

OPAC Queries at a Medium-Sized Academic Library

A Transaction Log Analysis

By Heather L. Moulaison

Patron queries at a four-year comprehensive college's online public access catalog were examined via transaction logs from March 2007. Three representative days were isolated for a more detailed examination of search characteristics. The results show that library users employed an average of one to three terms in a search, did not use Boolean operators, and made use of limits one-tenth of the time. Failed queries remained problematic, as a full one-third of searches resulted in zero hits. Implications and recommendations for improvements in the online public access catalog are discussed.

Many academic libraries seek to make their online public access catalogs more user-friendly and catalog searches more successful. This paper reports the results of a study conducted in March 2007 that examined transaction logs to determine if data about searching behaviors could be used to improve the catalog interface and inform plans to update the library's Web site. The author concludes with recommendations that may be applicable to other libraries.

Background

Librarians at The College of New Jersey (TCNJ) library began considering the need for changes in the online public access catalog (OPAC) interface and library Web site in the fall of 2006. Two library groups were interested in assessing these changes. The TCNJ library cataloging department's OPAC design working group wanted to improve the OPAC interface and display, and TCNJ library's Web committee wanted to create a new Web site for the library. They wanted the new Web site to give more straightforward access to the OPAC and other library resources. One cataloging librarian involved with both groups sought to address the questions raised, while incorporating research into the mechanics of human information behavior underlying the OPAC's current usage. A study assessing the transaction logs was deemed a concrete way to begin documenting patron use of the OPAC. This study was designed to respond proactively to questions likely to be raised by both library groups. Two research hypotheses were identified as needing to be tested.

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- Research Hypothesis 1: Users are more likely to employ simple queries (i.e., not use complex operators and search strategies) and will not take advantage of the value-added features available in the OPAC search environment.
- Research Hypothesis 2: When searches yield zero hits, whatever the reason, users will abandon the search.

The study reported in this paper took place at TCNJ, a highly selective public residential college focusing on the undergraduate experience. Student enrollment at TCNJ is composed of approximately six thousand undergraduate students and nine hundred graduate students. Incoming undergraduate students are in the top 7 percent of their graduating high school class, with an average SAT score of 1307. The student body is primarily comprised of students who attend college directly after graduating from high school; 95 percent of first-year students live on campus, and more than half the total student population lives on campus. TCNJ has approximately 950 full-time faculty and staff, and approximately fifty of them work in the library.

Literature Review

Two types of literature were investigated in preparation for the study: research studies of patron use of OPACs, including difficulties in the online environment and with searching, and research addressing undergraduates—the major patron group using the TCNJ library. Literature addressing the patron use of OPACs is vast; selected representatives are discussed here. Most undergraduates were born between 1986 and 1990 and have grown up surrounded with technology. In considering the OPAC and its ideal functionality, TCNJ wanted to take into account this important user group.

Patron Use of the OPAC

Numerous studies on the library OPAC have been published since its wide-scale adoption as a replacement for the card catalog. OPAC studies published before the mid-1990s tend to focus on OPACs with MS-DOS interfaces. Although these studies give insight into the mechanics of searching behavior as a branch of human information behavior and information seeking, they do not necessarily reflect how the current generation of library patrons is approaching the tasks of formulating queries and searching. Many OPAC studies are older than the student users in today's colleges and universities. Despite the fact that these articles cannot address the immediate question of undergraduate use of modern library systems, articles about OPAC studies from

the 1980s and early 1990s remain relevant and pertinent on many levels. Peters' article analyzing the transaction logs at the University of Missouri–Kansas City in the late 1980s remains strikingly applicable.¹ Observations such as "It is amazing that some OPAC users willingly spend hours learning the intricacies of software they want to use on their personal computers, but they grow impatient spending five minutes learning the basic commands and structure of an online catalog in the library" seem as relevant today as they were almost twenty years ago.² Peters' overall search failure rate of 40 percent is partly attributed to system design. One might safely assume that modern users would find keyword searching via a graphic user interface (GUI) to be more straightforward and less prone to failure than command-line searching in a MS-DOS interface such as the one Peters studied.

Borgman's paper from 1996 attempts to lay to rest the card catalog design model, noting that current OPACs had not yet moved forward.³ "The record structure, content, and primary searchable fields are drawn from card catalog design models, with the searching functions and many of the interface design characteristics are drawn from retrieval system models."⁴ Borgman synthesized research showing that "people arrive at a catalog with incomplete information for any of the access points. . . . They must use information external to the catalog."⁵ An incomplete knowledge of the information to be retrieved complicates the use of the OPAC when carrying out an unknown item search.

Issues relevant to today's OPACs have also been explored, and solutions for improving OPACs have been advanced. Papers by Arsenault and Ménard and by Corrado investigated the erroneous use of initial articles in left-anchored title browses and the failures that can ensue.⁶ One of the recommendations made by Corrado was the provision of additional title access via the initial article. Lau and Goh have also done work with academic library OPACs and user queries; they used the OPAC transaction logs to study the queries and to assess the failure.⁷ Transaction log analysis such as the one carried out by Lau and Goh at a large academic institution reveals that strategies employed by OPAC users have not changed, even with the ubiquity of the Internet and search engines. They find that users continue to enter simple queries of one to three terms and that users employ Boolean operators only slightly more than 11 percent of the time. They, too, wrote their article with a Web-savvy library patron in mind as the primary user. TCNJ's project was carried out in this new environment.

Undergraduate Users in Academic Libraries

Due to the large percentage of undergraduate students at The College of New Jersey, attention was paid to literature

addressing the way this user group interacts with information systems in the online environment. When Marcum described a hypothetical user experience for an undergraduate student on an average American college campus, she might well have been describing the undergraduate users at TCNJ.⁸ As work was undertaken to redesign the OPAC and the library Web site, librarians and designers wanted to keep this largest user group in mind.

Library-related research has investigated the way in which contemporary undergraduate users interact with libraries. Sweeney pointed to expectations on the part of the undergraduate library user, whom he called a Millennial, and recommended technology-based ways for libraries to remain relevant.⁹ Millennials are also sometimes called the Internet Generation, Echo Boomers, the Boomlet, Nexters, Generation Y, the Nintendo Generation, the Digital Generation, and, in Canada, the Sunshine Generation. Sweeney wrote that spirited individualism is a defining characteristic of Millennials and explained that they expect more choices, want more personalization, are less likely to read instructions, and learn experientially and continuously.

Several observations provided by Oblinger are pertinent to how today's Millennials approach the library catalog. Because these students have never known life without computers and the Internet, "the computer is not technology—it is an assumed part of life."¹⁰ They approach problem solving through trial and error; learning resembles playing Nintendo more than the more logical approach to solving problems of earlier generations. Millennials have zero tolerance for delays and multitasking is a way of life.

Surveys carried out by the Pew Internet and American Life Project also can inform librarians as they work to understand undergraduate users. In "Generations Online," Fox and Madden stated that "Internet users ages 12 to 28 years old have embraced the online applications that enable communicative, creative, and social uses. Teens and Generation Y (age 18 to 28) are significantly more likely than older users to send and receive instant messages, play online games, create blogs, download music, and search for school information."¹¹ Preskey suggested that, while the generation currently doing undergraduate studies is a generation of digital natives; digital immigrants need to understand and, indeed, enter the digital world to teach and reach these students effectively.¹² This is the current environment in which academic libraries must operate to provide services to the new generation of academic users, and this is the domain in which OPACs have to compete in order to remain viable research tools.

While undergraduates may be comfortable in the digital environment, they are not necessarily expert searchers. A report by the United Kingdom's Joint Information Systems Committee observed that, while undergraduates may be digitally literate and comfortable using Google, "digital lit-

eracies and information literacies do not go hand in hand."¹³ The report further suggested that searching skills have not improved—and may have deteriorated—during the last twenty-five years.

Research Questions

The study sought to answer two research questions:

- Question 1: Are library patrons carrying out complex searches employing advanced search features such as limits and Boolean operators?
- Question 2: What is the reaction of library users when they launch an OPAC search that gets zero hits?

Question 1 grows out of an awareness that librarians usually have been trained in search strategies and information retrieval in the OPAC environment, and that undergraduate users have not received that same degree of training and do not have the same depth of experience. OPACs are populated, however, with carefully created MARC records that contain numerous fields that allow for limits to be enacted or that permit other advanced searches.

Question 2 begins with an understanding that undergraduates are more at home using Google and other search engines, which index whole documents along with metadata and information about linking sites. As Marcum noted, full-text indexing provides considerably more keyword access to full-text results in the search engine than to the surrogate in the OPAC.¹⁴ The number of hits returned in a Web search can be staggering. OPACs are not meant to work in the same way as Web-based search tools. In OPACs, especially those of medium-sized academic libraries such as the one investigated, receiving zero hits in response to a search is common.

Study Design

To address the research questions, the cataloging librarian worked in collaboration with the systems librarian to ensure that full and complete transaction logs were available for the month of March 2007. The integrated library system (ILS) in use was Voyager. Voyager allowed for a complete capture of transaction information based on IP address and session identification number. Using those transaction logs, this study took into account all nonlibrarian queries during the chosen month, then focused in particular on three days of transactions. Queries initiated by library faculty or staff workstations were isolated via IP range and removed from consideration. All other queries were retained for this study, including those generated from IP ranges for on-campus (for example, student dorms, library computer labs, and

other public, nonlibrary staff computers) and all off-campus, Web-initiated, non-Z39.50 queries. All Z39.50 queries of the library catalog were omitted from the study because they do not utilize the OPAC interface to the ILS. Three days judged to be representative of the month were selected for close examination: Monday, March 5, the first day of the school week and a week before Spring Break; Saturday, March 24, a weekend day one week after Spring Break; and Wednesday, March 28, a weekday when undergraduate classes do not meet. The Wednesday schedule allows students time to do research and participate in on-campus activities and therefore no classes are held.

The retained queries were first analyzed to address the research question about the nature and sophistication of the OPAC queries. When possible for this study, all system queries were taken into account. All queries from the selected days were used to calculate the average number of queries per user, the average number of terms per query, the type of search or the index browsed, and whether errors using initial articles were present. However, because the ILS in use at the library does not allow for advanced limits or Boolean operators to function in "browses" (such as the "Subject Heading Browse" or the "Author Browse"), only queries with the labels "Keyword—Relevance" and "Keyword—Boolean" were examined for limit- or Boolean-based elements.

In addressing the second research question about the reaction to zero hits, all non-library staff queries for each of the three days were examined. In each case of failure, the study noted what patrons did to correct or re-run the query, or if they abandoned the query. For this part of the study, some users modified the terms used in their query without changing the type of query. Other users, when faced with a failed search, chose to query a different index or to change search terms and switch indexes. Others modified the search by adding advanced operators such as Boolean terms or quotation marks, or search limits such as location or item type. Other possibilities included running the same erroneous query again, unchanged, or stopping the search entirely. Each of these possibilities was coded for the failed searches.

The library's OPAC may differ from other search interfaces that patrons have encountered on the Web or when using other library Web sites. The library's OPAC interface defaults to a left-anchored browse of the title index. OPAC users are instructed in the drop-down list of queries to "omit initial articles" because initial articles are not interpreted in the system as stop words. The initial articles are not indexed as part of the title due to the MARC 245 (title field) second indicator in the bibliographic record. This indicator instructs the system to begin indexing the title under the first significant word; initial articles are ignored by the system. Left-anchored, patron-initiated searches that begin with an initial

article fail automatically.

Patrons may run other queries when doing research on the OPAC. A series of searches and browses appears on a drop-down list to the right of the box where patrons enter text. Two primary keyword searches "Keyword—Relevance" and "Keyword—Boolean" are possible through this drop-down menu. Neither of these keyword search options is immediately visible to users; users must first select from the drop-down list of choices before scrolling down to these last two options. The "Keyword—Boolean" search does not automatically "AND" together users' search terms. Therefore, if users include two or more terms but do not enclose them in parentheses or add Boolean operators between them, the search will fail. The "Keyword—Relevance" is the only search that allows for a relevance ranking; it automatically "OR"s together terms without necessarily "AND"ing them first. The system also counts some frequent words as being less relevant. A query, therefore, can have a hit high in the relevancy ranking, but all of the search terms will not appear in the corresponding bibliographic records. Figure 1 presents the screen capture for a failed search.

Besides using the queries from the drop-down box on the search screens, users can navigate to desired records in other ways. Access points in bibliographic records automatically have blue underlined hyperlinks. Clicking on a hyperlink launches a browse of that access point's index, automatically placing that term in the results screen. The "Advanced" search functionality, a separate search interface on the "Advanced" or "Guided Search" tab, is another way for patrons to query the OPAC. The advanced option automatically inserts Boolean operators between concepts and applies quotation marks if the user chooses to search as a phrase.

Manipulating the Transaction Logs

Server transaction log entries were manipulated using Microsoft Excel. The date and time of the query, the session ID assigned by the system for all queries carried out during

The screenshot shows the TCNJ Library Catalog search interface. At the top, it says "TCNJ LIBRARY CATALOG" with a "Start Over" button. Below that are navigation tabs: "New Search", "Advanced Search", "History", "Alerts", and "Print". The database name is "The College of New Jersey Library". The search results are displayed as "Your search resulted in no hits!". There are four tabs: "Basic Search" (selected), "Guided Search", "Materials on Reserve", and "New Books". The "Search for:" field contains "apple". The "Limit to (optional):" dropdown is set to "None". The "Search in:" dropdown is set to "Title (keyword or phrase)". There are "Search" and "Clear" buttons, and a "50 records per page" dropdown at the bottom left.

Figure 1. Basic Search Interface: No Hits

a fourteen-minute period of activity, the type of query, the terms entered (including Boolean operators, initial articles in title searches, and typographical errors), whether user-initiated limits were placed, whether the system placed limits on the search, whether the query was launched as a result of a hyperlink within a viewed record, the number of hits if a search was carried out, and the quality of the search (basic or advanced) were recorded as part of the transaction logs.

For the one-month period of study, 43,587 queries emanated from non-librarian computers on campus and from off-campus searchers. This number of queries was significantly higher than anticipated by librarians given the small size of the campus community and the fact that this was a medium-sized library. Sessions were counted as queries that took place within a system-defined time limit. If the system was inactive for fourteen minutes and forty seconds, it timed out the session. The end of a session did not necessarily indicate the end of a set of related patron queries. If patrons resumed a search after being timed out, they had to start over. In starting over, users would have to reselect the index to search or the query to run and retype any search terms or queries.

Throughout the process of assessing the transaction logs, care was taken not to infer anything about the reaction of the user. Because users were unavailable to answer questions about their motivation, their behavior, or their satisfaction with the results, this survey only reports aspects of the queries that were quantifiable. Conclusions are not drawn about anything other than the mechanics of the searches themselves and the way in which they were constructed.

Results

Question 1: Are library patrons carrying out complex searches employing advanced search features such as limits and boolean operators? For the three days analyzed in-depth, the OPAC was queried 3,698 times from off-campus and library personnel computers. The largest percentage of queries (31.7 percent) was the default "Title (omit initial article)." Because this is the default search, it requires the least amount of effort to initiate on the part of the user. The second most common query was the "Keyword—Boolean" search (15.6 percent) and the third most common query was the "Keyword—Relevance" search (12.2 percent). These latter two searches were, as mentioned earlier, hidden from view on the drop-down menu (see figure 1 for the five visible index choices). Users had to intentionally seek out the keyword searches to use them. In table 1, the queries are listed in the order that they appear in the drop-down box visible to patrons. The results listed in table 1 only include queries keyed in by patrons. They do not include browses that were launched by clicking a hyperlinked access point in an opened bibliographic record. Such browses do not require patrons to select indexes, enter terms, or decide on a query strategy; for this reason, they have not been included. Noteworthy is that 1,071 (28.96 percent) of the 3,698 searches conducted during the three days initially failed.

For the purpose of this paper, the "Keyword—Boolean" and "Keyword—Relevance" were the only two queries considered in the discussion of keyword searching. "Title keyword" was ignored because it was initially assumed to

Table 1. Total Queries and Failures During Study

Label in System	Type of Query	Three-day Total for Queries N=3,698	Percent of Total Queries	Failed Searches N=1,071	Percent of Search Failures
Title (omit initial articles)	Left-anchored browse	1163	31.5	606	56.6
Title keyword	Keyword search	290	7.9	163	15.2
Journal or magazine title	Left-anchored browse, with system-applied limit	51	1.4	29	2.7
Author (last name first)	Left-anchored browse	404	10.9	--	--
Author (sorted by title)	Left-anchored browse	21	0.6	--	--
Subject heading browse	Left-anchored browse	290	7.9	--	--
Call number browse	Left-anchored browse	0	0.0	--	--
Keyword—Boolean	Keyword search	576	15.6	174	16.3
Keyword—Relevance	Keyword search	452	12.2	17	1.6
Tab 2: Guided search	Search	200	5.4	82	7.7

be much less popular. In retrospect, including it would have been worthwhile because it was more frequently used than expected. Future iterations of this research will therefore consider "Title keyword" along with the other two keyword search queries possible.

Measures of search complexity, such as the number of terms included in each search and the number of limits used, are a way of documenting the sophistication of the queries. More than one-third of the three days' keyword searches used two terms in the query. The average number of search terms was 2.6. Fewer than 2 percent of queries entered included either "6 terms" or "7 or more terms." See table 2 for further details.

Another measure of search complexity is the use of limits and advanced operators such as Boolean operators. Both were observed being used in the searches studied. In TCNJ library's OPAC, a searcher can post different kinds of limits, including date of publication, type of material, and location in the library. In the keyword searches studied over the three-day period, 10 percent (365) had these kinds of limits applied. The addition of limits can be an effective strategy for restricting to the information when used correctly. The number of searches with limits is much higher than anticipated, and implications will be discussed below. Table 3 shows the advanced and special operators used in the searches over the three days. The advanced search technique most commonly used employed Boolean operators. Operators may not have been used intentionally especially if, for example, they were simply words entered as part of a title. Intentionality on the part of the user is impossible to ascertain in a study such as this where users are not able to explain their actions. Although not advanced operators per se, periods appeared in several of the keyword searches (2.3 percent). "Not" and "&" were never used over the three-day period, while quotation marks were used in almost 10 percent of keyword searches.

Table 2. Use of Terms Keyword Searches

Number of Terms in Keyword Searches	3-day Total N=789	Frequency of Use %
1 term	142	18.0
2 terms	288	36.5
3 terms	201	25.5
4 terms	79	10.0
5 terms	54	6.8
6 terms	12	1.5
7 terms or more	13	1.7

Question 2: What is the reaction of library users when they launch an OPAC search that gets zero hits?

During the three days of the study, almost 30 percent of all searches failed overall. For this study, failure is defined as a query that results in zero hits. The default left-anchored title browse led to the most failures. In the drop-down box, this query is labeled "Title (omit initial article)." Despite the instructions about the initial article, a full 5 percent of these queries began with either "A" or "The." All of these queries failed because of the incorrect use of the initial article whether or not the material was used. Despite the fact that this query is a browse of the title index, if the character string does not make an exact match with entries in the title index, the system declares zero corresponding results.

When faced with failure, users had to devise a strategy for how to proceed. The most common reaction (52.3 percent) to a failed OPAC query was to relaunch it using different or modified terms at least once in the session. More than one-third (35.9 percent) of the searches opted to change the index, either with or without changing the search terms. Nine percent of users simply stopped searching after getting zero hits. More than 12 percent ran the same failed search again (either immediately or later in the session) without any changes. This percentage is lower than the 18.9 percent of re-run failed searches reported by Connaway, Budd, and Kochtanek before the advent of the Web.¹⁵ Some users tried adding search limits or other advanced search strategies when relaunching a search; in doing so, they did not always rekey the search terms. Although the addition of limits can be a good strategy when narrowing a large result set, it is not an effective strategy if the basic search is yielding no hits. Table 4 presents the user responses to a failed search.

Discussion

This study examined the transaction logs from queries carried out by students, faculty, and off-campus users at a

Table 3. Use of Advanced Search Features

Advanced Search Feature	Frequency of Use in Keyword Searches %
AND; and; And	17.0
OR; or; Or	0.8
NOT; AND NOT	0.0
. (period)	2.3
: (colon)	0.1
& (ampersand)	0.0

medium-sized academic library. Librarian searches were excluded from this study. Queries considered in this research likely were initiated by undergraduates, as this is the largest population served by the TCNJ library. Transaction logs give no indication of the status, experience, mindset, or goals of the user, and these aspects of the user experience cannot be evaluated in this study.

The answer to the first research question—whether users employ advanced operators such as Boolean operators and search limits—was seen as affirmative. For this element of searching, users understand that there are ways to limit within the library catalog in order to refine their search. The use of limits was especially noteworthy because patrons had to apply them manually from the search screen. The prevalence of using Boolean operators is less certain, because the conjunction “AND” may have simply been a word that was part of the search string being queried.

Almost 30 percent of searches resulted in failure (zero hits) with the current OPAC system. Despite different types of queries, use of limits, and browses that could potentially get users the information they require, the TCNJ OPAC produced failure nearly one third of the time. A medium-sized academic library does not have every piece of material that its users may want. The OPAC, however, should be designed in a way that is intuitive for patrons.

Because the default search and most-used query was the “Title (omit initial article)” and because this search was responsible for the most failures, it deserves special consideration. Users are supplying initial articles with this query despite instructions. At this selective college with top-ranked students, users are not reading instructions and are approaching the default query assuming they know how to use it. Libraries need to be sure that the default search made available to patrons is one that does not need explana-

tion or instructions.

The way the ILS is constructed influences some of the failure that patrons experience. Patrons are forced to supply Boolean operators or quotation marks when doing a “Keyword—Boolean” search. Users who do not add these advanced operators generate failed searches, no matter how correct their search terms are. Of the failed searches in the study, Boolean searches accounted for 16.3 percent of the total (see table 1). Users had fewer instances of failure when carrying out the “Keyword—Relevance” search. Relevance searches failed less than 2 percent of the time. However, when users opted for the relevancy ranking afforded by the “Keyword—Relevance” search, their terms combined in a way that made multi-term queries or nonunique terms ineffective.

Other failures or problems came from the patrons themselves. Users did not necessarily choose the most logical index or query type for the terms that they entered. In some instances, users did not read the instructions. This is clear in the way that they did not follow the examples, especially concerning the use of initial articles in the default search. Typographical errors also kept patrons from finding materials (see figure 1 for an example of the basic search interface result for no hits due to a typographical error). Interestingly, patrons often re-ran a failed search, exactly as typed, before quitting the session.

The strategy of applying limits to searches, especially failed ones, demonstrated that users were willing to make use of advanced operators and special OPAC-only capabilities. Users were aware that these features were available and were willing to try them. For this reason, despite the current ubiquity of Web search engines as gatekeepers to digitized information, suggestions about abandoning some of the rigorous work that goes into cataloging library materials would be premature. Users do understand that library OPACs have unique features, and are forming their search strategies accordingly. Librarians will also want to continue studying the pros and cons of providing only a simple “Google-like” search box as the primary OPAC interface if the system provides no way for patron-supplied limits to be incorporated in the search.

Concluding Recommendations

Two primary recommendations for improving the OPAC search experience could be considered based on

Table 4. Patron Responses to Failure

Strategy Employed	Frequency of Use	Frequency of Use When Search Failed %
Modify terms	560	52.3
Change index	384	35.9
Add or remove advanced operator	60	5.6
Stop searching after failure	96	9.0
Redo failed search outright	110	10.3
Redo failed search later in session	21	2
Observation: Typos in failed searches (minimum)	28	2.61

this study. The first recommendations include adding elements to the ILS to enhance the user experience. The second set of recommendations assumes that ILS technology cannot be modified for the moment and that a reconfiguration of the local decisions that underlie the OPAC setup must be carefully undertaken.

To alleviate the issue with failed searches due to typographical errors, automatic spell-check functionality should be added to the system. The spell-check feature should be based on the live local OPAC, and should only suggest spelling suggestions that are actual terms in active OPAC records. Search engine spell-check features or generic dictionary-based approaches are discouraged. They may suggest terms that are spelled correctly, but that do not correspond with the content of bibliographic records in the local OPAC. Correcting the misspelled word is desirable; being able to suggest relevant library holdings after the correct spelling is identified is more desirable.

As an added feature to the ILS, a separate indexing of titles that includes initial articles could be generated to complement the regular index. If a system had titles indexed both with and without initial articles, regardless of the coding in the MARC 245 field, left-anchored title searches beginning with initial articles would no longer fail. Left-anchored title searches would succeed even if patrons misunderstand the instructions for title entry. From a cataloging point of view, this solution is not perfect. It would, however, get patrons closer to the material they seek and solve the problem of failed title searches that include initial articles.

The second set of recommendations focuses on the in-house setup of the database. Even among TCNJ librarians, confusion existed between the two types of keyword searching. For the public search experience, one type of keyword search needs to be chosen and perfected within the limitations represented by the system. The search terms ideally would be "AND"ed together automatically and should not require patrons to enter Boolean operators in order to run a basic search. After terms are searched using an automatic "AND," a way to "OR" together the terms and to continue to populate the list of hits should be possible. Because the default left-anchored title search resulted in so many failures, the library should make the new keyword search the default search for users.

Finally, the OPAC interface needs to be intuitive enough to use without reading instructions, tips, or help screens. Web usability is studied in the creation of Web pages; it should also be a major factor in the creation of a design layout for the OPAC. Patrons are major stakeholders in the look and feel of the OPAC, and they need to be consulted when the OPAC interface is being studied. User-centered design principles should be employed. When possible, the OPAC should be customized for the patrons, keeping in mind their expectations and the popular online

information systems they use.

Like the search interfaces and online services (e.g., book, video, and music merchants) that are ubiquitous on the Web, library OPACs should not be change-adverse. Evaluating and updating interfaces should be continuous. Continued and repeated research, such as the study described in this paper, should be conducted to ensure that the library Web site continues to serve user needs. OPAC design and evaluation is an ongoing process and through proactive initiatives such as OPAC redesign projects, libraries are uniquely positioned to work with patron-stakeholders to meet their evolving information needs in the Web environment.

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