

# Revitalizing the Library OPAC: Interface, Searching, and Display Challenges

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*The behavior of academic library users has drastically changed in recent years. Internet search engines have become the preferred tool over the library online public access catalog (OPAC) for finding information. Libraries are losing ground to online search engines. In this paper, two aspects of OPAC use are studied: (1) the current OPAC interface and searching capabilities, and (2) the OPAC bibliographic display. The purpose of the study is to find answers to the following questions: Why is the current OPAC ineffective? What can libraries and librarians do to deliver an OPAC that is as good as search engines to better serve our users? Revitalizing the library OPAC is one of the pressing issues that has to be accomplished.*

The information-seeking behavior of today's academic library users has drastically changed in recent years. According to a survey conducted and published by OCLC in 2005, approximately 89 percent of college students across all the regions that were included in the study (including areas outside the United States) begin their electronic information searches with Internet search engines.<sup>1</sup> More than half of U.S. residents used Google for their searches. Internet search engines dominate the information-seeking landscape. Academic libraries are the ones affected most, because many college students are satisfied with the answers they find on the Internet for their assignments, and they end up not taking advantage of the many quality resources in their libraries.

For many years, before the Internet search engine emerged, library catalogs were the sole information-seeking gateway. Just as the one-time industry giant Kodak has lost ground to digital photography, academic library OPACs are losing ground to online search engines. All along we academic librarians have devotedly and assiduously produced good cataloging records for the public to use. We have diligently and faithfully educated and helped our faculty and students find the proper library resources to fulfill their research needs and assignment requirements. We feel good about what we have achieved. Why have our users switched to online search engines?

## The evolution of user behavior

It is technology and rising user expectations that have contributed to the changes in user behavior. As Coyle and Hillmann pointed out: "Today's library users have a different set of information skills from those of just a few

decades ago. They live in a highly interactive, networked world and routinely turn to Web search engines for their information needs."<sup>2</sup> A recent study conducted by the University of Georgia on undergraduate research behavior in using the university's electronic library concluded that Internet sites and online instruction modules are the primary sources for their research.<sup>3</sup> The students' year of study did not make much of a difference in their choices. Tenopir also concluded from her study of approximately 200 scholarly works published between 1995 and 2003 that no matter what type of resources were used, "convenience remains the single most important factor for information use."<sup>4</sup>

Recently, OCLC identified three major trends in the needs of today's information consumers—self-service (moving to self-sufficiency), satisfaction, and seamlessness.<sup>5</sup> Services provided by Google, Amazon, and similar companies are the major cause of these emerging trends. Customers have wholeheartedly embraced these products because of their ease of use and quick delivery of "good enough" results. Researchers do not need to take information literacy classes to learn how to use an online search engine. They do not need to worry about forgetting important but infrequently used search rules or commands. In addition, the search results delivered by online search engines are sorted using relevance ranking systems that are more user-friendly than the ones currently employed by academic library OPACs. These are just some of the features that current academic library OPACs fail to deliver. In 2004, Campbell and Fast presented their analysis of an exploratory study of university students' perceptions of searching OPACs and Web search engines.<sup>6</sup> They found that "[s]tudents express a distinct preference for search engines over library catalogues, finding the catalogue baffling and difficult to use effectively." As a result, library OPACs, because they do not fulfill user needs, have been bombarded with criticism.<sup>7</sup>

We often hear librarians complain about how library users forget what they have learned in user education classes. Librarians sometimes even laugh at users' ignorance and ineffectiveness in searching library OPACs. This legacy mentality has actually prevented librarians from recognizing the changes in user behavior and expectations that have occurred in the past decade. Rarely have librarians considered ineffective OPAC design to be at the root of unsuccessful OPAC use. Roy Tennant has mentioned frequently in his presentations that "only librarians like to search; users prefer to find"; that "users aren't lazy, they are

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human.”<sup>8</sup> It is only natural that library users turn to Internet search engines first for their information needs.

## ■ The OPAC reexamined

Cutter, in his 1876 book, introduced the objectives of the library catalog as follows:

1. To enable a person to find a book of which either
  - a. the author
  - b. the title
  - c. the subjectis known
2. To show what the library has
  - a. by a given author
  - b. on a given subject
  - c. in a given kind of literature
3. To assist in the choice of a book
  - a. as to its edition (bibliographically)
  - b. as to its character (literary or topical)<sup>9</sup>

The majority of today’s OPACs have successfully fulfilled Cutter’s model in finding known items. Following the card-catalog convention, bibliographic elements such as title, author, and subject have been the leading search options in OPAC search menus for many years. It was assumed that users always came to the library with specific author, title, or subject information in mind before searching the catalog. The OPAC bibliographic display is in essence an electronic version of the card catalog. To accommodate the bibliographic data from card catalogs, many display labels were created, but often without regard to whether or not they were suitable in an online environment. This data-centered, card-catalog type of design was easily understood and fluently used by librarians, but not by most end users. Campbell and Fast found in their study that “while the participants were generally happy with their understanding of search engines, they frequently expressed a low opinion of their ability to search the catalogue.” They also found that students felt that “[t]he Web is cluttered; the catalogue is organized. However, this organization was not always helpful; it was admired, but not understood.”<sup>10</sup>

The traditional catalog retrieval mechanism is significantly different from the Web search engine. As Yu and Young noted in 2004, “Web search engines and online bookstores have a number of features that are not typically incorporated into OPACs. These functions include: natural-language entry, automated mapping to controlled vocabulary, spell-checking, similar pages, relevance-ranked output, popularity tracking, and browsing.”<sup>11</sup> These features have unquestionably affected user expectations in searching library OPACs. Teaching users

to search for structured bibliographic data is completely opposed to the ever-popular free and open Internet search mechanism drawn from the Google-like search experience, which does not require any special training.

Since academic libraries aim to provide more dynamic and versatile services, revitalizing library OPACs should be considered a top priority. Furthermore, librarians’ expectations of user behavior should adjust to today’s needs. Educating users to become fluent in using OPAC search commands and rules has become less relevant as users now seldom read and follow instructions. Investing effort and energy in designing a truly user-friendly OPAC that functions intuitively to achieve productive retrieval could not be more imperative.

Academic librarians have started pondering what changes should be made to library OPACs so that a truly user-friendly, twenty-first-century catalog that offers a “Google-like” experience can be delivered. Two important aspects that affect the usability of library OPACs are addressed in this article: (1) the current interface and searching capabilities and (2) the bibliographic display. The OPAC’s public interface and searching capabilities together function as a finding aid. It determines how successful a user is in retrieving information and is the gateway to library resources. The effectiveness of an OPAC’s bibliographic display affects the user’s understanding of the bibliographic description. Users use bibliographic information to identify, select, and obtain library resources.

## ■ The study of the public interface of library OPACs

To find out how academic libraries designed and administered their OPACs, the authors examined the interfaces of 123 Association of Research Libraries (ARL) libraries’ OPACs powered by five major integrated library systems (ILS): Aleph, Horizon, Millennium, Unicorn, and Voyager. The study focused on searching ability, relevance ranking, layout, and linking functionalities.

During the study, we expected each ILS system to have its own OPAC design. We also anticipated that search mechanisms would be managed differently at each location. However, we were surprised by the great disparities that we discovered in OPAC quality, a clear indication of the time and effort (or lack thereof) devoted to their maintenance and improvement. The findings are summarized below.

### Google-driven changes—keyword search as the default search key

In his article “Mental Models for Search Are Getting Firmer,” usability expert Jakob Nielsen argued that cur-

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rent users have already developed a firm mental model of searching:

Search is such a prominent part of the Web user experience that users have developed a firm mental model for how it's supposed to work. Users expect search to have three components:

- A **box** where they can type words
- A **button** labeled "search" that they click to run the search
- A **list** of top results that's linear, prioritized, and appears on a new page—the *search engine results page* (SERP)

In our experience, when users see a fat "Search" button, they're likely to frantically look for "*the box where I type my words.*" The mental model is so strong that the **label "Search" equals keyword searching**, not other types of search.<sup>12</sup>

Studies have also shown that the default search option to which an OPAC is set affects users' success in retrieving information. Two studies on university OPAC search transactions confirmed that novice users preferred searching by keyword. At Nanyang Technological University, Singapore, a recent search transaction log study was conducted to "identify query and search failure patterns with the goal of identifying areas of improvement for the system." Results indicated that "the most commonly used search option for the NTU OPAC is the keyword search. The use of keyword searches contributed to 68.9 percent of all queries while other options such as title, author, and subject accounted for 16.5 percent, 8.2 percent, and 6.4 percent of all searches respectively."<sup>13</sup>

At California State University–Los Angeles, a four-quarter (2002–2003) search transaction log analysis also revealed similar results. After the library implemented an "advanced keyword search" feature that provided more user-centered, behind-the-scenes search algorithms and that set keyword search as the default, the keyword search queries rose dramatically.<sup>14</sup>

Many university library OPACs have already begun to adopt features employed by Internet search engines. Among the 123 ARL library OPACs studied, 81 have "keyword(s) anywhere" as the default search key (see appendix A). This is a positive sign that libraries are paying attention to user search behavior. Thirty-six libraries' default search keys are still set to "title," and six libraries, instead of providing a default search option, list field choices from which users must choose before entering their search terms.

The title search used as the default option holds some potential problems. In order to retrieve good results from a title search, users are expected to type in a title in the right order, spelled correctly, and omitting the initial article (a, an, the), if any. While librarians are fluent with

these seemingly simple rules, students and faculty constantly have trouble remembering them. Providing online search tips and offering information literacy classes only help a little. Since presenting keyword search as the default has proved effective, libraries using title search as their OPAC default search option might want to reconsider switching their default setting to keyword.

### Search ability—true keyword search

The basis of current OPAC search systems is Boolean logic. The ease of using Google-like search engines comes from its implicit "AND" feature, which eliminates the need to enter Boolean connectors (AND, OR, NOT) between search terms. This is logical because users usually look for records that contain all the terms that they enter.

Sixty-six percent of the ARL libraries studied have OPACs with keyword set as the default search option. These libraries handle Boolean logic in keyword searching very differently. All five ILS vendors offer "automatic AND" functionality, but not all of these libraries have adopted it: in some cases, users are required to enter Boolean operators during a search. Emory University Library's OPAC automatically executes "same" for multiple search words if no Boolean operators are entered which means that it will find records with the search terms in the same bibliographic fields. Syracuse University's OPAC automatically uses the Boolean operator "OR" for all keyword queries. This practice can generate too many irrelevant results. Libraries that automatically supply the Boolean operator "AND" for multiple terms entered in the search box consequently produce more relevant results. In addition, none of the ARL OPACs studied handle auto-correction for typos, spell-check, auto-plurals, auto-word-truncation, punctuations, or special characters. This makes searching unnecessarily inconvenient.

For many years now, teaching students how to properly use Boolean operators has been one of the essential topics in information literacy classes. After taking these classes, do students use Boolean operators when searching? A study of 2,374 transaction logs collected by 836 French universities revealed that French university students use Boolean operators infrequently. Fifty-six percent of the queries used only a single term. Approximately 28 percent of the queries contained one Boolean operator. To further investigate the impact of information search expertise on the use of Boolean operators, the study showed that approximately one-third (32 percent) of the students (considered the "novice" group in the study) still did not use Boolean operators even when they were explicitly invited to do so, compared to 83 percent of librarians (considered the "expert" group in the study), who used at least one Boolean operator for their queries.<sup>15</sup> Therefore, complicated search strategies and syntax are mostly used by expert users. Novice users

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prefer to use natural-language queries.

Libraries also handle phrase searching in different ways. Phrase searching usually is embedded within keyword search either explicitly or implicitly depending upon the ILS system. Aleph (Ex Libris) libraries use a radio button for “word or phrase” or “words adjacent” or “exact phrase” options for the computer to execute the command. Unicorn (Sirsi/Dynix) libraries provide three options: “keyword,” “begins with,” and “exact.” Some libraries have the “exact” command executed to search every field in a bibliographic record; other libraries search the title, subject, and author fields only. The Millennium system’s (Innovative) keyword search feature can do automatic phrase and “AND” search. Some Millennium libraries (e.g., Michigan State University) take advantage of this feature to search words entered as phrases first and, if unsuccessful, the system then repeats the search for the same words using the Boolean operator “AND.” This feature produces more relevant search results. However, several Millennium libraries have not implemented this feature. They still use “Boolean keyword” search as the default and instruct users to add quotation marks to define phrases. The Voyager (Ex Libris, formerly Endeavor) system offers two types of keyword searches: “keyword Relevance” and “keyword Boolean.” Both options can handle phrase searching. But users are required to enter quotation marks for specific terms used as phrases. Some libraries intentionally made only one keyword search option available. Other libraries provided both options and used different languages as an OPAC search key (see appendix B). These search keys are not self-explanatory, and users will often find them puzzling. The default help screen provided by the ILS vendor and adopted by many Voyager libraries does not help much either (see appendix C). Thirty-one of the 35 Voyager libraries provide a Boolean keyword search option. Only five libraries utilize the automatic “AND” feature. One library uses Boolean keyword search as the only keyword option, but did not activate the automatic “AND” functionality.

### Relevance ranking in search results

When users search by keyword, the best way to sort the results is by relevance. Presenting the most relevant results at the top of the results page is crucial because it enhances library resource discovery and access. Other sorting options, such as title or publication date, are not very useful since users usually do not have titles or publication dates in mind when browsing search results from a keyword search.

Three ILS systems (Millennium, Unicorn, and Voyager) have a relevance-ranking feature, yet this functionality was very much underutilized by the libraries studied. Of the eighteen Unicorn libraries, only five offered relevance

ranking. None made it the default sorting option. Thirty-six of the 38 Millennium libraries provided relevance ranking as a sorting option. Only twelve of those libraries made relevance ranking the default sorting system. Twenty-seven out of the thirty-five Voyager libraries offered the keyword (relevance) search option, under which the search results were automatically ranked by relevance. Out of the twenty-nine Voyager libraries that offered the keyword (Boolean) search option, only four libraries used relevance as the default sorting system. The rest of the libraries used a “system sort” mechanism that sorted search results by bibliographic control number. Figure 1 summarizes the sorting options used by the ARL libraries studied and also shows the default sorting options for keyword search.

Unlike online search engines, which pull data directly from full-text documents, library OPACs search for words from the structured metadata entered by catalogers. Different fields are set to carry different weights for relevance considerations. The behind-the-scenes algorithm (the criteria used to decide the level of relevance) should be carefully established to warrant a good ranking scheme. For example, the new OPAC of North Carolina State University Library, powered by Endeca, adopted an algorithm based on field weighting, phrase matching, facet LCSH, term frequency (TF), and inverse document frequency (IDF). Their search results are indeed more logically ranked by relevance. Recently there have been suggestions to incorporate circulation statistics, book review data, and a Library of Congress call number table into the algorithm. The checkout data would provide a rough substitute for Google’s PageRank (a count of links to a site, which is an indication of the site’s popularity), and book reviews would provide more text to be considered in the relevancy tests. Using Library of Congress call numbers would either require having the call number table loaded and then running the search terms against it or including call numbers in the algorithm, giving more weight to titles having the same call number. For example, seven out of twenty-three results generated for a search for “New York history” on an OPAC have the call number “F128.” The call number “F128” is linked to the call number table with the subject New York and history. It can be confirmed that seven items with call number “F128” should be considered more relevant and ranked first on the results list. More research needs to be done in this area.

### The search results display

The search results display is critical. The information, options, and bibliographic data presented on the browse page help users decide what actions to take next. In the OPACs examined, the authors found the following problems:

OPAC Sorting Options for Keyword Search									
	Relevance		Year (Publication Date)		Author	Title	Call # (Subject)	Format	Default
ALEPH 21	0		21		21	21	8	4	Year/Author: 17 Title/Year Ascending: 1 Title: 1 System sort: 2
HORIZON 7	0		7		7	7	0	0	Publication Date: 2 Title: 2 Author(ascending): 1 System sort: 2
Millennium 38	36		38		0	38	0	0	Date: 20 Title: 5 Relevance: 12 System sort: 1
Unicorn 18	5w		Descending 18	Ascending 18	18	18	18	0	New to Old: 5 Relevance: 1 (NCSU) System sort: 12
Voyager 35	Kw (R) 27	Kw (B) 4	Descending 34	Ascending 34	35	35	0	0	Relevance: 5 KW with Relevance: 27 System sort: 8

**Figure 1.** ARL libraries sorting options for keyword search (as of March 2007)

**1. Search terms and search boxes were not retained on the results page**

After a search is performed, many OPACs do not effectively carry the original search information onto the results screen. This information includes the search key and the words typed in the search box. Users need to consult this information to identify and select records relevant to their needs from the search results page. Based on the retained information, users also decide what to do next. For example, they might change their search strategy or modify their previous search. Many of the OPACs studied neglected to display the original search information.

Even better than just displaying the text of the user's search terms would be to maintain them in search boxes

at the top *and* bottom of the results display page. This way, users would only have to modify their search terms rather than type new search terms each time they wished to modify their original search. Only one of the twenty-one Aleph libraries studied kept the previous search terms in the search box on the results page. Fourteen of the Aleph libraries retained neither the previous search strategy nor the search terms. Six libraries placed the search box at the *bottom* of the search results page, which could be easily missed.

**2. Post-search limit functions were not always readily available**

Sometimes keyword searches produce an overwhelm-

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ing number of search results. Since the relevance ranking functionality currently provided by ILS vendors does not work very well, the best way to refine searches is to make effective search limit options available. Limiting options such as format, language, date, availability, and location should be readily available on the results page. Some ILSs in our study hid this feature, either under a modified search link or an advanced search link. This made refining a search unnecessarily cumbersome.

### **3. Item statuses were not available on the search results page**

In addition to bibliographic information, users also need to know whether an item they want is available. Having the item status on the browse page is very helpful because users can skip the records that have been checked out. Some libraries studied did not have this information on the results browse page. Users needed to go to the individual bibliographic records to find out whether an item was available or not. A few libraries provided an added-value option to limit the results by “available items”—a very useful feature.

### **4. A lack of value-added information**

A book cover image conveys an impression of a book that words cannot. It can also help a user recognize a book he or she has seen previously. In addition to cover images, libraries can provide value-added and contextual information by linking those images to tables of contents, summaries, sample passages of text, and reviews. One way libraries provide value-added and contextual information is to link cover images to the Library of Congress’s table of contents page. Another way is to link OPACs to information obtained from Syndetics.com, a company that provides cover images, tables of contents, summaries, author biographical information, and reviews. The Ohio State University Library not only adds the table of contents into the MARC record, but also links the names of the authors of a particular resource to other works by the same authors. This is a great discovery tool for finding related resources, and it is especially helpful, since in the future OPACs will be able to search not only books but also articles and other resources.

### **5. Title links were misleading**

We found that several libraries’ OPACs title links on the results page did not take users to the detailed bibliographic record, but instead directed users to an alphabetical title-browsing page. To get to the actual bibliographic record, users had to click a “display full record” link (which is sometimes difficult to locate) to view the individual bibliographic record. This misleading feature makes the retrieval process inefficient.

### **6. Switching between individual records and the results list was cumbersome**

After viewing an individual bibliographic record, users will want to return to the results browse page, either by hitting the “back” button or by clicking on a “return to results” link. Many library OPACs in our study returned the user to the top of the results page rather than to the location to which the user had previously scrolled. This forced the user to scroll back down through the records that had already been examined. This feature ought to be improved.

### **7. The color of entry links that had already been read were not differentiated**

For over a decade now, Web browsers have changed the color of links that have already been clicked on. However, this has not been the case with OPACs. To solve this problem, visited bibliographic entry links on search results pages should likewise be given a different color from entries that have not yet been visited. This feature facilitates the browsing of the search results. If what has been viewed is clearly marked, users only need to focus on entries that have not yet been visited. Some libraries in our study did not have this feature.

### **8. Searched keywords were not highlighted**

When a keyword search is performed, highlighting the entered keywords in each bibliographic record that has been retrieved is helpful. Based on the bibliographic elements in which the highlighted keywords appear, users can then decide how relevant the retrieved publication is to their research. All five ILS vendors provide this feature, and many libraries did a good job of implementing it. However, some libraries neglected to make this feature available.

### **9. Many libraries lack a meaningful call-number browse feature**

Library OPACs should take better advantage of call number links by allowing users to browse them much as if they were browsing shelves in the stacks. To that end, OPACs should link call numbers directly to a page with more useful identifying information, such as the authors and titles. No Aleph library OPACs that we studied currently have this feature. Instead, clicking on the hyperlinked call number field only leads users to a list of more call numbers, which is not helpful at all.

### **10. Title link, subject link, and author link should be labeled to be meaningful to end users (other value-added features)**

Millennium’s “Similar records” and Voyager’s “More like this” are added to pull similar titles under the same

subjects. Unicorn and Horizon offer a panel on the left side of the detailed book record, which can add meaningful information to these links. But how the panel is used depends on the individual libraries. Some libraries use the panel with only library holding information, but other libraries, such as University of Virginia, make an informative presentation of those links to students. Virginia has added three browse features to make the index links much more meaningful: “Find more by this author” (author link), “Find more on these topics” (subject link), and “Nearby items on shelf” (call number link). (See figure 2.) This value-added feature can indeed facilitate retrieval process.

By analyzing five major integrated library systems’ OPACs among ARL libraries, the authors have come to believe that librarians can make a big difference in improving OPACs. No matter how good the library system is, librarians still need to invest effort, time, and technical knowledge to configure and take full advantage of the many capabilities that ILSs offer. Public services, technical services, and system librarians should all work together to continuously study the usability of OPACs and to make them more effective. It is true that all current OPACs lack spell-check and automatic stemming functionality. Aleph and Horizon need to add relevance ranking, and Millennium, Unicorn, and Voyager should make our data work harder and relevance ranking algorithms more effective. Besides those systems in need of improvements, the study shows that all library OPACs could do a much better job if they focus on the user’s needs.

## The OPAC bibliographic display study

When the Web OPAC was introduced, libraries around the world quickly abandoned the traditional card cata-

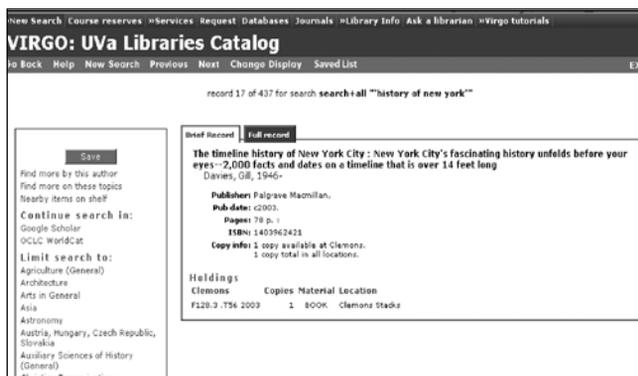


Figure 2. University of Virginia Libraries Catalog

log display and adopted the line-by-line display with display labels on one side and bibliographic information on the other. Because the line-by-line display format can be locally customized, each library’s OPAC bibliographic display looks very different. For decades, most academic libraries in the United States have used AACR and MARC as their content and metadata standards for resource description and access. MARC and AACR were originally created for card catalogs in which descriptive elements and access elements were separately defined and presented. The line between the two types of elements has become less distinct in today’s Web environment. Many elements in bibliographic records can serve as both description and tracing elements on OPACs.<sup>16</sup> Hyperlink functionality has also streamlined the retrieval process.

To see how academic libraries in the United States format their OPAC bibliographic displays, the authors examined the OPACs of fifteen academic libraries.<sup>17</sup> The purpose was to study the effectiveness of the display of records in different formats. In the mid-1990s, Wool studied the bibliographic display practices for monographs of thirty-six online catalogs in the United States. In his study, five criteria were used to analyze each bibliographic record structure.<sup>18</sup> The authors of this paper adopted for analysis three of the five OPAC bibliographic display criteria used by Wool, only this time with an emphasis on the user’s perspective and needs. Eight different titles were reviewed and compared: three monographs, two serials, one video recording, and two sound recordings.<sup>19</sup> The analysis given below is based on the following three criteria:

- the accuracy and clarity of display labels;
- the order of bibliographic elements display; and
- the utilization of bibliographic data.

### Accuracy and clarity of display labels

For this discussion, the authors divided the bibliographic elements into three areas:

- the first tier: information about author/contributor, title, imprint, and subjects;
- the second tier: other descriptive information, including the physical description, notes, related contributors, related titles, etc.; and
- the third tier: the linking fields (MARC 76X-78X fields) and the electronic location and access field (i.e., 856 field).

### The first-tier elements

The information displayed in the first tier can be consid-

MARC Fields	Library of Congress Subject (MARC 650 field 2nd indicator 0)	Medical Subject (MARC 650 field 2nd indicator 2)
Display Labels	Subject (LCSH)	Subject (MESH)
	Subject-Lib. Cong.	Subject-Medical
	Subject LC	Subject Medical
	Library of Congress subject headings	Medical subject headings
	Subject(s)	Subject(s)
	Subject, general	Subject, medical
	Subject, geographic	
Subject	Med. Subject	

**Figure 3.** Display labels for subjects

ered the key elements for identification. OPAC users first examine them and decide if the manifestation described is relevant to their query. Most OPACs studied used "title" as the display label for the title statement. This element actually consists of the title and statement of responsibility (author, etc. statement). Using the label "title" alone is not inclusive enough. One library (University of Arizona Library) displayed only the title portion under the label "title" and provided a separate label, "author/contributor info," for the statement of responsibility portion, which, while helpful in a limited way, could also create more confusion.

Let us consider, for example, the Project directory (Répertoire des projets) of TDC (in French, CDT). The title statement for this data would be "Project directory / TDC = Répertoire des projets / CDT." Here, the English title and statement of responsibility is equivalently presented with its French title and statement of responsibility.

The OPAC display using the University of Arizona Library's model is as follows:

**Title:** Project directory

**Author/contributor info:** TDC = Répertoire des projets / CDT.

This arrangement will not work for items with titles and statements of responsibility in multiple languages presented on a single manifestation. The French title appears under the label "Author/contributor info," which makes no sense.

Most libraries in our study used the label "author" for the principal author. The principal author could be a personal author, a corporate author, or a conference name. If it is a personal author, it could be a writer, an artist, or a composer. Some OPACs used "author" to represent all types of responsible bodies, be it a personal author, a corporate author, a meeting name, an artist, a music composer, etc. This use of a single label to cover a diverse set of situations is confusing. Some libraries used separate labels ("author," "corporate author," "meeting name," "author/artist," "author/composer," or "author, etc.") for different types of responsible bodies

(see appendix D).

"Uniform title" was defined in AACR to collocate resources derived from the same original intellectual or artistic creation. For example, when cataloging a translation, in addition to its official translated title, an established uniform title is entered to indicate the original work. When browsing by uniform title on a properly set OPAC, all entries related to the original intellectual creation should be retrieved. This uniform title browsing feature helps users locate related publications in the catalog. The problem is that the term "uniform title" is only understood by catalogers, not by others. There is no label for such an entry that can be easily understood by the average user. However, suppressing the uniform title entry to avoid confusing users will cause the OPAC to lose its helpful collocation functionality. Some libraries studied use the term "uniform title" as a display label. Some libraries use "other title" as a display label. Some libraries display this entry under the label "title" along with the title proper (title in the 245 field). None of the above-mentioned arrangements are ideal.

The display labels for subject headings provided by each library were very similar. Most academic libraries in the United States use the Library of Congress subject headings and the medical subject headings as the thesauri for subject entries. Specifying the thesauri for headings on OPACs with acronyms like "LCSH" and "MESH" is of no help to users, because these thesauri do not clarify anything that would assist users in their research. Figure 3 lists the display labels used by libraries in the study.

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## The second-tier elements

The elements in the second tier include the physical description, notes, related authors, and related titles. This is an area where mapping bibliographic elements onto proper display labels is difficult. This area was also not managed well by the libraries studied.

Unlike first-tier elements in which one element usually corresponds to a unique display label, second-tier elements exhibit two patterns in the OPACs examined: many-to-one and one-to-many. That is, multiple categories of data (of different MARC fields) can be represented by one display label, e.g., incorporating physical description, numbering notes, and publication numbering into “description” (many-to-one). On the other hand, one display label can represent one single, repeatable bibliographic element (the same MARC field repeated many times), e.g., multiple general notes (one-to-many). Both arrangements (one-to-many and many-to-one) can result in a simpler, cleaner public display, since some descriptive elements are self-explanatory and users can get by without specific display labels supplied. The disadvantage of these arrangements is that the level of specificity of public displays is compromised. Some important descriptions can be easily missed if they are clustered in a group of elements. For bibliographic elements that are not self-explanatory, this type of arrangement can fail to convey useful information, or even worse, deliver inaccurate or vague information. For example:

- Description:** v. : ill. ; 28 cm (physical description, MARC 300 field)
- Report year ends Mar. 31. (numbering note, MARC 515 field)
- '77- (publication span, MARC 362 field)
- Published:** Philadelphia : Robert Morris Associates, 1977- (imprint, MARC 260 field)
- '77- (publication span, MARC 362 field)
- Annual (frequency, MARC 310 field)

The numbering field (field 362) is defined to describe a serial publication’s chronological or numerical publication extent. Carelessly placing data like “’77-” under labels such as “description” or “published” is very unclear. In fact, it is inaccurate because “’77-” is the publication span, not the publication date. Without a proper

label, it is difficult to convey this information to users. Some libraries we studied used such labels as “publication history,” “publishing history,” “publication dates,” or “volume/date range” to describe the publication span. This practice is misleading (see appendix E).

Names like coauthors, editors, cast members, performers, related corporate names, or meeting names of people who contributed to or were involved in the creation of the work are considered secondary contributors. Using one label to cover the various roles (author, editor, composer, etc.) is the practice most libraries have adopted. Like the primary author field, this element represents a variety of roles depending upon the type of manifestation. Some OPACs used one display label to cover all related personal names, corporate names, and meeting names (see appendix F).

Most libraries failed to supply a proper label for a secondary name when it was entered with a related title. This so-called “name-title added entry” is provided to collocate materials under the same author and title in the catalog. Ideally, the name-title combined element, provided with redirect functionality via hyperlink, should perform an author-title combination search for exact retrieval. Most OPAC systems could only perform either an author or a title search. The search results were unsurprisingly irrelevant, because they did not utilize both elements of the name-title added entry to produce results that were sufficiently specific: users would get only a list of authors or a list of titles instead of an author-title combination entry list. Some libraries presented this type of element only as an unhyperlinkable note, which defeats the purpose of having such data available.

Handling series for OPAC displays is also challenging. The majority of OPACs studied did a poor job in this area. In general, a series title transcribed from the resource also functions as an access element if the transcribed title is the same as the established one in the authority file. When the transcribed series title is different from the established series title, ideally the transcribed series title should only be accessible via the library system’s cross-references feature, which then directs users to bibliographic records that contain the established entry. This type of descriptive element is not meant to be displayed on the OPAC. The OPACs examined used the labels listed in figure 4 to handle transcribed and established series entries. Labels listed in the same row were taken from the same OPAC.

As can be seen, users are not expected to know the difference between a “series statement” and a “series.” In many cases, these two elements are identical due to the vendor authority control process.<sup>20</sup> This could confuse the user, especially when both elements are displayed right next to each other.

### The third-tier elements

The third-tier elements consist of linking fields (MARC 7XX fields) and electronic location and access fields (MARC 856 field). The linking fields are used mostly in serial bibliographic records. Their purpose is to link the title being described to its related publications, e.g., supplements, translations, preceding titles, or succeeding titles. Elements in this category should be displayed and linked directly to the related record via control numbers provided in the bibliographic record. If the catalog does not have the related record, a clear message should indicate this to the user. Unfortunately, many libraries do not display all the linking entries. None of the OPACs studied offered direct link functionality. Instead, what was usually offered was a redirect feature via hyperlink that prompted the system to issue a new author or title search. The direct link functionality via record control numbers was never made available. If the library did not have the related entry, the OPAC system simply took the user back to the original entry—a very confusing design flaw.

To ease the user's access to Internet resources, the electronic location and access element (MARC 856 field) was defined for catalogers to record the Internet location of the resource being described and its related information. By clicking the hyperlinked element on an OPAC, users seamlessly get to the desired electronic document site. The URL specified in the field might link to full-text documents, the table of contents, the document abstract, the publisher's description, or the author's biographical information. A label that fits all types of materials is crucial. The bibliographic elements displayed under the label should also be carefully managed. Under the label, some libraries displayed the type of resource (e.g., table of contents). Other libraries displayed the HTTP URL only. Some libraries displayed both the type of resource and the HTTP URL (see figure 5). As for the location of the label in the OPAC record, we found that the location of the URL link depended on the OPAC in which it appeared: In some OPACs, links were located at the top

of records; in others, they appeared in the middle or at the bottom. We found that the location of the link was not terribly critical, provided that the label was prominent and the display text understandable.

### The order of the bibliographic elements display

The way bibliographic data is organized in each OPAC record, together with display labels, helps users to quickly identify library resources. Although each library can locally choose the arrangement of bibliographic data displayed on its OPAC, most libraries prefer to place the citation information (author, title, publication) ahead of other elements. The sequence of the other elements exhibited enormous variation in the OPACs studied. Some libraries placed the electronic access element above all other data (SUNY Buffalo); some libraries placed local holdings information, call number, and item availability in the middle of the bibliographic record. Arrangements were clearer and more understandable when provided with clear labels and a distinct layout between the local holdings information and bibliographic data. Problems arose when second-tier elements were mingled with first-tier elements and when they shared the same display label. See example in figure 6.

In this example, two titles are displayed under the "title" label. The first title, "RMA annual statement studies," is the full title (MARC field 245) of the publication. The second title, "RMA annual statement studies: Industry default probabilities and cash flow measures," is the title of the resource's related publication (MARC field 730), which normally is considered a second-tier element and should be placed farther from the title proper with a clear label. Since the display order of bibliographic elements is completely customizable, we found in our study that few libraries put enough effort into providing clear bibliographic displays. More importantly, records in different formats (e.g., monographs, serials, music materials, video recordings) were not given equal attention. Some labels and data sequences might work for one format, but not another.

### Utilization of bibliographic data

Another factor that has an effect on the usability of an OPAC is the utilization of bibliographic data. Two issues are addressed in terms of utilization of bibliographic data: (1) the completeness and suitability of the metadata displayed on an OPAC, and (2) the extent of repurposing the bibliographic data and creating added value to an OPAC.<sup>21</sup>

A typical bibliographic record contains descriptive data, access data, and admin-

Label for transcribed element	Label for established element
Series Statement	Series
Series Statement	Series indexed as
Other Series	Series
Series note	Series
Description	Series

Figure 4. Display labels for series

istrative data. Descriptive data is provided to describe the manifestation cataloged and is considered of interest to the public. Access data is entered and indexed for retrieval. Administrative data is used for setting up search limits (e.g., limit by language, format) and pulling statistics (e.g., how many titles in Spanish). It is most useful for internal, administrative use. Librarians must be careful when deciding whether such data elements will be displayed.

In terms of the completeness and the suitability of metadata in the OPAC display, the authors discovered the following in the OPACs studied:

1. Many libraries' OPACs displayed control numbers, such as the OCLC control number (the 035 field), the LC control number (010 field), and other local system control numbers. This type of information is usually of no interest to the public. See example in figure 7. In this example, the numbers listed under the label "Wln #" represent different types of system control numbers, which are of no concern to users and therefore should not be displayed.
2. Some OPACs displayed bibliographic data from the leader fields of the cataloging record. MARC leader fields are a group of fixed-length codes that represent the type of resource (monograph, serial, or musical score) and material format (print, electronic, or sound recording). The information could be helpful for patrons if they are displayed with the proper label on the OPAC. Libraries that chose to display the leader data on their OPACs did not do a good job of making the information clear to users. For example, one library listed "journals and newspapers," "computer file," "serial," "book," "e-resource," and "gov publication" under the label "record type" (see figure 8). Seeing so many record types under one label can easily confuse library users.
3. Some libraries omitted certain crucial variable fields, e.g., the linking entry complexity note (field 580, containing information about title history), related title access entries (fields 730 and 740, containing related titles), and linking entries (linking the record to other bibliographically related records, e.g., 76X, 77X, and 78X fields). These fields are defined with a clear purpose and should

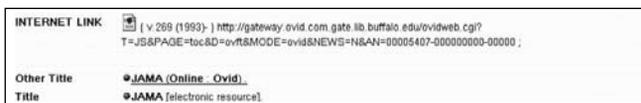


Figure 5. Online OPAC record from SUNY Buffalo

be carefully considered for public display with clear labels. Some libraries in our study displayed them but left other irrelevant information on the OPAC, which clutters the display with information that does not help users. See example in figure 9.

In this example, under the label "related publication," the French version and the Spanish version of *JAMA* are displayed. In addition to the French title and the Spanish title, the MARC 21 language code and its corresponding ISSN are also displayed. The language code and the eight-digit ISSN number—since no separate label is provided for them—are confusing.

4. The linking elements not only should be displayed on the OPAC, but should also be hyperlinkable. They ought to be used to link to related bibliographic records. In an online environment, this sort of field can also function as a descriptive element. Some OPACs displayed linking entries but did not enable hyperlink functionality. Some libraries displayed two instances of them, one as a descriptive element and the other as a linking element with hyperlink capability.

Another important aspect of making use of bibliographic data is repurposing the bibliographic data to provide added value to OPACs. Lorcan Demsey mentions frequently in his blog that in order to sustain library value, libraries should "make data work harder." He points out that "libraries have invested a great deal in bibliographic data—yet it has remained somewhat inert in our catalogs, failing to release the value of the investment."<sup>22</sup> These rich data can be better utilized for different purposes, including designing an enhanced OPAC. Lavoie, et al. described further in their recent article about data mining:

As more activities move into networked spaces, more areas of our lives are shedding data. This data is increasingly being mined for intelligence that drives services. . . . [C]ompanies like Amazon repurpose data to create added value. This is a lesson librarians must learn if they want to improve their own visibility and value in increasingly crowded digital information spaces where users, as always, want good results without too much time or effort. . . . The good news is that libraries don't come to this task empty-handed but with

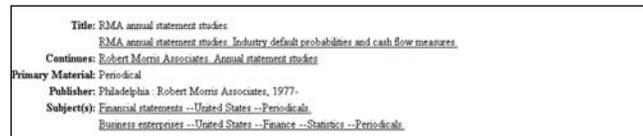


Figure 6. Online OPAC record from the College of New Jersey

rich, structured information about the materials in our collections.<sup>23</sup>

Tim O'Reilly highlighted in his article the successful example of how Amazon reutilizes data:

Amazon relentlessly enhanced the data, adding publisher-supplied data such as cover images, table of contents, index, and sample materials. Even more importantly, they harnessed their users to annotate the data, such that after ten years, Amazon, not Bowker, is the primary source for bibliographic data on books, a reference source for scholars and librarians as well as consumers. . . . Effectively, Amazon "embraced and extended" their data suppliers.<sup>24</sup>

All OPACs reviewed in the study operate within the traditional vendor-supplied module. This long-established approach gives libraries limited flexibility to customize the search key options, search results displays, restricted sorting options, and pre- and post-search limit options of their OPACs. Unfortunately, libraries can do very limited data mining inside the vendor's hard-coded framework. Many valuable metadata are buried in the bibliographic database. System vendors have failed to make the most of technology to better utilize data. Very few libraries have thought outside the box and taken advantage of the existing rich bibliographic data. The emergence of North Carolina State University's Endeca-powered OPAC was a good example of repurposing data

<b>Wtn #</b>	1124917 (Sirsi) I82643544 (WaOLN)1364692 (OCoLC)1124917 (DNLM)J03340000(s)
<b>Phys desc</b>	v. : ill., ports. ; 28 cm.
<b>Frequency</b>	Four issues per month <, Mar. 21, 1980->
<b>Subject</b>	<a href="#">American Medical Association -- Periodicals.</a> <a href="#">Medicine -- Periodicals.</a> Medicine -- periodicals.

**Figure 7.** Online OPAC record from the University of Washington.

<b>Publication dates</b>	Print began in 1996.
<b>Notes</b>	<b>Report</b> covers fiscal year.
<b>Notes</b>	Description based on: Fiscal year 2002; title from title screen (viewed Dec. 12, 2006)
<b>Subject</b>	<ul style="list-style-type: none"> <li>● <a href="#">Judicial statistics -- United States -- Periodicals.</a></li> <li>● <a href="#">Criminal statistics -- United States -- Periodicals.</a></li> </ul>
<b>Record Type</b>	Journals and Newspapers Computer file Serial Book E-Resource Gov Publication i ixi

**Figure 8.** Online record from SUNY Buffalo

and creating value-added information.

The data facets used on NCSU's single search-and-browse combined OPAC interface are pulled and repurposed from their Sirsi/Dynix database. As one might have expected, eight of the eleven facets are extracted from the library's MARC bibliographic records ("availability" and "browse: new" are from item records). Out of the eight facets, four are extracted from subject headings; two are from the fixed fields; one is from the call number field and one from the variable fields of the bibliographic record.<sup>25</sup>

## Discussion and recommendation

Based on the authors' findings above, the following are the primary factors that have contributed to the ineffectiveness of the OPACs offered by today's academic libraries.

### 1. System limitations

The inadequacy of today's ILS has been a known problem. Inflexible search options make library catalogs difficult to use. Despite the fact that some vendors diligently enhance their systems' functionalities, overall performance is still disappointing. Karen Markey pointed out in a recent article that one of the reasons why the solutions recommended by researchers in the 1990s were not applied to online library catalogs was "the failure of ILS vendors to monitor shifts in information-retrieval technology and respond accordingly with system improvements."<sup>26</sup> Antelman et al. observed similarly that

all major ILS vendors are still marketing catalogs that represent second-generation functionality. Despite between-record linking made possible by migrating catalogs to Web interfaces, the underlying indexes and exact-match Boolean search remain unchanged. It can no longer be said that more sophisticated approaches to searching are too expensive computationally; they may, however, be too expensive to introduce into legacy systems from a business perspective.<sup>27</sup>

Since ILS vendors first introduced their products back in the 1980s, user behavior and expectations have changed immensely. While libraries have started to

	Other editions available: <a href="#">JAMA</a> French. <a href="#">JAMA</a> , and: <a href="#">JAMA en Español</a> .
<b>Description</b>	v. : ill., ports. ; 28 cm.
<b>Frequency</b>	Four issues per month <, Mar. 21, 1980->
<b>Numbering</b>	Vol. 173, no. 9 (July 2, 1980)-
<b>Related publication</b>	<a href="#">JAMA</a> French. <a href="#">JAMA</a> fre 0221-7878 <a href="#">JAMA en Español</a> spa 0211-4445

**Figure 9.** Online OPAC record from the University of Michigan.

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recognize the changes and are working hard toward meeting the needs of multiple generations of users, little can be done if ILS products still operate within the same old-fashioned information-retrieval structure. Because ILS vendors have failed to revamp their OPAC modules to meet user needs, libraries have been forced to seek other options. North Carolina State University is one of the first libraries to exercise its options. Its new OPAC system, powered by Endeca (operated on the Sirsi/Dynix platform), has shown remarkable improvements in ease of use, which usability tests have verified. Recently, two ILS vendors (Innovative and Ex Libris) have been in the process of developing new OPAC modules using new technology and a new approach in data mining.

## **2. Libraries are not fully exploiting the functionality already made available by ILSs**

Unsurprisingly, the OPACs examined by the authors, if powered by the same vendor, showed similarities in general layout and interface features. During the study, it soon turned out to be easy for the authors to recognize the ILS system of each OPAC. As mentioned previously, we expected OPACs to vary somewhat. What was unexpected was the huge differences in, among other things, interface layout, search options and search languages, behind-the-scenes search algorithms, search results displays, display labels and the corresponding bibliographic data, and what data was chosen for display. The disparities that we found in these features suggested that there had been great differences in the amount of attention, energy, and time devoted by each library to designing its OPAC. Some libraries took advantage of available features and made better use of them than others. (See appendix G for examples of best practices of library OPACs.) Many libraries did only the very minimum. While we recognize that academic library OPACs are difficult to use, we also need to recognize that some libraries do not fully exploit existing resources, thereby exacerbating the difficulty of using their OPACs.

## **3. The unsuitability of MARC standards to online bibliographic display**

As previously mentioned, AACR and MARC were initially designed for card catalogs without display labels in mind. Many MARC fields can be used for multiple purposes. Providing labels that properly fit all the cataloging data needed to cover all types of resources is nearly impossible. From the OPACs studied, some libraries used vague labels in an effort to encompass as many circumstances as possible. Some libraries used labels suitable only for certain formats, but not all formats. Neither approach is satisfactory. The solution has to come from cataloging and metadata standards. Wool identified this issue back in the 1990s:

The interchangeability of descriptive data elements and access points (since each can be made to serve both functions online) makes the separate creation of description and headings seem pointless and burdensome. Labeling of data elements (made possible through the mapping of terms to MARC fields) creates a need for simpler, less ambiguous bibliographic data definitions than are appropriate for the dense and context-rich narrative-style records catalogers continue to create . . .

Cataloging standards will need to be rewritten in order to provide the kind of data flexibility expected in online systems . . . records flexible enough to be added to, subtracted from, and rearranged without loss and garbling of meaning. What is needed is a modular record structure, in which every segment of data can stand on its own with appropriate labeling and which can support all possible display lengths and combinations of data elements.<sup>28</sup>

A decade later, not much progress has been made in improving cataloging and metadata standards for online display. While enhancing cataloging and metadata standards for better retrieval is desirable, making the standards more complicated and difficult to adopt in order to accommodate OPAC displays is not. As librarians are working to simplify cataloging, our essential rich metadata should not be sacrificed. One possible solution is to have the system recognize the existence of certain subfields and produce specific display labels accordingly. This certainly will not solve all the issues with regard to display labels. Regardless, there is much room for improvement, and librarians' attention in this area is critically needed.

## **Conclusion**

The information-seeking world has entered an era of self-service. Roy Tennant described well the self-service trend: "I wish I had known that the solution for needing to teach our users how to search our catalog was to create a system that didn't need to be taught."<sup>29</sup> Tim O'Reilly also indicated in his article "What is Web 2.0" that "the Web 2.0 lesson [is to] leverage customer-self service and algorithmic data management to reach out to the entire web, to the edges and not just the center, to the long tail and not just the head." He also argued that "[t]rusting users as co-developers" is one of the core competencies of Web 2.0 companies.<sup>30</sup> Academic libraries should aim toward designing a user-centered, self-sufficient, twenty-first-century online catalog that fits the Web 2.0 model. The ultimate goal is that users will be comfortable and confident using library OPACs for their information needs wherever a computer

is available and without special training.

As Campbell and Fast have trenchantly asked, "Are we witnessing a major disruption, a large-scale redefinition of information design and delivery so radically different from the traditional library environment that it renders irrelevant all our experience in bibliographic control?"<sup>31</sup> This remains an open question. Regardless, a new generation of OPACs will need to be in place soon. Much needs to be done to make academic library OPACs matter. Academic librarians cannot afford to be considered irrelevant in the information-seeking world. The future of academic libraries relies on effective OPACs. This is one of the most pressing tasks that must be accomplished.

## References and notes

1. Cathy De Rosa et al., *Perceptions of Libraries and Information Resources: A Report to the OCLC Membership* (Dublin, Ohio: OCLC, 2005), 1–17. <http://www.oclc.org/reports/2005perceptions.htm> (accessed Jan. 20, 2007).

2. Karen Coyle and Diane Hillmann, "Resource Description and Access (RDA): Cataloging Rules of the 20th Century," *D-Lib Magazine* 13, no. 1/2 (2007). <http://www.dlib.org/dlib/january07/coyle/01coyle.html> (accessed Feb. 3, 2007).

3. Anna M. Van Scoyoc and Caroline Cason, "The Electronic Academic Library: Undergraduate Research Behavior in a Library Without Books," *Portal: Libraries and the Academy* 6, no. 1 (2006): 47–58.

4. Carol Tenopir, "User and Users of Electronic Library Resources: An Overview and Analysis of Recent Research Studies," Council on Libraries and Information Resources, 2003. <http://www.clir.org/pubs/reports/pub120/pub120> (accessed Jan. 20, 2007).

5. Cathy De Rosa et al., *The 2003 OCLC Environmental Scan* (Dublin, Ohio: OCLC, 2003), <http://www.oclc.org/reports/escan/introduction/default.htm> (accessed Jan. 20, 2007).

6. D. Grant Campbell and Karl V. Fast, "Panizzi, Lubetzky, and Google: How the Modern Web Environment Is Reinventing the Theory of Cataloguing," *The Canadian Journal of Information and Library Science* 28, no. 3 (2004): 25–38.

7. Roy Tennant, "Breaking Library Services Out of the Box," Presentation (2005), <http://www.cdlib.org/inside/news/presentations/rtennant/2005netspeed/> (accessed Feb. 11, 2007); Andrew Pace, "My Kingdom for an OPAC," *American Libraries Online* (Feb. 2005), <http://www.ala.org/ala/online/techspeaking/2005columns/techFeb2005.cfm> (accessed Feb. 11, 2007); Karen G. Schneider, "How OPACs Suck, Part 1: Relevance Rank (Or the Lack of It)," *ALA TechSource Blog* (Mar. 13, 2006), <http://www.techsource.ala.org/blog/2006/03/how-opacs-suck-part-1-relevance-rank-or-the-lack-of-it.html> (accessed Feb. 11, 2007); Karen G. Schneider, "How OPACs Suck, Part 2: The Checklist of Shame," *ALA TechSource Blog* (Apr. 3, 2006), <http://www.techsource.ala.org/blog/2006/04/how-opacs-suck-part-2-the-checklist-of-shame.html> (accessed Feb. 11, 2007); "How OPACs Suck, Part 3: The Big Picture," *ALA TechSource Blog* (May 20, 2006), <http://www.techsource.ala.org/blog/2006/05/>

[how-opacs-suck-part-3-the-big-picture.html](http://www.techsource.ala.org/blog/2006/05/how-opacs-suck-part-3-the-big-picture.html) (accessed Feb. 11, 2007); Lorcan Dempsey, *Lorcan Dempsey's Weblog* (Oct. 4, 2005), <http://orweblog.oclc.org/archives/000815.html> (accessed Feb. 11, 2007); Kristin Antelman, Emily Lynema, and Andrew K. Pace, "Toward a Twenty-First Century Library Catalog," *Information Technology and Libraries* 25, no. 3 (2006): 128–139.

8. Roy Tennant, "Libraries Through the Looking-Glass," 2004 ALA Midwinter Endeavor presentation. <http://www.cdlib.org/inside/news/presentations/rtennant/2004ala/> (accessed March 16, 2007).

9. Charles Ammi Cutter, *Rules for a Printed Dictionary Catalogue* (Washington, D.C.: Government Printing Office, 1876).

10. D. Grant Campbell and Karl V. Fast, "Panizzi, Lubetzky, and Google: How the Modern Web Environment Is Reinventing the Theory of Cataloguing," 31.

11. Holly Yu and Margo Young, "The Impact of Web Search Engines on Subject Searching in OPAC," *Information Technology and Libraries* 23, no. 4 (2004): 194.

12. Jakob Nielsen, "Mental Models for Search Are Getting Firmer," in *Jakob Nielsen's Alertbox*, <http://www.useit.com/alertbox/20050509.html> (accessed Feb 20, 2007).

13. Eng Pwey Lau and Dion Hoe-Lian Goh, "In Search of Query Patterns: A Case Study of a University OPAC," *Information Processing and Management* 42, no. 1 (2006): 1316–1329.

14. Holly Yu and Margo Young, "The Impact of Web Search Engines on Subject Searching in OPAC," 173.

15. Dinét Jérôme, Favart Monik and Passerault Jean-Michel, "Searching for Information in an Online Public Access Catalogue OPAC: The Impacts of Information Search Expertise on the Use of Boolean Operators," *Journal of Computer Assisted Learning* 20, no. 5 (2004): 338–346.

16. Gregory Wool, "The Many Faces of a Catalog Record: A Snapshot of Bibliographic Display Practices for Monographs in Online Catalogs," *Information Technology and Libraries* 15, no. 3 (1996): 184.

17. The fifteen libraries are located at The College of New Jersey, Library of Congress, Northwestern University, Princeton University, State University of New York at Buffalo, Temple University, University of Arizona, University of Florida, University of Illinois–Urbana-Champaign, University of Michigan, University of Minnesota, University of Rochester, University of Texas–Austin, University of Washington, and Vanderbilt University.

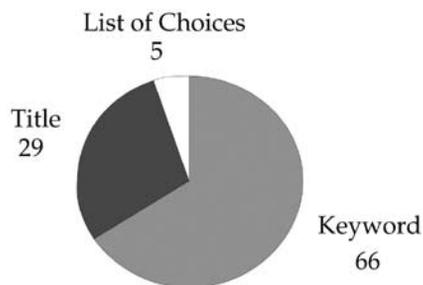
18. Gregory Wool, "The Many Faces of a Catalog Record: A Snapshot of Bibliographic Display Practices for Monographs in Online Catalogs," 173–195.

19. Eight titles representing monograph, serial, video recording, and sound recording were used to study the effectiveness of the bibliographic display. The eight titles are:

- (1) *To love the wind and the rain: African Americans and environmental history*, edited by Dianne D. Glave and Mark Stoll. University of Pittsburgh Press, 2006. (Monograph)
- (2) *To kill a mocking bird*, by Harper Lee (Monograph)
- (3) *RMA annual statement studies*, Robert Morris Associates, 1977- (Serial)
- (4) *Sideways* (20th Century Fox, 2004) (Video recording)
- (5) *Chamber music* (Newport Classic, 2000) (Sound recording)
- (6) *End of summer book of hours*; Bright music, Naxos, 2003 / by Ned Rorem (Sound recording)
- (7) *JAMA: the journal of the American Medical Association*, 1960- (Serial)

- (8) *The 21st century at work*, by Lynn A. Karoly (Rand, 2004) (Mongraph)
20. Many vendors retag the 440 field to 490 in bibliographic record and create an 830 field based on the contents of the 440 field. The series title in the 830 field receives authority control. Many libraries prefer not to restore the 830 field back to the 440 fields causing the duplicate series statements on OPAC if both fields are displayed.
21. Lorcan Dempsey, "Making Data Work—Web 2.0 and Catalogs."
22. Ibid.
23. Brian Lavoie, Lorcan Dempsey, and Lynn Silipigni Conaway, "Making Data Work Harder," *Library Journal.com* (Jan. 15, 2006), <http://www.libraryjournal.com/article/CA6298444.html> (accessed Jan. 28, 2006).
24. Tim O'Reilly, "What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software," (Sept. 30, 2005), <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html> (accessed Jan. 28, 2007).
25. Tito Sierra, "A Faceted Interface to the Library Catalog," ALA 2007 Midwinter Meeting, <http://www.lib.ncsu.edu/endeca/presentations.html> (accessed Feb. 11, 2007).
26. Karen Markey, "The Online Library Catalog: Paradise Lost and Paradise Regained?" *D-Lib Magazine* 13, no.1/2 (2007). <http://www.dlib.org/dlib/january07/markey/01markey.html> (accessed Feb. 11, 2007).
27. Kristin Antelman, Emily Lynema, and Andrew K Pace, "Toward a Twenty-First Century Library Catalog," 129.
28. Gregory Wool, "The Many Faces of a Catalog Record: A Snapshot of Bibliographic Display Practices for Monographs in Online Catalogs," 184–185.
29. Roy Tennant, "Lipstick on a Pig," *Library Journal.com* (Apr. 15, 2005), <http://libraryjournal.com/article/CA516027.html> (accessed Feb. 11, 2007).
30. Tim O'Reilly, "What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software."
31. D. Grant Campbell and Karl V. Fast, "Panizzi, Lubetzky, and Google: How the Modern Web Environment Is Reinventing the Theory of Cataloguing," 26.

## Appendix A. Default search keys used by ARL libraries (as of March 2007)



## Appendix B. Keyword search keys used by Voyager libraries

### Keyword (Relevance)

- Keyword with relevance ranking
- Keyword Anywhere (user "" for phrase)
- Keyword Anywhere (Relevance ranked)
- Keyword Anywhere
- Words Anywhere
- Basic Keyword
- Any word anywhere
- Relevance Keyword (User + for key terms)
- Keyword Phrase
- Keyword
- Keyword (Results sorted by relevance)
- Keyword
- Keyword
- Ranked Keyword

### Keyword (Boolean)

- Keyword (enclose phrases "in quotes")
- Keyword Combined (use and/or/not " " for phrase)
- Keyword (and or not)
- Advanced Boolean
- Keyword Boolean
- Keyword(s) (user AND, OR, Not, or "a phrase")
- Boolean search (use and or not)
- Command Keyword
- Keyword (use "And" "Or" "Not")
- And Or Not( Keyword Boolean)
- Expert Keyword
- Keyword Expert (user an or not "phrase")
- Command
- Keyword

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Keyword (Ranked by relevance)

Keyword

Find all words

Keyword (Quick search)

Keyword

Command Search

Search for a phrase

Boolean Search

## Appendix C. Default keyword search help page provided by Voyager system

### Keyword Search

- Enter words and/or phrases
- Use quotes to search phrases: "world wide web"
- Use + to mark essential terms: +explorer
- Use \* to mark important terms: \*internet
- Use ? to truncate (cut off) words: theat? finds theaters, theatre, theatrical, etc.
- Do not use Boolean operators (AND, OR, NOT) to combine search terms

### Boolean

- Use the Boolean terms (and, or, not) to combine search terms.
- Use quotation marks to search for a phrase, e.g., "United States"
- Use ? to truncate a word, e.g., browser?
- Use parentheses to group search terms, e.g., (automobile or car) and repair

## Appendix D. Display labels for entries of principal responsibility

### MARC Fields

Libraries	100 (personal name)	110 (Corporate name)	111 (Meeting name)
U. of Arizona	Author	Author	Author
U. of Ill.	Author	Author	Conference
LC	Personal Name	Corporate Name	Meeting Name
U. of Minnesota	Author	Author	Author
U. of Michigan	Author	Author	Author
Northwestern U.	Author, etc.	Author, etc.	Author, etc.
Princeton U.	Author/Artist	Author/Artist	Author/Artist
U. of Washington	Author	Author	Author
SUNY Buffalo	Author	Author	Author
Temple	Author	Corp Author	Conference
U. of Florida	Author, etc.	Author, etc.	Author, etc.
U. of Rochester	Main Author	Main Author	Conference
UT Austin	Author	Corporate author	Conference
TCNJ	Principal author	Principal author	Conference name
Vanderbilt U.	Author	Corporate author	Meeting/Event name

## Appendix E. Display labels for publication extent

Libraries	MARC 362 field
U. of Arizona	Issued
U. of Ill.	Publication history
LC	Description
U. of Minnesota	Published
U. of Michigan	Pub History
Northwestern U.	Extent of publication
Princeton U.	Description
U. of Washington	(Suppressed from OPAC)
SUNY Buffalo	Publication dates
Temple	Publication Started
U. of Florida	Publishing history
U. of Rochester	(Suppressed from OPAC)
UT Austin	Publication coverage date
TCNJ	Description
Vanderbilt U.	Volume/date range

## Appendix F. Display labels for entries of secondary responsibility

Libraries	MARC Fields		
	700 (Personal name)	710 (Corporate name)	711 (Meeting name)
U. of Arizona	Other Auth	Other Auth	Other Auth
U. of Ill Champaign	Other Name	Other Name	Other Name
LC	Related Names	Related Names	Related Names
U. of Minnesota	Contributor	Contributor	Contributor
U. of Michigan	Contributors - People	Contributors - Other	Contributors - Other
Northwestern U.	Other authors, title, etc.	Other authors, title, etc.	Other authors, title, etc.
Princeton U.	Related name(s)	Related name(s)	Related name(s)
U. of Washington	Alt author	Alt author	Alt author
SUNY Buffalo	Contributors	Contributors	Contributors
Temple	Other author(s)	Other author(s)	Other name
U. of Florida	Other author(s), etc.	Other author(s), etc.	Other author(s), etc.
U. of Rochester	Other Author(s)	Other Author(s)	Other Author(s)
UT Austin	Added author	(Not Display)	(Not Display)
TCNJ	Other Contributor(s)	Other Contributor(s)	Conference name
Vanderbilt U.	Author, editor, etc.	Corporate author	Meeting/Event

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## Appendix G. Examples of best practices of OPACs (accessed July 16, 2007)

Search interface, including retaining search keys and searched terms	University of Notre Dame	<a href="http://alephprod.library.nd.edu:8991/F/?func=find-b-0&amp;local_base=ndu01pub">http://alephprod.library.nd.edu:8991/F/?func=find-b-0&amp;local_base=ndu01pub</a>
Keyword searching ability	Michigan State University	<a href="http://magic.msu.edu/search~/X">http://magic.msu.edu/search~/X</a>
Facets browsing (Endeca)	North Carolina State University	<a href="http://www.lib.ncsu.edu/catalog">http://www.lib.ncsu.edu/catalog</a>
	McMaster University	<a href="http://libcat.mcmaster.ca">http://libcat.mcmaster.ca</a>
Make author, subject and call number links more accessible	University of Virginia	<a href="https://virgo.lib.virginia.edu/uhtbin/cgisirsi/0/UVA-LIB/0/60/1180/X">https://virgo.lib.virginia.edu/uhtbin/cgisirsi/0/UVA-LIB/0/60/1180/X</a>
Links to Amazon ratings	Ohio State University	<a href="http://library.ohio-state.edu/search">http://library.ohio-state.edu/search</a>
Direct export to RefWorks	Johns Hopkins University	<a href="https://catalog.library.jhu.edu/ipac20/ipac.jsp?profile=default#focus">https://catalog.library.jhu.edu/ipac20/ipac.jsp?profile=default#focus</a>
	University of Chicago	<a href="http://libcat.uchicago.edu/ipac20/ipac.jsp?profile=ucpublic">http://libcat.uchicago.edu/ipac20/ipac.jsp?profile=ucpublic</a>
Cover art/TOC/Summary/Review	Indiana University	<a href="http://www.iucat.iu.edu/authenticate.cgi?status=start">http://www.iucat.iu.edu/authenticate.cgi?status=start</a>
Guesstimate/del.icio.us persistent link enabled	Virginia Tech	<a href="http://addison.vt.edu">http://addison.vt.edu</a>