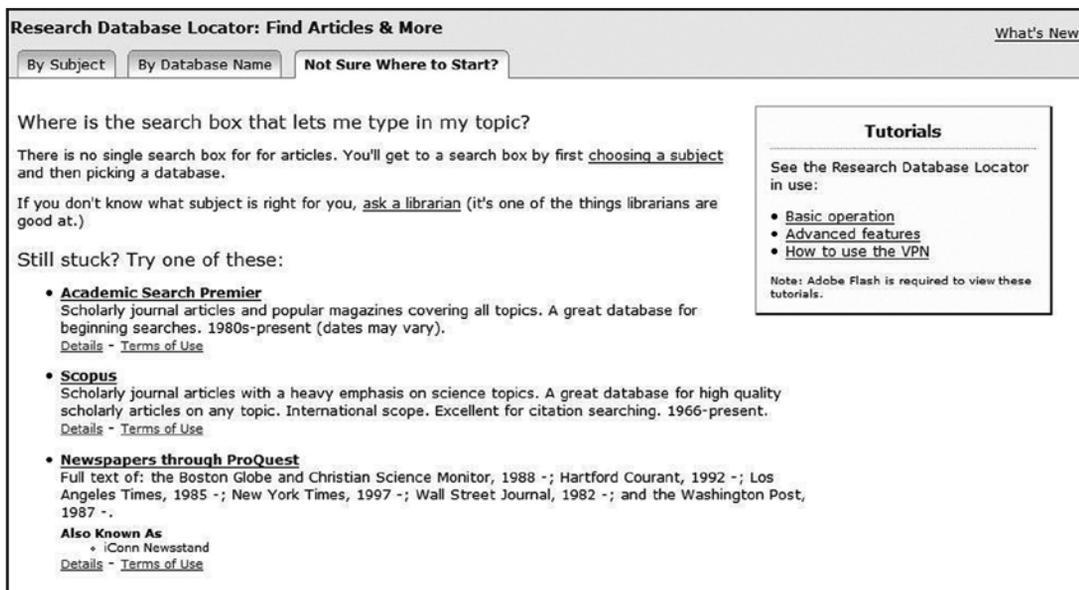
The third and final round of testing involved four undergraduate students (one from a regional campus) and one graduate student. The results from the test were very similar to those of the earlier round. Of the forty tasks presented to participants, seven (18 percent) were not completed, eleven (28 percent) were completed with difficulty, and twenty-two (55 percent) were completed easily. In total, thirty-three tasks (83 percent) were completed, whether easily or with difficulty. Small improvements were seen in navigation of formats and the visibility of the side bar. “Not Sure Where to Start?” continued to disappoint, but this time for different reasons: We had designed a full screen of information, which we thought was brief and well-segmented into two columns; however, we found that users were only perusing the left column.

Following the third round of testing, we made more graphical changes to increase the effect of the formats, sidebar, and to further edit and rearrange “Not Sure Where to Start?” Edits to the “Not

Figure 4. Redesigned Research Database Locator (<http://rdl.lib.uconn.edu>)



Figure 5. “Not Sure Where to Start?” (<http://rdl.lib.uconn.edu/help.php>)



Sure Where to Start?” page included reducing the amount of text, placing the most critical information in the upper-left corner, and adding three screencasts for basic operation, advanced features, and how to use the Virtual Private Network for off-campus access.

CURRENT STATUS AND FUTURE PLANS

During UConn’s spring break in March 2007, the new database locator was rolled out to the UConn Library’s website. See figure 4 (redesigned

interface), figure 5 (redesigned “Not Sure Where to Start” page), figure 6 (sample “best bets” page for business), or visit our website (<http://rdl.lib.uconn.edu>). The collective response to the redesigned site has been extremely positive, and we are pleased with the results. However, as with any iterative design process, the cycle of testing and improving does not naturally come to an end; there are always more problems to discover and more improvements to be made. To that end, we have created a wish list of items for future development that address known shortcomings and introduce new functions. These include improved

Figure 6. Best Bet Databases in Business. <http://rdl.lib.uconn.edu/subjects/1871>

visibility of navigational elements (formats and sidebar), improved effectiveness of the “Not Sure Where to Start?” page, cross-referencing between subjects, a search box for database descriptions, a mechanism to redirect commonly misspelled database names (e.g., *PsycINFO* and *LexisNexis*), database descriptions that can be customized for each subject list, and a “My Databases” feature that allows expert users to create pages with their favorite databases.

The one-year redesign process was time-consuming, occasionally overwhelming, and left us with more to be done; however, we are certain that the iterative design approach was essential for the project's success. A great many websites are expertly and attractively designed, following established design principles and with knowledge of and input from users. Yet, when launched, these sites may still fail. The iterative design process recognizes that usability can only be determined by users. It makes failure, though not ever welcome, beneficial by allowing it to occur in a testing environment where problems can be identified and later corrected. Our experience has borne out that well-planned sites, which seem intuitive to librarians, may simply not work for our users. At the UConn Libraries, we were able to create a more user-friendly and accessible database locator by partnering with our users in a test-to-success process. The process required a heavy investment from staff, but the feedback we have received thus far from patrons and staff alike has made it well worth the effort.

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 12. Nielsen, "Top 10 Mistakes in Web Design."
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 14. Not all actions are searches. We logged what the users did from this page: ran a keyword search, linked to a title letter, or chose a subject from the category pull-down menus.
 15. We cannot say how many of these knowledgeable users are library staff and other "expert" users. We did not limit our collection of usage data to nonstaff IP's. It is hard to say at this point whether librarian use of the interface significantly affected these numbers.
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APPENDIX A. QUESTIONS USED IN TESTING

Preliminary Questions

1. Please indicate your status at UConn.
 - Undergraduate student
 - Graduate/Post-graduate student
 - Faculty Member
2. What is your home campus?
 - Storrs
 - Regional
3. How long have you been at UConn?
 - Less than one year
 - One–two years
 - More than two years
4. Are you now, or have you ever been, employed by the UConn Libraries?
 - I am currently or was formerly employed by the Library
 - I have never been employed by the Library
5. Are you at least 18 years old?
6. What is your major or department?
7. Which of the following best describes your experience with the UConn Library website:
 - I never use it
 - I seldom/hardly ever use it
 - I use it on average once a month
 - I use it once a week or more
8. Have you ever participated in a library instruction class?

Session Questions

1. What does that word “databases” mean to you? Talk about what you think it means or where you have seen it before. What do you think is the overall purpose of this page?
2. Your nursing professor asked you to find articles on diabetes, your hypothetical patient’s condition. What would you do from this page?
Alternate question for graduate students/faculty: Your friend has recently been diagnosed with diabetes and you want to research her condition. What would you do from this page?
3. You’ve got to do research for one of your classes on the topic of college students and depression. Where would you start from this page?
Alternate question for graduate students/faculty: You’ve got to do research on the topic of college students and depression. Where would you start from this page?
4. Search for a database named ERIC (scholarly articles in education) and connect to it. (Ask: why did you select that particular ERIC?)
5. You’re doing research on the history of Apartheid in South Africa. Where would you start from here?
6. Find a list of databases by subject and choose biology. Specifically, you need to find some articles in the field of biopharmacology. Where would you go?
7. You’re looking for a newspaper article on the use of performance-enhancing drugs in sports. From this page, what would you do?
8. You need to find a newspaper article written on the day you were born. Where would you go/what would you do from this page?
9. Have you written a paper or article [*depending on participant; use “article” for faculty*] recently?
 - What was the topic?
 - What sources did you use, if you remember?
 - What did you use to find sources?
 - [*If they didn’t use the Research Database Locator, ask . . .*] Now that you’ve seen this, how would you have used it for your topic?

Post-Evaluation Questions

1. What is a good name for this resource that you’ve just used? What are some terms you’d use to describe it?
2. If you had to tell a friend or colleague what this site does, what would you say?
3. How easy is it to find information resources from this site?

Not easy				Very easy
1	2	3	4	5
4. How would you rate your experience using the site?

Frustrating				Very pleasant
1	2	3	4	5
5. What else did you like or not like with this site?
6. What suggestions do you have for improvement?
[If user tried “Not sure where to start”]
7. You used the page “Not sure where to start?” What did you expect to find there?
[If user did not use “Not sure where to start”]
7. There is a part of the site called, “Not sure where to start?” What would you expect to find there?
8. Would you use this site again? Why or why not?
9. Do you have any additional comments or questions about this study?