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Mutilation of library materials has been a perennial problem since the inception of libraries (Aungerville 1907; Thompson 1968, Almagro 1985). When mutilated materials are discovered, librarians have several options. They can repair, replace, or discard mutilated materials. They can ignore the mutilation and return the material to the collection, or they can restrict future access to the material by placing it in a special collection.

At East Carolina University’s Joyner Library, we too are confronted with our share of mutilated material. However, we were especially concerned with the mutilation we discovered in art-related books, particularly the N and TR Library of Congress (LC) classification areas. In order to learn how other libraries deal with mutilated art materials, we surveyed academic institutions in the United States that are also members of the Association of Research Libraries (ARL) about their procedures with art materials. In this article, we describe the situation at Joyner Library that prompted the survey. We also discuss the survey and its results. Finally, we summarize the findings and suggest areas for further research.

East Carolina University (ECU) is one of 16 universities that form the University of North Carolina System. Student enrollment at ECU tends to fluctuate between 17,000 and 18,000 students. This figure includes approximately 2,500 graduate students and 300 students pursuing their...
first professional degree. More than 1,000 faculty members are affiliated with the university.

ECU houses two distinct campuses. The first is the original campus that contains many of the administrative offices and the programs affiliated with the Academic Affairs Division. Joyner Library supports the programs of this division, including the schools of Art, Business, Education, Health and Human Performance, Human Environmental Sciences, and Industry and Technology, as well as 17 departments and 7 interdisciplinary programs of the College of Arts and Sciences. Joyner's branch Music Library supports the School of Music. The second campus houses the Health Sciences Division, which administers the medical school and allied health programs. The Health Sciences Library provides services to the Health Sciences Division.

ECU's School of Art is nationally recognized for its strong arts program. The school is accredited by the National Association of Schools of Art and Design (NASAD), the National Council for Accreditation of Teacher Education (NCATE), and the North Carolina Department of Public Instruction. Approximately 550 undergraduate and 35 graduate students are enrolled in art programs such as art education, art history, metal design, painting, and sculpture. Currently, 43 faculty members teach in the School of Art. The school has a media center that houses a large slide collection, a small videocassette collection, and a limited collection of books and periodicals. Most printed art materials are housed in Joyner Library. At the present time, Joyner has just over a million volumes. With few exceptions, the art collection (approximately 30,000 volumes) is shelved in open stacks with other circulating materials. Joyner's art books are heavily used, not only by art students, but also by students in a variety of subjects such as literature, education, and history. Unfortunately, our automated system does not allow us to compare the circulation of art materials to that in other subject areas. However, it is generally accepted that art materials are well used. Given the usage and the nature of many art books (beautiful plates as well as black-and-white and color illustrations), it is not surprising that art materials become mutilated.

In 1993 Joyner Library created the Preservation and Conservation Department to assess the condition of the library's collections and to develop a systematic program for protecting and repairing the library's holdings. Before this department was created, identifying and repairing mutilated books was handled by several units on an ad hoc basis and included such activities as tipping in replacement pages obtained through interlibrary loan, taping torn spines, and preparing materials for commercial binding. The circulation staff presently discovers most mutilation when materials are returned or are picked up for reshelving in the library. When staff members discover a book with missing or mutilated pages, they insert a slip noting the problem and send the item to the Preservation and Conservation Department. Mutilated books are then placed on a shelf for subject librarians to review and recommend action to be taken, based on the book's value to the collection. As the process of reviewing books developed, it soon became apparent that art books are mutilated in ways that differ from mutilation in other subject areas. For instance, tearing out single, isolated pages or removing complete chapters or sections of books tend to be the typical ways in which non-art materials are mutilated. Although a nuisance, such mutilation can be dealt with simply by obtaining the missing pages through interlibrary loan and tipping them in or rebinding the book.

"Of all the manifold materials in a general research library, art books are probably the most vulnerable to destruction" (Samuel 1981, 141). Mutilation of art materials takes on a slightly different character than mutilation of books in other areas, perhaps because art books frequently contain numerous illustrations and photographs. It also appears to happen more frequently to art books than to materials in other subjects. Often patrons use razor blades or similar implements to cut out entire pages or specific pictures on part of
a page. When using a razor blade, the patron will frequently cut through several pages, thus mutilating many pages at once. Many of the missing or mutilated pages contain color illustrations or plates.

Replacing color pictures adds another dilemma to the process. If color illustrations are to be replaced, librarians must decide whether to pay the extra cost of color photocopies. Additionally, at our institution books must be borrowed through interlibrary loan and then transported to a color photocopier outside of the library. The situation becomes even more complex when mutilation is too extensive to add replacement pages in a cost-effective manner. Moreover, by the time such mutilation is discovered, the title is often no longer in print. We are faced with the choice of keeping an item with some, but limited, usefulness or withdrawing the item completely and then not having any of its information readily available to patrons. In some instances, Preservation and Conservation staff members check OCLC and make discard decisions based on the number and location of copies that might be available through interlibrary loan. If OCLC lists few holdings, the staff members keep the title no matter what its condition and make the book a higher priority for preservation treatment. While the title may be available from an out-of-print dealer, the cost will undoubtedly be high (Samuel 1981), which affects the library's ability to replace such titles.

**Literature Review**

We turned to the literature for assistance on how to deal with the special problems art materials presented. Although we found little that addressed our specific concerns, we did discover a variety of related materials in our search.

A number of researchers have investigated the problem of mutilated library materials. However, none appear to address the particular problems associated with the mutilation of art books. Griffin (1993) addresses the issue of conservation and preservation of materials in fine arts libraries, but does not mention mutilation at all. Samuel (1981) identifies mutilation as one of the special problems librarians face in preserving art materials; however, she does not provide much guidance for dealing with it. In an earlier article, Samuel (1978) outlines steps taken at New York University's Institute of Fine Arts to limit theft and mutilation. By describing a specific experience with mutilation, Reed (1991) alerts readers to the value of older art publications and warns that many libraries do not adequately protect their collections. Dane (1991) laments the paucity of library literature dealing with art mutilation, while Birney and Williams (1985) comment on the lack of research studies on mutilation in general. Others describe a particular incident or related incidents detailing the facts involving the theft of valuable art plates (Theft 1991).

Writing about art books, not general books, in libraries, Worman (1988) argues that removing plates from books can have benefits when the text of the book is readily available and the individual book itself is in poor condition. Saving plates and discarding the text can preserve the most valuable components of such books.

The common thread in the articles about mutilated art materials is that most offer opinions or provide basic information. The lack of research studies addressing mutilation of art materials is surprising considering the importance the profession has placed on conservation and preservation of materials in the past few decades (Dane 1991). The mutilation research that has been conducted has dealt with other types of materials. A number of these studies are discussed below.

According to many researchers, mutilation is a pervasive problem that occurs worldwide (Prasad 1968; Souter 1976; Nawe 1988; Msuya 1991; Adewoye 1992; Alemna 1992; Obiagwu 1992) and in all types of libraries: school (Marshall 1960; Baine 1993), public (Kamm 1995), academic (Mast 1983; Pedersen 1990; Lilly, Schloman, and Hu 1991), law (Richmond 1975; Edwards 1986), and medical (Culp 1976). Library materials of every category are vulnerable to mutilation (Ragains 1975; Richmond 1975; Weiss 1981; Edwards 1986; Ottesen 1988; Atwood and
Wall 1990). Also, mutilation is not a new phenomenon. Librarians have attempted to deal with the issue since libraries have been in existence (Thompson 1968; Almagro 1985). Most researchers addressing the issue of mutilation tend to examine why patrons mutilate materials (Hendrick and Murfin 1974; Souter 1976; Gouke and Murfin 1980; Baine 1983; Mast 1983; Lilly, Schloman and Hu 1991) or to examine the extent of periodical mutilation (Luke 1991; Schumm 1992; Constantinou 1995).

Presently, we are unable to pinpoint a specific cause for mutilation. Research suggests that a variety of elements play a role in patrons’ decisions to mutilate: negative attitudes toward the library (Hendrick and Murfin 1974), pressure to succeed academically (Weiss 1981; Varner 1984; Obiagwu 1992; Baine 1993), lack of concern for others (Souter 1976; Varner 1984; Pedersen 1990; Msuya 1991; Baine 1993), belief that they will not get caught or will suffer only minor penalties (Weiss 1981; Pedersen 1990; Obiagwu 1992), and lack of awareness of the costs involved in repairing or replacing damaged materials (Hendrick and Murfin 1974; Pedersen 1990; Obiagwu 1992) all contribute to the mutilation problem.

Library policies and practices themselves may inadvertently encourage mutilation. For example, lack of quality copiers has been cited as a possible contributor to the mutilation problem. Poor-quality copies, an inadequate number of copiers, and the lack of color photocopiers can create a situation in which patrons feel compelled to mutilate library materials (Hendrick and Murfin 1974; Samuel 1978; Msuya 1991). Library facilities (Dane 1991; Msuya 1991), inadequate collections (Obiagwu 1992), unaware staff (Dane 1991; Adewoye 1992), and restrictive borrowing privileges (Edwards 1986; Obiagwu 1992) can also increase the amount of mutilation that occurs.

Failure to educate patrons about the costs of mutilation (Gouke and Murfin 1974; Kesler 1977) and to enforce disciplinary action (Mast 1983; Kamm 1995) can also contribute to the problem. Additionally, Hendrick and Murfin (1974), as well as Gouke and Murfin (1980), report that patrons are more likely to mutilate an item that is already damaged than an item that is in perfect condition. Consequently, failure to identify and repair mutilated materials may lead to subsequent mutilation.

On the other hand, some writers suggest that mutilation is not a significant problem (Atwood and Wall 1990). Colliver (1990), for instance, contends that 60% of mutilated items are never used again and thus concludes that mutilation does not necessarily have a negative effect on service. Hines (1975) argues that the impact of mutilation cannot be assessed unless librarians have calculated a loss-to-use ratio. Furthermore, Schumm (1994) claims that demand for mutilated periodical articles decreases over time. As a result, repairing mutilated items may not be a high priority for every library.

Compounding the situation is the fact that some actions taken to decrease book theft and mutilation might, in some instances, actually increase mutilation. Cosser (1975), Kesler (1977), Sleep (1982), Watstein (1983), and Edwards (1986), for example, report that installing electronic sensing devices to curb book theft can lead to increased mutilation. However, Gouke and Murfin (1980) maintain that installing a detector did not increase the rate of mutilation at their institution.

Even when mutilation is a problem, several writers warn librarians to make sure that the cost of controlling mutilation and repairing damaged materials is overall the best use of library resources. For instance, while prosecuting mutilators can be a deterrent, librarians should “consider whether it is worth the time and cost to take this course of action” (Bloom and Stern 1994). Each library must decide whether the negative reaction of patrons is worth risking an escalated rate of mutilation.

Even when libraries plan to punish mutilators, it is often difficult to apprehend the culprits in the act. Staff cannot keep every patron under constant surveillance. Individual pages, removed from books, generally will not set off electronic
detection systems. Libraries unfortunately cannot even rely on patrons to report witnessed acts of mutilation. In an attempt to assess patrons' reactions to mutilators, Hoppe and Simmel (1969) planted "stooges" to mutilate what appeared to be library materials. Many patrons simply ignored another patron whom they witnessed damaging materials.

Researchers have investigated mutilation of periodicals more than monograph mutilation. Hendrick and Murfin (1974) suggest that patrons are more apt to mutilate current periodicals than book materials, but no study appears to substantiate this belief. Perhaps librarians study periodical mutilation because it is the simplest to discover and track. As periodicals are prepared for binding, it is easy to identify mutilated or missing pages. In addition, many libraries have established formal procedures for replacing mutilated periodical pages or for making copies of them available to patrons (Lightfoot 1970; Collver 1990), thus, investigating this type of mutilation is easier.

The literature cited above does lend insight to the problem of mutilation in general. However, little is available that specifically addresses the extent of mutilation of art books or the ways in which libraries deal with these materials. One may suspect that art materials with plates and numerous illustrations are prime targets for mutilation. Zimmerman (1961) and Alema (1992) report that art books with plates and photographs are among those most prone to mutilation.

For several years, the Preservation and Conservation Department at ECU, in consultation with the art subject librarian, made decisions about mutilated art materials on a case-by-case basis. Eventually, the Head of Preservation and Conservation, along with the art subject librarian, began to explore ways of improving the decision-making process. We decided to investigate how other librarians handle mutilation of their art books.

**Survey**

In the fall of 1995, we conducted a survey to learn how other libraries deal with mutilated art books. We wanted to select libraries that had a significant number of art books and also might have had a preservation program at the time of the survey. If a library had a preservation program, we reasoned that it might have a more formalized process for dealing with mutilated materials. As a result, we targeted academic ARL libraries in the United States—a total of 95 libraries. According to the 1993–94 ARL preservation statistics, 71 of the libraries (75%) reported having preservation units (Association of Research Libraries 1995).

Most of the schools offer degrees in art. Eight institutions (8%) offer the bachelor's degree as the highest art degree; 41 (43%) offer the master's as the highest degree in art, while 43 schools (45%) have art programs at the doctoral level (The College Blue Book 1995). Three institutions do not award art degrees. Twenty-six institutions (27%) are accredited by NASAD (National Association of Schools of Art and Design 1995). According to a membership list supplied by the Art Libraries Society/North America (ARLIS/NA), 61 institutions (64%) are members of this organization.

We were uncertain about who in each library department should receive the surveys. At first, we considered the head of the preservation unit to be the most logical recipient. However, many of the targeted libraries had separate art libraries on their campuses. Not knowing how institutions handle the preservation of departmental library materials, we called several art libraries to inquire about preservation policies. Unfortunately, no clear pattern emerged. Some departmental libraries handled all repairs of art materials. At other institutions, all repairs were sent to the preservation unit at the main library. In the end, we sent a survey to the unit handling preservation or conservation responsibilities (in some cases, not a formal department by that name) at each of the 95 libraries we had identified. In addition, we sent surveys to librarians in the art libraries if we could identify them using The American Library Directory (1995). We color-coded the questionnaires to keep the responses separate.
White questionnaires were sent to librarians in preservation units at main libraries while yellow questionnaires were sent to those in art libraries. Forty-three art librarians were sent questionnaires. A total of 138 questionnaires were mailed. We expected to receive only one response from each of the 95 targeted institutions, although that turned out not to be the case.

The questionnaire was intentionally kept brief. We limited the survey to a maximum of one sheet of paper, in the hope that the recipients would be more inclined to respond. The questions focused on points we wanted to clarify in our own setting. We inquired whether problems with the removal of pages, plates, or illustrations from art books were experienced. We then inquired how mutilated materials were handled and by whom. We also asked what type of replacement pages were used. Finally, we asked respondents to supply statistics, decision trees, policies, procedures, and any other related data they might wish to share with us. Before sending out the survey, another librarian, a member of our library’s Preservation Committee, reviewed the questionnaire and made suggestions.

The survey response rate was better for art librarians than for those in main libraries. Thirty art librarians (70%), and 38 librarians in main libraries (40%) replied, for a total of 68 responses, representing a cumulative response of 49%. We received a questionnaire from both main and art librarians at 9 institutions, which means that 59 of the 95 targeted institutions responded to the survey for a nonduplicative response rate of 62%. A number of respondents included additional documents such as policies, procedures, and forms.

**Results**

The survey responses parallel our experiences at Joyner Library. Most libraries have a problem with mutilated art materials. Thirty-seven main librarians (97%) and 29 art librarians (97%) report problems with pages, plates, or illustrations being removed from art books. Only one main librarian and one art librarian report that mutilation is not a problem.

In spite of the problem, few libraries keep statistics about the amount of mutilation they encounter. Seven main librarians (18%) and 2 art librarians (6%) keep mutilation statistics. The type of statistics kept are rather general and not very informative. Librarians gathering statistics are most apt to tally the total number of replacement pages. These frequently do not distinguish among the reasons the replacement pages are requested. One librarian responded to the question about keeping statistics in the following way: “What’s the point? It keeps happening.” This resignation to the inability to control the situation may shed some light on why so few libraries keep mutilation statistics. Even so, “a library must determine the nature and extent of losses before knowing whether corrective measures should be considered” (Edwards 1986).

Missing pages are discovered in a variety of ways. Librarians most frequently become aware of mutilation from patron reports of missing pages, plates, or illustrations. This finding is in line with what other librarians have reported (Varner 1983; Birney and Williams 1985; Collver 1990). Discoveries by the circulation staff occur almost as frequently. Over half of all respondents indicate that the reference department sometimes notifies them of missing pages. Sometimes, shelvers and other library staff refer mutilated materials for repairs. In addition, when examining books for other projects or for routine repairs, the preservation staff may discover mutilation.

Librarians employ a variety of strategies for dealing with mutilated art materials. Most replace missing pages with black-and-white photocopies (92% of main libraries and all art libraries). Replacing the book is another popular option. Seventy-nine percent of main libraries and 83% of art libraries replace books whenever possible.

When examining the other methods for dealing with mutilation, we discovered some differences between art and main libraries. At main libraries, the third
through fifth most popular ways of dealing with mutilation are: replacing pages with color photocopies (55%); discarding the book (42%); and ignoring the mutilation (34%). For art libraries, methods 3 through 5 are: discarding the book (43%); replacing pages with colored photocopies (33%); and ignoring the mutilation (27%).

Other ways of dealing with the problem include placing replacement pages at a reserve desk, adding a note to books about missing pages or plates; transferring the item to a secure location; or asking librarians to make a decision about discarding or replacing the book if the damage is excessive. One art librarian commented that mutilated illustrations are no longer replaced; only damaged text is replaced. Similarly, a main librarian replied that a note is included in certain books indicating that the library will not obtain replacement pages due to repeated mutilation. Another art librarian mentioned that preservation photocopying is considered for important mutilated art titles that are out of print. One deterrent to theft related by a respondent was to place a security stamp on all plates in new and previously mutilated materials, while another respondent plans to scan replacement pages digitally in the future.

Librarians were asked to prioritize factors that influence their treatment decisions (see table 1). The amount of mutilation ranks the highest for both types of libraries with 11 main librarians (29%) and 13 art librarians (43%) rating it as the number one factor. Intellectual content and intrinsic value rank as the second and third highest priorities respectively by both types of librarians. Few librarians at any library selected the cost of repair and replacement as their number one factor in making treatment decisions. However, cost of repair and cost of replacement rank high as second and third priorities in the main libraries. Consequently, repair and replacement costs may play a larger role in main libraries.

One art library does not have black-and-white photocopiers available for patrons on the premises. While $.10 appears to be the most frequently cited charge for photocopies, the charges range from $.03 to $.15. Several respondents report that photocopying charges are $.02 to $.05 less for patrons using copy cards than for those using cash. Color photocopiers, on the other hand, are much less accessible. Only 8 main librarians (21%) and 6 art librarians (20%) indicate that color photocopiers are available on the premises. Several librarians report that color copiers are available at other facilities on campus. Color photocopies cost more than black-and-white photocopies, with charges ranging from $.25 (one main library) to $2.00 (another main library).

Only a small number of librarians identify the specific brand or model of copier(s) used either by patrons or for replacement pages. For replacement pages, a number of librarians indicate that they accept whatever copy is sent via interlibrary loan. Presently, no standard copier brand or model appears to be employed at a majority of the libraries. As might be expected, Xerox, Canon, and Sharp copiers are mentioned frequently as the copier used by the respondents.

Preservation units handle all of the repairs to art books at 22 main libraries (58%) and 7 art libraries (23%). At the main libraries, only a small percentage of repairs is done at circulation or in techni-
cal services, and a few repairs are made by other units. In art libraries, repair responsibilities are dispersed more widely.

In order to manage mutilation, libraries sometimes restrict access to particular materials. Items believed to be targets of mutilation are frequently placed in special collection areas. Twenty-six main libraries (68%) and 23 art libraries (77%) restrict access by placing materials in special collections. A number of librarians responded that they would like to transfer many more items to special collections, but space limitations prevent them from doing so. Also, 15 main libraries (39%) and 15 art libraries (50%) restrict access by placing art materials in closed stack areas. Twelve main libraries (32%) and 11 art libraries (37%) place books on reserve as a means of controlling mutilation. Finally, 2 main libraries (5%) and 4 art libraries (13%) have limited access to items that they consider targets of mutilation.

Librarians decide to restrict access to items based on various factors (see table 2). An item’s value and its subject matter are the two most important factors in limiting availability. For instance, several librarians mentioned controlling access to items containing erotic art. One library limits the accessibility of certain books with original artworks and all books by selected artists, in addition to restricting erotica. Value and subject matter tie as the number one factor for main librarians. Value is the number-one factor for art librarians with subject matter being the second most important factor. An item’s condition and past mutilation also play a role in decisions to restrict access, but are less significant.

**Conclusion and Recommendations**

Several survey findings were much as we expected. Specifically, mutilation of art books appears to be a problem encountered by most libraries. Mutilation occurs at both main and art libraries. The majority of mutilation is discovered and reported by patrons and circulation staff members. Frequently, preservation units attend to mutilated art materials.

The survey responses did provide a few surprises, however. For instance, while most libraries have black-and-white photocopiers available for patron use, a much smaller number of libraries have color photocopiers. It is surprising that so few art libraries have color photocopiers available. Given the importance patrons are likely to place on having color photocopies of color illustrations, this was an unexpected finding. A similar surprise was that a number of librarians reported requesting replacement copies via interlibrary loan rather than requesting the book and making their own copies. These libraries have placed the quality of the replacement pages in the hands of others, rather than controlling the quality of the replacements by photocopying the pages themselves.

We were also surprised to discover that so few librarians keep statistics on the amount of mutilation that they encounter. While the survey focused on mutilation statistics, the respondents’ comments seem to indicate that few statistics of any kind are being collected. This raises the question of how well librarians are able to plan or budget for repairs if no accurate information is available. How can librarians assess whether or not the detection rate of mutilation is increasing without accurate statistics? How can they tell whether steps taken to limit mutilation are

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*Age of book; availability in other library; bibliographer's input; difficulty of replacement; format: size, loose plates; importance to scope of collections; intellectual content, i.e., catalogues raisonnés; LC classification; monetary value; original art work; rarity; unique holdings; type of mutilation, value for research; very erotic.
successful? Moreover, how can librarians determine whether the cost of the "cure" is more than the cost of the damage (Birney and Williams 1985)? Statistics on mutilation routinely encountered by patrons and staff can only measure the rate of detection. In order to assess the rate of actual mutilation, librarians would need to conduct regular random samples of the collection. Statistics of encountered mutilation may help identify areas of the collection to target for random sampling.

As preservation units become a more standard feature in libraries, especially larger libraries, it would be instructive to resurvey the respondents to see whether more libraries will begin to gather statistics in the future. If so, we may have a better understanding of the extent and the amount of mutilation of art books that actually occur. It will be interesting to see whether more libraries install color photocopiers for patron use and to assess the impact color photocopiers may have on mutilation. Moreover, as the availability of electronic images increases, librarians may see a change in the pattern of mutilation. Bloom and Stern (1994) suggest that electronic resources may help limit the amount of mutilation to paper materials, only to be replaced by mutilation and tampering of electronic files. Additionally, it might be informative in future surveys to query libraries about the disciplinary actions they take toward mutilators as well as steps taken to educate patrons about mutilation.

Presently, it appears that no one method for dealing with mutilation of art collections, or any collection, will be successful in all instances. "The most any librarian can expect to do to lessen both thefts and mutilations is to remain constantly vigilant and to utilize whatever controls seem practical for him to adopt in his own particular situation" (Zimmerman 1961, 3440).

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Variation in Interlibrary Loan Use by University at Albany Science Departments

Eleanor Gossen and Sue Kaczor

Interlibrary loan use patterns for scientists at the University of Albany, SUNY, were determined by analyzing one year’s worth of filled interlibrary loan (ILL) requests for journal articles. Differences were observed among scientific disciplines in their reliance on ILL to obtain journal articles, with biology requesting the most (54%) and geology the least (1%). Most requests were made for only 1 or 2 articles. Individual journal titles were generally requested only once (79.9%). The majority of requests were for journal articles published in the ten years prior to the study, although 21% were for earlier materials. At the University at Albany, scientists are actively using electronic indexing and abstracting tools to identify journal articles (48%), although printed resources remain an important component of identification (32%).

As budgets have become tighter and as periodical prices have risen in recent years, academic libraries have been forced to reduce their periodical holdings and rely increasingly on interlibrary borrowing to fulfill their patrons’ needs for journal articles. This has been particularly true in the sciences, where journal price increases over the last 5 years have generally been on the order of 10–15% per year (Ketcham and Born 1996). Because science titles are among the most expensive, they have become likely targets for cancellation, causing concern on the part of science faculty and students, who fear that they will not be able to get the information they need in a timely manner.

Numerous authors have written about patterns of expenditures in libraries, the impact of rising serials prices on library budgets, and the cost-effectiveness of journal subscriptions (see, for example, Barschall 1988; Hamaker 1989; Ketcham and Born 1996; Kingma 1996). Hamaker (1994) found that a third of the chemistry titles subscribed to by the Louisiana State University Libraries were of interest to only a single faculty member and that the chemistry faculty was generally receptive to substituting document delivery for ownership of many titles. Herzog (1993) carried out a use study at the University at Albany, State University of New York (SUNY), of its periodical collection in 1991–92, which provided information on relative use by department and showed that there were many titles that were rarely used. This information was useful.
in drawing up a list of titles for cancellation in 1992, and has in fact led to an experiment for substituting document delivery for ownership with the biology department there. In discussions about alternatives to ownership for the low-use titles identified by Herzog, it became apparent that very little was known about Interlibrary Loan (ILL) use patterns. It was felt that better information about existing patterns of requests for science journal articles in particular could help inform decisions about journal collection decisions.

ILL transactions are an integral part of the access versus ownership dilemma confronting academic libraries. Because ILL transactions have become safety nets for libraries, enabling them to meet patrons’ information needs in spite of shrinking resources, such transactions merit evaluation. This study, focusing on a year’s worth of requests for journal articles, was undertaken to describe ILL behavior of faculty, staff, and students in 7 science departments (atmospheric science, biology, chemistry, computer science, geology, mathematics and statistics, and physics) at the University at Albany. Some of the questions that we try to address in this study are: Is ILL used more frequently by people in some scientific disciplines than in others?, Is there any relationship between the amount of money spent on periodicals in a discipline and the number of article ILL requests by patrons in that discipline?, Are most ILL requests for very recent articles or is there a demand for older materials?, and How do patrons find out about articles? The answers to such questions can provide useful information to subject bibliographers and library administrators and enable them to make well-informed decisions about how to invest their resources.

**Background**

Authors of various studies have recently published reports on ILL use in a specific discipline or a small group of scientific disciplines. Ferguson and Kehoe (1993) studied ILL and commercial document delivery requests made by faculty and graduate students in biology, physics, and electrical engineering at Columbia University. In 1994, Kingma (1995) surveyed University at Albany patrons throughout the university who requested science articles through ILL, and analyzed their use over time as well as by patron status (i.e., faculty, graduate student, undergraduate). He did not include information about variation among individual disciplines within the sciences. Besides this, no recent articles that compare ILL use by discipline across the spectrum of the hard sciences were identified.

Several researchers have studied the information-seeking behavior of scientists, including their use of citations. Brown (1956) examined citation patterns in selected scientific disciplines. Devin (1989) studied the extent to which researchers in a variety of fields cited the journal literature in their publications. Hallmark (1994) reported on how scientists from a variety of disciplines found out about and retrieved articles that they cite in their publications. These studies support the authors’ belief that access to literature, whether in the library or elsewhere, is and is likely to remain an important concern.

**Methodology**

To examine what scientists actually request through ILL, filled-out ILL request forms for articles submitted by faculty, staff, and students of the 7 previously mentioned University at Albany science departments were separated out from those submitted by people from other departments. The following information was extracted from these forms: requester’s name, department, status, journal citation, source of citation, source of filled request, date of request, and date of receipt of article. The study period encompassed one year, from May 1, 1993, through April 30, 1994. Articles of a scientific nature that were requested by patrons who identified themselves as being from a nonscientific discipline (i.e., for this study, all departments other than the 7 specific departments) were not included in the study because the focus of this study
was on the information-seeking behavior of scientists. Requests for nonscience materials made by scientists were included. If a request was for a title clearly on a scientific topic but there was no departmental affiliation indicated, it was treated as if it were a request made by a scientist. The data were entered into an Enable database and analyzed for trends. Data on full-time equivalent (FTE) faculty and students in the university as a whole and in individual science departments were obtained from the university’s Office for Institutional Research. Data on staff by FTE are no longer kept by the university, so those figures were unavailable.

### ILL Use by Scientists

Of the 4,655 requests for articles that were filled by the ILL office during the 1993–94 academic year, 412 requests (approximately 9%) were made by faculty, staff, or students in the sciences. Given that the sciences represent roughly 18% of the FTE faculty and students at of the University at Albany (see table 1), scientists requested journal articles from ILL during this year less often than would be expected if one assumed that there were a direct correlation between number of faculty and number of ILL requests. It is not clear whether this results from the sciences having sufficient library journal collections, members of the scientific community having more sources of information outside the library, the fact that scientists do not use periodicals outside their area of specialization, the fact that they cannot wait two or more weeks to receive materials, or some combination of these. Hallmark (1994) found that, for the fields of physics, chemistry, biology, mathematics, and geology, scientists rely heavily on nonlibrary sources (reprints, preprints, photocopies from colleagues, and personal subscriptions) for copies of articles in journals not found in their libraries. This is probably the case at the University at Albany also and may help explain the relatively low use of ILL by scientists on campus.

There is some evidence that scientists at the University at Albany request articles via ILL relatively less often than might be expected because they have more extensive journal collections than do people in some other fields. All periodicals in the University Libraries’ collections are assigned a fund code that corresponds to an academic department. Periodicals assigned to science departments represent 26% of the collection and 68% of the periodical budget. Figures from a use study carried out during the 1991–92 academic year at the University Libraries showed that, for current subscriptions, science periodicals accounted for 22% of total in-library periodical use. This is somewhat higher than would be expected if there were a direct correlation between percentage of FTEs (18%) in the sciences and percentage of use. Scientists at the University at Albany may be able to find more of the articles they need in the library than can people in other disciplines and therefore have less need to use ILL.

Another possible explanation for the relatively lower use of ILL by scientists at Albany is that the sciences have a smaller percentage of graduate students than does the campus as a whole. In 1993–94, 13% of the FTEs in the sciences were graduate students (representing 10% of the total campus graduate student population), whereas graduate students made

### TABLE 1

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Graduate Students</th>
<th>Undergraduate Students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sciences</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Faculty</td>
<td>111</td>
<td>12</td>
<td>357</td>
</tr>
<tr>
<td>Campus</td>
<td>928</td>
<td></td>
<td>3,604</td>
</tr>
</tbody>
</table>
TABLE 2
PERCENTAGE OF FTEs AND GRADUATE STUDENTS IN SCIENCE DEPARTMENTS

<table>
<thead>
<tr>
<th>Department</th>
<th>%Total FTEs</th>
<th>% Grads in Dept</th>
<th>% ILL Requests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric Sciences</td>
<td>9 (232.5)</td>
<td>15</td>
<td>2 (7)</td>
</tr>
<tr>
<td>Biology</td>
<td>23 (604.5)</td>
<td>10</td>
<td>54 (221)</td>
</tr>
<tr>
<td>Chemistry</td>
<td>13 (351.5)</td>
<td>10</td>
<td>20 (82)</td>
</tr>
<tr>
<td>Computer Science</td>
<td>14 (362.5)</td>
<td>17</td>
<td>3 (13)</td>
</tr>
<tr>
<td>Geology</td>
<td>3 (91.5)</td>
<td>12</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>25 (661.5)</td>
<td>12</td>
<td>4 (13)</td>
</tr>
<tr>
<td>Physics</td>
<td>14 (378.5)</td>
<td>21</td>
<td>10 (43)</td>
</tr>
<tr>
<td>Total</td>
<td>(2,682.5)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

up 24% of the campus population as a whole. Kingma (1995, figure 4.1) found that 62% of ILL requests were submitted by graduate students, so it is reasonable to argue that departments with a smaller percentage of graduate students can be expected to submit fewer ILL requests than departments with a high percentage of graduate students. This theory, however, is contradicted by the evidence for individual departments within the sciences. The departments that generated the most ILL requests (biology and chemistry) had the lowest percentages of graduate students (see table 2). Since professional research staff were responsible for a considerable number of the ILL requests from the biology and chemistry departments, these figures may reflect active faculty research programs in which research staff rather than graduate students carry a lot of the burden for gathering information.

**Use by Department**

There seems to be little relationship between ILL activity and the amount of support provided by the library for a discipline. For example, 33% of the science journal titles in the library and 30% of the total cost of science journals were in biology, yet biologists made 54% of the ILL requests. On the other hand, 10% of the science journals are in geology, but geologists made only 1% of the ILL requests. Likewise, 16% of the science journals in the library are in the area of mathematics, but mathematicians made only 4% of the ILL requests (see table 3). There are several possible explanations for these phenomena. They may be due to different patterns of information use in the various departments. In a study of the reliance of various disciplines on the serial literature, Devin (1989) reported that citations to journal articles (as opposed to monographs) ranged from 76.8% in mathematics to 93.6% in chemistry. While interesting, these numbers may not accurately reflect ILL use in these areas. For example, biologists may need to use a greater variety of periodical articles in their research than do computer scientists or geologists, a need that may be addressed through ILL. Or perhaps some fields rely more heavily on alternative methods of gaining access to information that bypass the library, such as preprints of articles or communication with colleagues. Of note, Ferguson and Kehoe (1993) also found that biology had the heaviest use of ILL among the disciplines they studied, which were biology, physics, and electrical engineering.

Differences in ILL use might also be explained by the different sizes of the departments, but there seems to be little correlation between the size of a department and the percentage of ILL requests filled for that department (see table 2). The department of mathematics and sta-
Statistics accounts for 25% of the FTEs in the sciences, and yet made only 4% of the ILL requests. Biology accounts for 23% of the FTEs, yet made 54% of the requests. Chemistry, with only 13% of the FTEs, made 20% of the ILL requests. Geology, with the smallest percentage of FTEs (3%), also made the smallest number of requests (1%). There is no clear pattern here.

Data from the 1991–92 use study mentioned above show that the science departments that were the heaviest users of ILL (biology and chemistry) also accounted for the highest number of uses of the in-house collection of current periodicals. Physics and computer science, on the other hand, used both the in-house collection and ILL less than would be expected, given the number of users in those departments. In fact, there is a surprisingly good correlation between high in-house journal use and high ILL use in the sciences (see table 4), but little correlation between percentage of FTEs and percentage of use of both in-house collections and ILL. More departmental personnel do not necessarily generate more use.

If these patterns prove consistent from year to year, they may suggest a reevaluation of collection development policies.

### TABLE 3
**INTERLIBRARY LOAN REQUESTS COMPARED TO LIBRARY SUPPORT**

<table>
<thead>
<tr>
<th>Department</th>
<th>No. ILL Req.</th>
<th>% ILL Req.</th>
<th>No. Titles in Lib.</th>
<th>% Sci. Titles</th>
<th>% Sci. Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric Sciences</td>
<td>7</td>
<td>2</td>
<td>71</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Biology</td>
<td>221</td>
<td>54</td>
<td>361</td>
<td>33</td>
<td>30</td>
</tr>
<tr>
<td>Chemistry</td>
<td>82</td>
<td>20</td>
<td>134</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Computer Science</td>
<td>13</td>
<td>3</td>
<td>57</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Geology</td>
<td>5</td>
<td>1</td>
<td>112</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>15</td>
<td>4</td>
<td>176</td>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td>Physics</td>
<td>43</td>
<td>10</td>
<td>118</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>General Science</td>
<td>—</td>
<td>—</td>
<td>68</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Unknown Dept.</td>
<td>26</td>
<td>6</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

### TABLE 4
**INTERLIBRARY LOAN REQUESTS COMPARED TO IN-LIBRARY USE**

<table>
<thead>
<tr>
<th>Department</th>
<th>In-House No. Uses 1991–92</th>
<th>In-House % Use 1991–92</th>
<th>% ILL</th>
<th>% FTEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric Sciences</td>
<td>1,404</td>
<td>4</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Biology</td>
<td>12,927</td>
<td>38</td>
<td>54</td>
<td>23</td>
</tr>
<tr>
<td>Chemistry</td>
<td>6,654</td>
<td>19</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Computer Science</td>
<td>1,655</td>
<td>5</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Geology</td>
<td>1,577</td>
<td>5</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>2,067</td>
<td>6</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>Physics</td>
<td>3,132</td>
<td>9</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Unknown Dept.</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>General Science</td>
<td>5,031</td>
<td>15</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
and the allocation of funds among departments. During the year of the study, there appeared to be differences in the ways different disciplines in the sciences find and use information. The amount of use of ILL did vary by department, with those in the biological sciences and chemistry demonstrating greater use. Faculty and students in other scientific disciplines either may not need access to periodical articles outside their areas of specialty or may rely more heavily on other sources of information for their research needs.

**USE BY TITLE**

During the 1993–94 academic year, scientists at the University at Albany requested 412 articles from 291 different periodical titles. Of these journal titles, 232 (79.7%) were requested only once, while 59 were requested more than once. Table 5 shows the frequency of requests for articles from the same journal. Only 6 titles were requested more than 5 times, the point at which copyright issues emerge. These results are similar to those reported by Ferguson and Kehoe (1993), who found that 72% of their requests were for articles from titles requested only once during their study.

**TABLE 5**

**FREQUENCY OF REQUESTS FOR THE SAME JOURNAL DURING THE STUDY PERIOD**

<table>
<thead>
<tr>
<th>No. Titles</th>
<th>% Total</th>
<th>No. Times Requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>232</td>
<td>79.7</td>
<td>1</td>
</tr>
<tr>
<td>34</td>
<td>13.7</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>3.1</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>1.0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>1.0</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
<td>12</td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>288</strong></td>
<td><strong>409</strong></td>
</tr>
</tbody>
</table>

Do articles from the same journals get requested repeatedly year after year? All of the titles that were requested by scientists in the 1993–94 academic year were checked against the records of requests for articles that were published less than 5 years previous to the request, data which the ILL Department keeps for copyright law compliance purposes. These files reflect ILL requests dating back to 1991. Although the files do not contain information on requests made for articles that were more than 5 years old at the time of request, they do give a good indication of whether the same titles get requested year after year. As it turns out, of the 291 periodical titles that were requested in 1993–94, 73 had also been requested in previous years. Again, of the 291 titles, 25 were requested only in 1993–94 and only 39 titles were requested between 2 and 10 times during the years for which we have records, indicating that there is not great repeat demand for most of the journals that are requested through ILL. However, 8 titles were requested between 11 and 22 times, and 1 (Pediatrics) was requested 54 times during those 5 years! Given that Pediatrics is not an expensive journal ($130/year in 1995), it is clearly neither cost-effective nor efficient to rely on ILL to supply this journal, particularly when the copyright fees for more than 5 requests in a given year are included. On the other hand, while the European Journal of Pharmacology was requested 14 times, it is very expensive ($3,874/year in 1995) and would have to be used considerably more than this to make it cost-effective to subscribe to it. Again, this information has implications for collection development and suggests that ILL request patterns should be carefully monitored for cost effectiveness.

**USE BY INDIVIDUALS**

Is use of ILL spread fairly evenly throughout the scientific user population, or is it used heavily by a few individuals and little or not at all by the majority of the population? The 412 requests were submitted by 128 individuals, or roughly 5% of the science community. Analysis showed that 69
people requested only 1 article during the study period, and 42 requested 2 to 5 articles. Twelve people made between 6 and 10 requests, and 5 individuals requested 11 or more articles; these 5 individuals accounted for 131 requests, just over 30%. Of these 5 individuals, one requested 11 articles, one 12, one 24, one 35, and one 49 (see table 6). Four of these heavy users were faculty members and one was a staff member. It is interesting to note that the three heaviest users of ILL have research interests that are peripheral to the core interests of their departments as reflected in the University Libraries’ collection development policies. The individual who requested 24 articles conducts research in an area that is not a primary research area at the institution and made most of his requests for articles that were published more than 20 years ago, many in journals that have ceased publication. Many of the articles requested by the person who requested 35 articles are from Japanese-language journals, which would not be useable by most of the user population even if the library owned them. The individual who requested 49 articles conducts research on a medical topic and needs articles from medical journals that are not collected since the University at Albany does not have a medical school.

In the cases of the titles that were requested 12 and 13 times, all the requests within each title were made by the same individual. In the majority of cases of multiple requests for articles from a single title, the requests were made by one individual on the same day. This suggests that scientists tend to do bibliographic research in batches, searching a topic, journal title, or author in several years of printed indexes or databases for citations, determining what they could get locally, and submitting multiple ILL requests at one time.

ILL requests appear to be an important source of journal articles for a few individuals who have research interests requiring resources outside the primary collection development focus at the University at Albany. They serve as a supplementary source of information for others who request 1 or 2 articles a year, but most of the scientists on campus seem to get the information they need in the local collection or to go to nonlibrary sources for information not held by the library. Similar results were found by Hallmark (1994).

**Use by Year of Publication**

Analysis of ILL transactions for people in the sciences by year of publication provides insights for both collection development and the ILL department. The data were broken down by year of publication and department of requester (see table 7). It is interesting to note that even though we included requests submitted and filled until April 30, 1994, only 1% of the requests were actually for articles published in 1994. In all probability, the most pressing current awareness needs are met largely by personal, library, or colleague subscriptions. In addition, there is a lag

<table>
<thead>
<tr>
<th>No. Req.</th>
<th>Faculty No.</th>
<th>Graduate Students No.</th>
<th>Undergrad. Students No.</th>
<th>Staff No.</th>
<th>Other No.</th>
<th>Total No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21</td>
<td>27</td>
<td>12</td>
<td>7</td>
<td>2</td>
<td>69</td>
<td>54</td>
</tr>
<tr>
<td>2-5</td>
<td>12</td>
<td>22</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>42</td>
<td>33</td>
</tr>
<tr>
<td>6-10</td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>11-15</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>&gt;15</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Total: 128
between the time when an article is published and when it appears in indexing services or is referred to in journal articles; this is likely to be an important factor in the low numbers of requests for current year publications.

The publication date for the majority of ILL requests (78%) ranges from 1984 to 1993, roughly the ten-year period prior to the study. This was to be expected, given the strong dependence of the sciences on recent information. Nine percent of the requests were published from 1974 to 1983, and 12% predated those (1793 to 1973). Looked at from another perspective, however, 21% of the requests were for articles published more than ten years before the study. We were surprised to find that there is still a considerable demand for titles published over 20 years ago (12%) (see table 7).

**SOURCE OF CITATION**

How do people find out about articles that they request on ILL? Although the ILL form stated that this information was "mandatory," 16% of the forms examined did not contain this information. The single-largest category, CD-ROM, was the source of 32% of the requests (see table 8). The next highest ranked categories are None Listed (16%), Online (16%), and Article (15%). When CD-ROM is combined with the Online category (16%), 48% of the requests were located using electronic technology (see table 8). In contrast, 32% of the citations were derived from so-called traditional format sources. These included the categories Article (15%), Paper Index (9%), Book (4%), and Personal Communication (2%). This pattern is most evident in requests for articles written in the ten years prior to the study (see table 9). Looking only at the ILL requests for journal articles that were published from 1793 to 1973, traditional formats are much more important. Of the 51 requests for documents more than 20 years old, only 6% of the citations were identified using electronic sources, while 73% came from the traditional sources listed above. The number of citations derived from

**TABLE 7**

YEAR OF PUBLICATION BY DEPARTMENT

<table>
<thead>
<tr>
<th>Date</th>
<th>Atm</th>
<th>Bio</th>
<th>Chm</th>
<th>Csi</th>
<th>Geo</th>
<th>Mat</th>
<th>Phy</th>
<th>Unk</th>
<th>Total</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1984–93</td>
<td>3</td>
<td>170</td>
<td>73</td>
<td>8</td>
<td>3</td>
<td>8</td>
<td>43</td>
<td>21</td>
<td>320</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>1974–83</td>
<td>0</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>35</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>1793–1973</td>
<td>4</td>
<td>35</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>51</td>
<td>12</td>
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<td>Total</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>411</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Atm = Atmospheric Sciences, Bio = Biology, Chm = Chemistry, Csi = Computer Science, Geo = Geology, Mat = Mathematics & Statistics, Phy = Physics, Unk = unknown departmental affiliation.

**TABLE 8**

WHERE CITED BY FREQUENCY

<table>
<thead>
<tr>
<th>Source of Citation</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional format</td>
<td>130</td>
<td>32</td>
</tr>
<tr>
<td>Article</td>
<td>(63)</td>
<td>(15)</td>
</tr>
<tr>
<td>Paper index</td>
<td>(39)</td>
<td>(9 )</td>
</tr>
<tr>
<td>Book</td>
<td>(17)</td>
<td>(4 )</td>
</tr>
<tr>
<td>Personal</td>
<td>(10)</td>
<td>(2 )</td>
</tr>
<tr>
<td>communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronic format</td>
<td>196</td>
<td>48</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>(130)</td>
<td>(32)</td>
</tr>
<tr>
<td>Online</td>
<td>(66)</td>
<td>(16)</td>
</tr>
<tr>
<td>None listed</td>
<td>67</td>
<td>16</td>
</tr>
<tr>
<td>Index*</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

*Index = index of unknown format.
TABLE 9
YEAR OF PUBLICATION BY SOURCE OF CITATION

<table>
<thead>
<tr>
<th>Date</th>
<th>Electronic</th>
<th>Traditional</th>
<th>Index*</th>
<th>Other</th>
<th>None</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1994</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1984-93</td>
<td>182</td>
<td>57</td>
<td>76</td>
<td>24</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>1974-83</td>
<td>8</td>
<td>23</td>
<td>17</td>
<td>49</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>1793-1973</td>
<td>3</td>
<td>6</td>
<td>37</td>
<td>73</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>196</td>
<td>48</td>
<td>130</td>
<td>32</td>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>

*Index = index of unknown format.

Electronic sources increases to 23% in the 1974–83 time period, and rises to 57% in 1984–93. For citations from traditional sources, the number decreases to 49% for articles published in 1974–83 and then to 24% for 1984–93 articles.

Although there is a heavy use of electronic technology to locate citations, the combined traditional sources are still a valuable tool for people in the sciences to locate citations of importance, especially for earlier materials. This can be accounted for in part by the fact that most of the major electronic sources do not index articles over 20 years old.

These findings differ from those reported by Hallmark (1994), who asked scientists how they became aware that journal articles existed. She reported that the primary sources of awareness were personal contacts and references in the literature. Databases (online or CD-ROM), traditional abstracting and indexing services, and current awareness services represented a much smaller percentage of information sources for her population. She was, however, surveying established scientists who had published in prestigious journals. These people undoubtedly have a wide network of colleagues and graduate stu-

TABLE 10
WHERE CITED BY STATUS

<table>
<thead>
<tr>
<th>Where Cited</th>
<th>Faculty</th>
<th>Graduate Students</th>
<th>Undergrad. Students</th>
<th>Staff</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article</td>
<td>34</td>
<td>22</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Book</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>61</td>
<td>44</td>
<td>14</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Index*</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Online</td>
<td>21</td>
<td>8</td>
<td>0</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td>Print Index</td>
<td>17</td>
<td>20</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Personal Communication</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>None Listed</td>
<td>27</td>
<td>30</td>
<td>7</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>184</td>
<td>137</td>
<td>33</td>
<td>53</td>
<td>5</td>
</tr>
</tbody>
</table>

*Index = index of unknown format.
TABLE 11
BREAKDOWN BY YEAR AND SOURCE OF DOCUMENT

<table>
<thead>
<tr>
<th>Time</th>
<th>Document Delivery</th>
<th>Interlibrary Loan</th>
<th>SUNY EXPRESS</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1994</td>
<td>1</td>
<td>20</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>1984-93</td>
<td>39</td>
<td>12</td>
<td>203</td>
<td>63</td>
</tr>
<tr>
<td>1974-83</td>
<td>2</td>
<td>6</td>
<td>21</td>
<td>60</td>
</tr>
<tr>
<td>1793-1973</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>88</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>10</td>
<td>271</td>
<td>66</td>
</tr>
</tbody>
</table>

Source of filled requests

The source used for obtaining documents through ILL, which was indicated on the forms by ILL staff, was analyzed for possible trends (see table 11). The most heavily used method was traditional ILL (66%), followed by SUNY EXPRESS (23%). SUNY EXPRESS is an expedited delivery service for books and journal articles that are requested from one of the SUNY University Centers—Albany, Binghamton, Buffalo, and Stony Brook. It was initiated about 6 months into our study. Document delivery services accounted for only 10% of filled requests, but the library was just beginning to experiment with document delivery during the study period. In general, document delivery is used if copyright has been exceeded, if heavy volume makes document delivery more expedient, or if there is a real need to rush a particular request. If the study were repeated today, it would probably show an increased reliance on document delivery. For articles published between 1793 and 1973 (prior to the current 20 years), document delivery was not used, and SUNY EXPRESS was a minor source (10%). For 1974-83, the use of SUNY EXPRESS jumped to 34%, then leveled off at 24% for 1984-93. In this most recent time period, ILL is the largest source (60%) and document delivery increases only to 6%. Document delivery at the time of the study did not seem to be very useful for older articles, most likely because these services tend not to have large retrospective collections.

Cost/Benefit Analysis

Because there seems to be a far greater demand for occasional articles from a wide variety of journals rather than repeated demand for articles from a few titles, ILL should be a cost-effective and relatively efficient way of supplying infor-
mation except in the cases of the few titles that were requested many times. Gossen and Irving (1995) and Kingma (1996) have recently investigated the economic efficiency of this arrangement. They showed that for titles that are infrequently used or very expensive, it is generally more cost effective to use ILL than to subscribe. Current prices for 209 of the 291 journals that were requested during 1993–94, were obtained. These titles accounted for 318 of the 412 requests. Many of the periodicals for which prices could not be found have been discontinued; others are irregular publications for which the price varies from year to year. The cost of subscribing to the 209 journals at current prices would have been $78,454. Assuming that use would be the same if the periodical were on the shelf, the average cost per use of these 318 articles would have been $246.70. Using the ARL/RLG average cost of $18.64 for borrowing an item on ILL (Roche 1993), the cost of acquiring the same information via ILL would have been $5,928, a considerable savings. Ferguson and Kehoe (1993) estimated the “fully loaded” ILL borrowing cost for articles in biology, physics, and electrical engineering to be $27 and the cost for an article through document delivery to be $39, including internal processing charges and the fees charged by the service. Using the higher figure, it would have cost $12,720 to obtain the 318 articles. This is still far less expensive than it would have been to subscribe to those journals. While it can certainly be argued that patrons may not request articles on ILL that they might have found useful if they were in the library, a strong case can be made for the cost effectiveness of ILL when budgets are not keeping pace. This is especially true for science periodical titles. One of the results of this dilemma has been the decision to cancel journals. Two large periodical cancellation projects were carried out in the University Libraries in 1988 and 1992. Journal titles from the ILL data were compared to the 1988 and 1992 cancellation lists to determine whether titles that had been canceled had later been requested on ILL. Of the 688 titles canceled in 1988, only 6 titles (1%) were requested a total of 8 times during our study. Of the 979 titles canceled in 1992, only 2 titles were requested a total of 2 times; it is probable that not enough time had elapsed between the 1992 cancellations and our study for their effect to have really been noticed. It is clear that the science titles canceled in 1988 were not heavily requested by the science faculty, staff, or students during the year of the study.

A number of explanations for this are possible. First of all, it may be that these cancellations were wisely chosen, based on accurate use studies and careful deliberation. Alternatively, the faculty, staff, and students in the sciences may have had other, nonlibrary sources for getting copies of articles from the canceled journals. It is also possible that information published in those journals was not important enough to their research to overcome the inconvenience and time delay involved in getting articles through ILL. Most likely, it is a combination of all of these factors.

**Conclusions**

There are several findings that emerge from our data:

1. There were differences among scientists by discipline in the amount of use made of ILL as a means of obtaining periodical articles. Two departments, biology and chemistry, accounted for 74% of the total use. These differences might be magnified (or diminished) in a longitudinal study of ILL use. One solution may not suit all disciplines, and different approaches could be taken in building collections and providing access.
to information in different disciplines.

2. ILL is used by researchers to obtain only 1 or 2 articles as well as by a few individual researcher to get large numbers of journal articles. ILL requests should be monitored to make sure that the same title isn’t being requested many times, in which case a decision to buy the title might be appropriate. We found that the vast majority (94%) of requests were for titles that were used only once or twice. Relying on interlibrary lending for these documents is a cost-effective way of providing such information.

3. While most requests were for articles that had been written within the ten-year period before the study, 21% of the requests were for older materials in spite of the supposed emphasis in the sciences on current materials. If requests from the humanities and social sciences had been analyzed, the percentage of older materials might have been even greater. Thus, it is not only current information that is in demand.

4. While researchers use electronic indexing services (CD-ROM and online) to generate a high percentage of their requests, there is still considerable use of traditional resources, such as print indexes and personal communication, as sources of information about journal articles. Traditional print sources are particularly important for older information and should be maintained in reference collections for the foreseeable future.

Further Study

Information about who uses ILL and what they are requesting can provide data on the use of journal titles not owned by the library and the variation in use among disciplines. This information can be useful in making management decisions about periodical collections and resource sharing among libraries. To add to this picture of ILL use by scientists at the University at Albany, we hope to do a similar study of their requests for books, and to interview them about their satisfaction with library resources and services and alternative methods used to access information. A more comprehensive and thus more informative picture of ILL use in the sciences will emerge if other libraries carry out similar studies.

Works Cited


Cutting Cataloging Costs: Accepting LC Classification Call Numbers from OCLC Cataloging Copy

Susan A. Massey and S. Michael Malinconico

Cataloging policy at the University of Alabama Libraries allows the acceptance of LC classification call numbers from OCLC cataloging copy into the local database without shelflisting. In this study, we measured error rates for locally unshelflisted samples and a control group of locally assigned and shelflisted call numbers to determine whether this policy produces disarrangement of the local online shelflist. The results show no significant differences between samples, indicating that catalogers’ task of local shelflisting is not a cost-effective use of their time. An analysis of the error data suggests that the types of disorder created by shelflisting errors would not impede the retrieval of items while subject browsing, but further study is needed to confirm this.

LOCAL SHELFLISTING POLICY

The University of Alabama (UA) Libraries utilize a national bibliographic utility, the OCLC Online Computer Library Center, Inc. (OCLC), to provide Machine-Readable Cataloging (MARC) records that are downloaded into the local online cataloging system (NOTIS). Since the migration of local online records to a new system in 1990, UA’s catalog department has accepted OCLC cataloging copy for monographs without locally shelflisting Library of Congress (LC) classification call numbers already in the records, whether assigned by LC or by a participating library. Regardless of the source of the record, call numbers are not checked against the existing online shelflist or revised to ensure that items are located on the shelf in correct logical order.

Copy catalogers perform a quick visual check of call numbers to make sure there are no obvious problems such as incorrect
or missing subfields or punctuation. They then add an edition date to the call number if it is not already present, along with a lower-case r for all call numbers not assigned by LC. Records that lack call numbers or have questionable call numbers (i.e., those that have apparent typographical errors or appear unusual in some way) are routed to original cataloging librarians for review. Call numbers assigned or revised by the catalogers are also shelllisted to fit in the arrangement of the local online database.

Assigning an LC classification system call number consists of both classifying and shelllisting the item. An LC call number is composed of a class number that represents a subject area as designated in the LC classification schedules, a book number that arranges items within a class in a specified order, and any prescribed additional unique identifiers for a particular item. Classification involves choosing the class number. Shelllisting is the process of logically arranging materials in the collection by creating a unique call number for each item through the addition of a cutter number or other identifiers, such as edition dates, to the class number. This activity is achieved in the context of comparing the call numbers to others in the local shelflist, a file of bibliographic records reflecting the order of the materials on the shelves (Library of Congress 1995, G10, 12).

The policies of library cataloging departments may vary widely concerning the extent to which they review call numbers from cataloging copy. While one institution may check whole call numbers from all copy, another may accept class numbers while reviewing cutters only, expecting to find classification errors in the process of shelllisting. Some institutions may accept call numbers only from particular cataloging copy sources without review. These decisions may be based on the library's cataloging philosophy (Taylor 1988, 184), economics, or a combination of factors.

By accepting OCLC cataloging copy containing call numbers assigned by other institutions without shelllisting or checking the class schedules for correct classification, UA's catalog department streamlines workflow and reduces cataloging costs. Class number assignment is not an exact science, however, and shelflist order is shaped by the holdings in the local database, so accepting a call number assigned by another institution may result in local shelllist disarrangement. In the process of shelllisting to assign a new call number, occasionally a section of the UA online database that is cuttered out of order or contains an incorrectly classified item is discovered. The current research was designed to discover whether UA's local shelllisting policy creates extensive disorder in the local database and therefore should be reconsidered.

**Serendipity at a Cost**

Theoretically, the purpose of local shelllisting is to ensure that an item fits in order by author, title, geographic area, or some other criterion represented by a cutter number within a particular classification or subject area on the library's shelves. The reason for this concern is to enable effective shelf browsing by patrons. If items are out of order to the extent that they are far removed from other similar items, they can only be retrieved if their exact location or call number is known. One of the benefits of the subject arrangement of items on a shelf is depth of access to several full texts when searching for a precise bit of information not reflected in a catalog record (LeBlanc 1995, 296). This serendipitous discovery of information could be lost if call numbers were only locating devices. In the online environment, LC class numbers can be used in searching to increase precision in retrieval and as the basis for broad subject searches (Chan 1989, 531–33). There is less evidence that the correct order of items achieved by cutting within a classification is a factor in a satisfactory online search. Neither is it clear whether near-perfect shelf arrangement of items within a subject area is necessary for successful stack browsing; moreover, maintaining an exact shelllist order for items may not be essential to information retrieval.
However, the size and nature of a collection may reduce the importance of shelf browsing by classification as a primary subject retrieval strategy. With the variety of information formats increasingly available in libraries, patrons may need to browse several physical locations to obtain a full range of materials in a given subject. This phenomenon increases the patron’s dependence on the library catalog as a locating device. In addition, the proliferation of interdisciplinary subjects in recent years and classification of the same topic within a variety of class schedules depending on the discipline emphasized may mean that a single item is classed with only one aspect of its subject matter, and use of the class number as method of subject retrieval becomes impossible to achieve consistently (Taylor 1988, 172).

While not diminishing the importance of shelf browsing, catalog departments must weigh the cost of shelflisting and reviewing classification carefully against its perceived benefits. Assigning call numbers has traditionally been viewed as a duty requiring the expertise of a highly paid professional librarian (Bleil and Renner 1990, 100). Although in some libraries the editing of call numbers may be performed by support staff, it is still a time-intensive and therefore expensive procedure. One recent study indicated that literature items with LC author numbers already established required 3.09 minutes per title to shelflist (LeBlanc 1995, 299). Based on this estimate, if a catalog department the size of UA’s were to revise its policy to include shelflisting the 22,000 monographs volumes cataloged annually, its workload would increase by 1,133 hours, requiring an additional 0.58 FTE position. Admittedly, projecting one library’s findings for one classification to another library’s entire operation may or may not be a reliable method. However, it does provide evidence that notable efficiencies can be achieved by not shelflisting.

As part of the current study, the sample items were manually shelflisted at an average rate of 50 call numbers per hour. This excluded several steps in normal online shelflisting, such as incidental database cleanup. Since the shelflisting was primarily performed from a computer printout, the time per item also did not include online searching and computer response time. This very low time estimate still indicates a required 440 hours to shelflist 22,000 volumes, or close to 0.25 FTE position. It is clear that changing the current policy in order to shelflist all items would be a costly endeavor. The only compelling reason for such a change would be the discovery of a high rate of database disorder resulting from the current policy, in conjunction with the frequent occurrence of types of shelflisting errors that seriously impeded patron browsing by placing titles on the shelf far removed from related volumes.

**Tracking the Elusive Error Rate**

One reason there has been little definitive research into the benefits of shelflisting may be the difficulty of extracting data to examine. Cataloging policies in the online environment are often fluid, depending on the technology available and the consequent evolution of workflow and procedures. The consistency of shelflisting policy at the UA Libraries and a long-term commitment to the same integrated library system provided a window in time when data were produced that could be sampled with confidence in the validity of the research results.

The main research question of the current study was broken into two parts: How much disorder is created in our local online database by accepting LC call numbers from OCLC cataloging copy without local shelflisting? and Is there a significant difference in the number of shelflisting errors caused by these unrevised call numbers and the error rate of call numbers that have been locally shelflisted? We also looked theoretically at the types of shelflisting errors we discovered in order to determine whether the kind of disorder produced appeared to impede patron browsing seriously. Obvious classification errors that placed an item among others about a different subject were included in the study because it is likely they would be
detected in the process of shelflisting online, just as they were indeed found in the course of the study, although correct classification was not checked in the class schedules for every item in the samples.

To answer the main research question, we drew a sample of LC call numbers that had been accepted from OCLC member copy without local shelllisting and compared it to a control group of call numbers that had been locally assigned and shelllisted. Samples represented records added to the catalog between October 1990 and March 1995. The main sample of call numbers from copy cataloging included both MARC 050 (LC-assigned) and 090 (other locally assigned) fields in all classifications, excluding those records containing UA's OCLC symbol as the cataloging or modifying agency. Therefore, this sample included copy cataloging from all participating OCLC institutions except UA. The control group consisted only of our local original cataloging records. The parameter compared was the amount of shelflist disarrangement, measured by the number of shelflisting errors detected. Error for the copy cataloging sample was defined as a call number that placed an item in a different place in the local online shelflist than where a correctly locally assigned call number would normally fall. Error for the local sample was defined as an incorrectly assigned call number. Shelflist disarrangement in all samples included inappropriate classification, incorrectly assigned cutters, and typographical errors that would have been noticed and revised during the shelllisting process.

We also wanted to know whether error rates differed between LC-produced copy and the overall rate of disorder for cataloging copy. This was to provide research data for institutions that accept only LC copy without revision. A sample was drawn of records with call numbers in the MARC 050 field with second indicator 0 (which represents an LC call number assigned only by LC).

We also wondered whether error rates differed between certain classifications, depending on the complexity of the schedule and types of cutting required.

The reason for including this part of the study was that libraries with holdings heavily weighted in a particular subject area might have different shelflist errors than an institution with generalized holdings. Since the subject mix of local libraries can differ considerably, similar error rates across classifications would enhance the possibility of generalizing our results to other institutions with different holdings. For this part of the research, samples were selected from classifications P (literature), Q (science), and T (technology). We expected a wide variation between institutions in local author cutters for literature classes, while the precision and structure of the Q classes would appear to foster greater continuity among shelflists. The technology schedule is typical of classes that include geographic subdivisions, special topic subdivisions, and the same topic addressed in more than one subclass.

**Drawing the Data**

We developed a sample selection algorithm to choose call numbers from the NOTIS database for each sample. The parameters used a combination of MARC field definitions and NOTIS system fields, taking into consideration UA's local cataloging policies and procedures. Each target call number came from a record that was entered in the database later than the records immediately preceding it and following it in the online shelflist order. This insured that any disorder discovered was due to an error in the sample call number, not another call number entered later out of shelflist order. If the preceding or following call number was found to be in error, the sample call number was discarded. This parameter was dependent on a local system field indicating the date the record was loaded into the system. The study was limited to records entered after October 1, 1990, a date that immediately followed a series of tape loads that occurred when UA changed local systems. All records were given the entry date of the tape loads, making sample selection prior to that date impossible.
The study was limited to monographs records processed in the main library cataloging unit, indicated by a fixed field code (bib lvl “m”) and a processing unit code. Nonbook formats at UA are arranged by schemes other than LC classification. Serials are normally locally shelflisted as a matter of policy. Other processing units on campus also have varying shelflisting policies.

Another parameter in the selection algorithm included a check to indicate that the call number had not been added or altered locally after the record was downloaded (the bib record call number must match the local copy holdings call number). This did not control for the possibility that the call number was locally added in OCLC before the record was downloaded, or that it was added to both the local bibliographic record and holdings screen after downloading, which would mean a cataloger had shelflisted the added call number. Therefore, all call numbers in NOTIS bibliographic records from the selected samples (except the control group) were compared to the call numbers in the corresponding OCLC records. Sample call numbers that differed were discarded.

Using the sample selection algorithm, a program was designed to choose the sample call numbers automatically. Since the local NOTIS database is updated in real time, a computer-generated shelflist frozen in time was used as the universe for sample selection. Samples were drawn on March 11, 1995. The programmer modified an inventory program to reproduce an exact replica of the NOTIS online shelflist order. Records were selected with a uniform random number generator, then the sample selection program was applied to each record. To compensate for items that were expected to be discarded for reasons discussed above, larger samples than needed were requested from the system. Then, during the manual processes of checking NOTIS call numbers against OCLC and shelflisting the sample items, call numbers that were discarded were simply replaced with the next available sample item until a total of 200 call numbers per sample was reached.

A report for each sample was printed showing a grouping of the selected call numbers with the call numbers immediately preceding and following them in the NOTIS shelflist order, along with the main entry, title field, and date of entry in the online catalog. These fields were considered basic for a quick visual scan of correct shelflist order. Sample items were printed in the order of random selection and numbered for identification on data analysis coding sheets.

Correct cutter number order and appropriateness of classification were determined by a visual check of the sample printouts. When a possible error was encountered by examining the printout data, or when the basis for cutting was not immediately apparent from the main entry and title, the target call number was shelflisted in the NOTIS database as it would have been at the time of cataloging. This meant that bibliographic records, holdings screens, and classification schedules were consulted to determine the correct call number. All errors detected in sample call numbers were recorded on a coding sheet.

The types of errors we encountered were: the assignment of an incorrect classification for the subject matter (not when the question was cataloger’s discretion, but an obviously wrong class number); the assignment of the wrong cutter number (i.e., it did not match the main entry or follow the cutting instructions in the class schedule); and call numbers cuttered out of local shelflist order (based on the criterion used for cutting). No duplicate call numbers were discovered, but these also would have been considered errors, since UA assigns unique call numbers to items. All categories of errors potentially contained typographical errors that could not be identified as a separate category, but in any case, should have been edited during the shelflisting process if the call numbers were checked at the time of cataloging. No obvious typographical errors, such as the transposition of two letters or numbers, were found.
In order to estimate the rate of occurrence of various kinds of shelllisting errors in the database, we drew random samples of entries resulting from different shelllisting policies. The fraction of each sample with incorrectly assigned call numbers was determined. Reduced to simplest terms, we sought to measure a binary variable (correct vs. incorrect call numbers) by examining a random sample of a large population (the entries in the UA catalog). It should be intuitively obvious that there is a correlation between the size of the sample studied and the reliability of the estimate derived from it. However, the amount of effort required to examine a sample increases in direct proportion to the size of that sample. Thus, considerable thought was given to the size of the sample to be drawn.

**Optimum Sample Size**

Counterintuitively, the size of the population from which a sample is drawn is of no consequence—provided certain reasonable conditions are met. However, the likelihood of occurrence of the condition to be investigated is an important factor. When random samples are drawn from a population and they are examined for a binary variable, it can be shown that the sample means are normally distributed. The sample mean serves as an estimate of the mean of the population and the standard deviation of the population can be estimated from the formula

$$\sigma = \sqrt{\frac{pq}{n}}$$

where \( p = \) the observed probability of occurrence of the condition under investigation, \( q = 1 - p, \) and \( n = \) the size of the sample (Hoel 1971, 82–85). The standard deviation has the property that approximately 68% of all measurements will fall within a range that is \( \pm 1 \) standard deviation from the mean, and 95% of all measurements will fall within \( \pm 1.96 \) standard deviations from the mean.

We examined preliminary samples in order to get an idea of the probabilities we would be seeking to measure. The preliminary samples were selected in the same manner as the study samples. These samples indicated that the likelihood of shelllisting error in the database was less than 10% but greater than 5%. We consequently developed table 1. Each column and each row corresponds to sample size and probability respectively.

The entry in each cell is \( 1.96 \times \) the standard deviation that we would obtain with such a sample divided by the assumed probability, i.e., it is a measure of how closely we could expect to estimate the population mean if we were to use a sample of the size represented by that column. As can be seen from table 1, the intersection of a sample of 200 and a probability of 8% yields a ratio of less than 1/2. Doubling the sample size to 400 only reduces the ratio to approximately 1/3 and quadrupling it to 800 only serves to reduce it to 1/4. Thus, we chose 200 as our sample size, as this provides what we judged to be the optimum discrimination relative to the effort required to obtain it, i.e., the measurement uncertainty would be 1/2 or less of the value of the variable we would be seeking to measure. Furthermore, the projected uncertainties are also well within reasonable tolerances for a study such as this. Small differences, e.g., 2%–3%, would not be sufficient by themselves to sway a choice of cataloging policy.

### Analysis of the Samples

Table 2 provides a summary of the results of examining call numbers in the samples selected. It is readily apparent that there is considerable overlap among the esti-
Figure 1. Comparison of Error Samples

TABLE 2

<table>
<thead>
<tr>
<th>Sample</th>
<th>Total Errors</th>
<th>p (%)</th>
<th>sd (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Cataloging (Control Group)</td>
<td>17</td>
<td>8.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Copy Cataloging, all sources</td>
<td>12</td>
<td>6.0</td>
<td>1.7</td>
</tr>
<tr>
<td>Copy Cataloging, LC</td>
<td>9</td>
<td>4.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Copy Cataloging—Class P (all sources)</td>
<td>14</td>
<td>7.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Copy Cataloging—Class Q (all sources)</td>
<td>10</td>
<td>5.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Copy Cataloging—Class T (all sources)</td>
<td>14</td>
<td>7.0</td>
<td>1.8</td>
</tr>
</tbody>
</table>

rates under different shelflisting policies. We can estimate these differences by subtracting the associated sample averages. Clearly, if the differences are large, we can be relatively confident that we have correctly identified a significant difference in the consequences of the shelflisting practices under consideration. If they are very small, our confidence in the significance of that difference is correspondingly weak. Thus, we need a test to assess the significance of differences we measure. Such a test can be established by noting that the difference between the means of two normally distributed variables is likewise normally distributed.

Therefore, we can formally state our test by formulating a hypothesis, H₁: There is a difference between the mean shelflisting error rate, μr, for call numbers that have been revised and those that have been accepted from the OCLC shared cataloging database without revision. It is easier to test the converse of a hypothesis such as the foregoing, the null hypothesis, H₀: There is no difference in the mean shelflisting error rate for records that have been shelflisted and those that have been accepted from the OCLC shared...
cataloging database without revision. The null hypothesis implies that the average error rates of call numbers in the two samples are consistent with a situation in which all records are selected from the same population, which implies that \( \mu_r - \mu_u = 0 \).

Attempts to measure this difference will yield sample results that have a normal distribution—we can expect that samples will yield non-zero differences; some differences will be positive and some negative, but their average will be zero. We also expect that large differences will be much less likely to occur than small differences. Thus, if we observe a large difference, we will be inclined to reject the null hypothesis in favor of the experimental hypothesis.

It is known that 95\% of all sample means will fall within \( \pm 1.96 \) standard deviations of the population mean. We do not know a priori the population mean or standard deviation; however, we can estimate them by assuming, in accordance with the null hypothesis, that both samples were drawn from the same population. Thus, if the number of shelflisting errors observed in the sample of \( n_r \) revised items is \( e_r \), and the number of errors in the sample of \( n_u \) unrevised items is \( e_u \), the probability, \( p \), that a call number drawn from the total population will be in error is,

\[
p = \frac{e_r + e_u}{n_r + n_u} = \frac{e_r + e_u}{2n}
\]

The standard deviation of the difference may also be estimated from the two sample standard deviations,

\[
\sigma = \sqrt{\frac{\sigma_r^2}{n_r} + \frac{\sigma_u^2}{n_u}}
\]

where \( \sigma_r \) and \( \sigma_u \) are the sample standard deviations of the revised, and unrevised, samples respectively (Hoel 1971, 134–37).

The results of this analysis are presented in table 3, where \( z \) is the standard variable computed for each sample.

The standard variable is a construct that simplifies computations and comparisons involving the normal distribution. It is defined as

\[
z = \left(\frac{x - \mu}{\sigma}\right)^2
\]

As is obvious from the contents of table 3, in none of the cases studied is the standard variable large enough to reject the null hypothesis at a 95\% level of confidence. The final column of table 3 gives the probability of observing a standard variable greater than that which was observed in our samples even under the assumption of the null hypothesis.

As we can see from table 3, only in the case of Library of Congress records do we come even close to being able to reject the null hypothesis. Not surprisingly, our sampling data indicates that the incidence of shelflisting error in LC-created records is possibly less than that found in UA-created records. In all other cases we have no evidence that would permit us to reject the null hypothesis, i.e., that there is no difference between the shelflisting error rate observed in unrevised copy cataloging records and original cataloging records.

**The Problem in Perspective**

Given the small number of errors encountered overall, it would appear that shelflisting every call number is not a cost-effective procedure. Before making that
TABLE 4

<table>
<thead>
<tr>
<th>Sample</th>
<th>Wrong Class Number</th>
<th>Wrong Cutter Number</th>
<th>Cutter out of Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 200</td>
<td>No.  %</td>
<td>No.  %</td>
<td>No.  %</td>
</tr>
<tr>
<td>Control</td>
<td>2  1.0</td>
<td>7  3.5</td>
<td>8  4.0</td>
</tr>
<tr>
<td>050/090</td>
<td>2  1.0</td>
<td>6  3.0</td>
<td>4  2.0</td>
</tr>
<tr>
<td>050 (LC)</td>
<td>2  1.0</td>
<td>2  1.0</td>
<td>5  2.5</td>
</tr>
<tr>
<td>P class</td>
<td>1  0.5</td>
<td>5  2.5</td>
<td>6  3.0</td>
</tr>
<tr>
<td>Q class</td>
<td>1  0.5</td>
<td>6  3.0</td>
<td>6  3.0</td>
</tr>
<tr>
<td>T class</td>
<td>1  0.5</td>
<td>6  3.0</td>
<td>7  3.5</td>
</tr>
<tr>
<td>Totals</td>
<td>9  4.5</td>
<td>28 14</td>
<td>36 18.0</td>
</tr>
</tbody>
</table>

decision, we wanted to know whether the errors that were found had little meaning for the library consumer browsing the shelves, or if they had major implications for access to the collection. As part of the study, the types of shelflisting errors found were coded and examined. Intuitively, it seems that some kinds of shelflist disorder would have more impact than others on the browsability of a collection. For instance, the assignment of an incorrect classification number could place an item totally out of its subject range on the shelf. The assignment of a wrong cutter number, on the other hand, might result in related works occurring on different shelves within a discipline, but still close enough to be discovered by perusing the spine titles in the general area. Similarly, having cutter numbers out of order that place items on a shelf a few books away from their proper place, or locate an author's works a short distance apart, would have little consequence for retrieval.

Table 4 shows the total numbers of the types of errors that were found in sample call numbers, and the fraction of the sample they represent. The results of this portion of the study show that only a small number of errors involved incorrect classification. Wrong class numbers were recorded when the classification obviously did not reflect the subject matter of the record. The largest number of errors involved cuttering of all types. Wrong cutter numbers included call numbers that did not follow the instructions for cuttering in the classification schedule; call numbers cuttered differently than earlier editions of the same work; or a cutter incorrectly assigned to the main entry. A cutter out of order placed the item out of correct filing sequence on the shelf by main entry, title, etc. This kind of shelflist disorder could be expected to have the least impact on retrieval through browsing. The fact that almost half of the errors involved a cutter out of local shelflist order is not surprising, given the diversity in holdings among institutions and therefore in their shelflists. Further study is necessary to determine the actual effect of item displacement on browsing success, but logically it would appear that local shelflisting has little real value to our patrons.

Another question concerning the interpretation of the data arises from the high error rate in the control group, which consisted of call numbers that had been locally assigned and shelflisted. We would have expected a much lower error rate for these than the rest of the samples, since they had been shelflisted and therefore deliberately placed in order in the database. The individual records for each item were examined to determine possible reasons for the errors and discover whether this phenomenon could be considered a confounding variable in the study. Several of the errors could be traced directly to a project in which a temporary staff member, a cataloging student, was hired to reduce backlog and trained to assign call numbers. Although quality control procedures were implemented, it would not have been cost-effective to check the shelflisting of every item after the student's training phase. During the time period of the study, three new monographs catalogers were also hired in the department. Some errors could be traced to the training periods of these catalogers. A small number of errors could be attributed to individuals by subject expertise, and probably represent random human fallibility. This brought up the question of whether our results can be generalized to other institutions. Although further study would be needed to draw definite conclusions, our circumstances may be typical of
other institutions trying to maintain current cataloging workflow while reducing backlogs in cataloging. Different results may have been obtained in a different time period within the same catalog department, as well as from another institution. No cataloger is infallible, and more than likely, no shelflist is perfect. The only way to answer the question of generalizability conclusively would be to replicate this study at other institutions. Given the expense and magnitude of such a project, it is unlikely many similar studies will be undertaken.

In conclusion, the results of this study indicate that local shelflisting is not a cost-effective operation for the University of Alabama libraries, and although it is not certain that the study can be generalized to other institutions, this research should be carefully weighed by other institutions in the process of reviewing local cataloging policy and workflow. The small number of errors detected produced a small amount of shelflist disorder and would therefore be expected to have a low impact on the browsability of the collections. The lack of a difference in disorder created by LC-assigned and member-assigned call numbers argues that differential work flow treatment of call numbers by source of cataloging copy does not significantly improve the quality of the local shelflist.

WORKS CITED


A Comparison of Pre- and Post-Cataloging Authority Control

Karen E. Greever

As librarians at Ball State University Libraries prepared to implement the authority control module of its automated system, little information about the dependability of the module or its effectiveness as compared to the active system of providing authority control was available. The head of cataloging decided that it would be advisable to compare the effectiveness of the pre-cataloging authority control procedures in place with the post-cataloging authority control procedures that could be provided through the NOTIS reports. The two systems would be run concurrently during the test period. To test the effectiveness of each form of authority control, the Authority Control Librarian compared the number and type of established headings for which local authority records would be added using the pre-cataloging procedures to the number and type of established headings for which local authority records would be added using the report system. The test, as expected, revealed that in most respects the post-cataloging authority control procedures provide as much or more in the way of authority control than the front-end procedures, and that their uses reduce redundancy and increase efficiency.

In library literature, many issues concerning authority control, including its usefulness or lack thereof, whether to do it at all, how much to do, and when to do it, have been discussed at length (see, for example, Younger 1995). However, as librarians at Ball State University Libraries prepared to implement the authority control module of the automated system (Kirby 1989), little information about the dependability of the module or its effectiveness as compared to the current system of providing authority control was available. Librarians at Texas A&M University chose to implement the same system without questioning its effectiveness (Halverson, Gomez, and Marner 1992), as did librarians at Auburn University, who planned carefully for implementation and for retrospective conversion of the paper authority file (Goldman and Smith 1989). Goldman and Havens (1990) provided statistics on increased efficiency with the implementation of automated authority control, but did not consider reliability. At Ball State, the new head of Cataloging...
Services had arrived from a library where authority control was done at the bibliographic utility level and where the local automated system did not always perform as advertised. She believed that the use of technology in the authority control process could result in overall performance improvement and was supportive of the implementation; however, she suggested that a verification of the new system’s reliability would be helpful in subsequent evaluation of performance. To allay the concerns of the head of Cataloging and to provide data to the library administration, the head of Cataloging and the Authority Control Librarian decided to test the module.

The local environment will be described first, including the system of providing authority control prior to full cataloging of items, i.e., pre-cataloging authority control, and the problems that developed with it. Next, the test that was conducted to satisfy questions about the system will be described, followed by the results of the test, conclusions, and finally issues regarding implementation.

**LOCAL ENVIRONMENT**

Ball State University Libraries have holdings of approximately 1.1 million titles. In 1995, 17,321 monographs were cataloged using the OCLC, Online Computer Library Center, Inc., bibliographic database as the bibliographic utility. Of those titles, 65% had Library of Congress (LC) copy, 30% member copy, and 5% required original records. In addition, 2,479 non-print titles were cataloged. Currently, our new cataloging records are tape loaded weekly. We load government documents records monthly and average one tape load of records for major microform sets per year. We use an Innovative Interfaces system for Serials and Acquisitions. In 1990, we began using NOTIS Library Management System for our online catalog. We loaded authority records from a vendor cleanup of our database in 1991, but did not implement any of the NOTIS authority control programs until 1994. This delay was due in part to personnel changes in the key positions of head of Cataloging Services and Authority Control Librarian.

Technical Services at Ball State consists of three units: Acquisitions, Educational Resources Technical Services (ERTS), and Cataloging Services. ERTS consists of 7 staff members and 3 professionals who perform cataloging, bibliographic maintenance, and physical processing for nonprint materials. Cataloging Services consists of 15 staff members and 6 professionals who perform monograph and serial cataloging, bibliographic maintenance, authority control, binding, and physical processing. The Authority Control section within Cataloging Services consists of one full-time staff member, several student assistants, and one professional, who also heads the Catalog Management section. For the most part, copy cataloging is performed by Technical Cataloging Assistants (TCAs). Original and locked records are done by catalogers, who also catalog the member copy for more complex titles and foreign-language materials.

**PRE-CATALOGING AUTHORITY CONTROL**

Authority control had been performed at Ball State during the initial stages of cataloging even after the tape load of retrospective authority records in 1991. Typically, Authority Control and Catalog Management TCAs searched for records in OCLC’s bibliographic and authority databases, with the exception of topical subject headings. If the TCAs found conflicts between the headings in the authority record and the bibliographic record, or if there were cross-references to the heading in question, a printout was made of the authority record and the printout was attached to the bibliographic record printout. If an authority record matched the heading on the bibliographic record but there were no cross-references on the authority record, no printout was made. If it was necessary for a cataloger to establish a new heading (because there was no corresponding authority record in OCLC for that heading even though the heading occurred on a bibliographic record), a workform for that heading was attached to the
bibliographic record. Typically, local authority records were created when there was a perceived need for cross-references (e.g., compound surnames, variant forms of names, and subordinate corporate bodies) or when there was a need for explanatory notes. The final decision to create a local authority record was left to the individual cataloger's discretion. Using Library of Congress Subject Headings (LCSH), catalogers also verified topical subject headings on all non-LC copy. In ERTS, both bibliographic and authority searching were typically performed by the individual cataloging the title.

After the item was cataloged and the records linked, the printouts for the bibliographic records and the authority records were forwarded to Authority Control. Students working in the Authority Control section exported the authority records from OCLC. Other students input the locally established headings into NOTIS. A TCA reviewed all of the authority records added to NOTIS, deleting duplicate authority records as necessary. This TCA then modified the authority record to reflect the holdings in the database. The Serials Section, using the same methods, had the responsibility for maintaining series authority records. These procedures were used initially to build the authority file and to compensate for the time lag between the vendor clean-up and the loading of the authority records. They were not intended to continue indefinitely.

**Problem**

Over the course of three years, the use of these pre-cataloging authority control procedures resulted in an increase in the percentage of duplicate authority records to approximately 40% of all exported authority records, as estimated by library staff. This duplication resulted in a number of inefficiencies. First, staff wasted time following pre-cataloging procedures searching for authority records on OCLC that were already in the local system, searching on OCLC for authority records to be exported that would later be identified as duplicates, searching NOTIS for duplicate authority records, and deleting the duplicate local authority records. Second, the costs associated with printing authority records during pre-cataloging were also wasteful. Third, the library incurred OCLC charges for the export of duplicate records. Finally, it was costly to store deleted duplicate records in NOTIS. Moreover, the Authority Control section was unable to keep current with the heavy workload, including the management and storage of hundreds of printouts of bibliographic and authority records arriving weekly. All of the Cataloging staff recognized the duplication of efforts and the waste of resources. This was the situation that greeted the new head of Cataloging in late 1993.

The front-end authority control procedures could have been modified to reduce the duplication of authority records, but because the NOTIS system offered programs to assist with the authority control process, any modification of front-end procedures was seen as an interim measure at best. In consultation with the head of Technical Services and with input from the Authority Control Librarian, the head of Cataloging decided that it would be advisable to compare the effectiveness of the pre-cataloging authority control procedures in place with the post-cataloging authority control procedures that could be provided through the NOTIS reports. The two systems would be run concurrently during the test period. This would allow time for staff to become familiar with the reports, to establish the reliability and accuracy of the reports, and to gather data to convince and reassure both staff and administration of the wisdom of implementation.

Before describing the methodology of the test, a brief characterization of the NOTIS New Headings Report is beneficial. Also known as the “first time use” report in other local systems, this report, which is the cornerstone of ongoing authority control, compares headings currently in the local NOTIS bibliographic database with those headings present at a previous time, e.g., the previous week. It then lists all the headings that are new to the database in a report (see figure 1).
Although the library's bibliographic database was loaded in 1990 and its authority records in 1991, the use of the New Headings Report did not begin until October 1994. Due to the long gap between the initial database load and the implementation of the New Headings Report, a large database of headings had been created for which the headings were precluded from this reporting process, because the report is produced when new bibliographic records are added to the database. Therefore, we began our use of this report with headings entered in October 1994.

**Methodology**

To test the effectiveness of each form of authority control, the Authority Control Librarian compared the number and type of established headings for which local authority records would be created using the pre-cataloging procedures to the number and type of established headings for which local authority records would be added using the report system. With the pre-cataloging practices, authority records were only added to the local file when there were cross-references for personal names, corporate names, and conferences in the OCLC record, or when cross-references were added locally either to the existing OCLC record or to a new authority record. For subject headings, authority records were also added to the local file for all subject headings as well as for subject-subdivision headings. This latter practice of adding local authority records for all subject-subdivision combinations was discontinued, however, prior to this investigation. These existing criteria for when to add authority records to the local file continued as the guidelines during the test. Only headings requiring locally created authority records were compared in this study because the number of new authority records imported from OCLC remains the same once the deduping process takes place, regardless of the method of authority control.

Working with the New Headings Re-
The Authority Control staff exported all available authority records in OCLC corresponding to the headings on the report into NOTIS. The Authority Control Librarian examined all of the headings on each report, kept a tally of the headings that required the addition of cross-references, and counted the headings that therefore required a local authority record in NOTIS, according to the pre-cataloging practices discussed above. Then the Authority Control Librarian examined the cataloging printouts (bibliographic records with attached authority records and local workforms) for the corresponding period and tallied the cross-references added to existing authority records and the local authority records created by catalogers. Pre-cataloging heading totals, as represented in the printouts, were then compared by heading type to the totals compiled from the reports.

The headings that were examined include those found in the 100, 110, 111, 700, 710, 711, and 6XX fields. Series and uniform title headings, specifically the 130, 240, 4XX, and 8XX fields, and 7XX subfield t, were not included in this comparison because the assumption from the outset of the test was that this authority work would continue to be done on the front end.

Because they had not been under authority control previously, headings on records for government documents were not initially considered part of the investigation. However, it became clear during the examination of the New Headings Report that headings on records for government documents formed a significant subset of headings requiring local authority work, so separate totals were recorded for these headings. Beginning in October 1994, 6 reports and the corresponding printouts were examined, covering the period from October to December. Approximately 7,700 bibliographic records were added to the database during this period, including 2,300 records for government documents.

**RESULTS**

The total number of local authority records created was 548. For records that were part of the regular authority control workflow using the New Headings Report, but exclusive of government documents, local authority records were created for 250 headings. One hundred thirteen of these (45%), however, were not detected using the current front-end authority control procedures. Primarily, these undetected headings were from member copy and original cataloging records. In figure 2, the number of local authority records added from the printouts and the reports is shown along with the subset of government document headings. During the test period, government documents records came under authority control for the first time. Two hundred ninety-eight local authority records were created for headings from document records, accounting for over half of the total number of locally created authority records. A summary of the results is provided in table 1. A comparison of the number of headings added using the printouts and reports and subdivided by heading type is provided in figure 3.

Results of the cross-reference comparison are also presented in table 1, followed by a comparison of the number of headings detected from the printouts but that were not found on the reports. In this category of "Headings missed on reports," the 10 undetected headings are most likely the result of errors in local processing of the first report received.

**CONCLUSIONS**

The percentage of locally established headings detected using the reports was substantially higher than the headings detected using the front-end approach. This difference may be explained by the fact that the old system introduced more variation and inconsistencies in decision making about creating local authority records because more people were making these decisions. During the examination of the reports, the Authority Control Librarian alone made judgments about the need for local authority records for all headings, which allowed for greater consistency in adhering to the criteria governing creation of local authority records.
Figure 2. Total Number of Headings by Source

Figure 3. Total Number of Headings by Heading Type
### TABLE 1
SUMMARY RESULTS FOR LOCALLY ESTABLISHED AUTHORITY RECORDS
REPORT/PRINTOUT COMPARISON BY HEADING TYPE

<table>
<thead>
<tr>
<th>Heading Type</th>
<th>Source</th>
<th>Locally Cataloged</th>
<th>Gov Doc Tapeload</th>
<th>Total–Local Authorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Names</td>
<td>Printouts</td>
<td>82</td>
<td>0</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Reports</td>
<td>109</td>
<td>59</td>
<td>168</td>
</tr>
<tr>
<td>Corporate</td>
<td>Printouts</td>
<td>46</td>
<td>0</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Reports</td>
<td>72</td>
<td>27</td>
<td>99</td>
</tr>
<tr>
<td>Conference</td>
<td>Printouts</td>
<td>8</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Reports</td>
<td>13</td>
<td>43</td>
<td>56</td>
</tr>
<tr>
<td>Subject</td>
<td>Printouts</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reports</td>
<td>56</td>
<td>169</td>
<td>225</td>
</tr>
<tr>
<td>Total headings</td>
<td>Printouts</td>
<td>137</td>
<td>0</td>
<td>137</td>
</tr>
<tr>
<td></td>
<td>Reports</td>
<td>251</td>
<td>298</td>
<td>549</td>
</tr>
<tr>
<td>X-refs</td>
<td>Printouts</td>
<td>226</td>
<td>0</td>
<td>226</td>
</tr>
<tr>
<td></td>
<td>Reports</td>
<td>109</td>
<td>114</td>
<td>223</td>
</tr>
<tr>
<td>Missed on Report</td>
<td>Printout</td>
<td>10</td>
<td>N/A</td>
<td>10</td>
</tr>
</tbody>
</table>

Figure 4. NOTIS Authority Records Monthly Increases
The number of cross-references detected through the reports compared to the printouts was similar. This may have been because under the old system, catalogers may not have forwarded authority records when they did not perceive a need for cross-references. The number of new authority records added to the database increased during the trial. We were pleased to see that the number of records exported from OCLC decreased significantly, most likely due to the elimination of the exporting of duplicate headings (see figure 4).

Even though these procedures were new, the Authority Control staff was able not only to keep up with processing the authority control reports, but also to process the backlog of authority control printouts that had accumulated using the older methods. In addition to regaining and maintaining currency, the use of the New Headings Report greatly reduced the redundancy inherent in earlier authority control procedures. Although the post-cataloging authority control system has proven to be very efficient, the intense analysis required to process these reports is very taxing, in part because of the physical demands of spending extended periods of time at a computer terminal and also because of the mental exertion of carefully examining authority records and bibliographic records for inconsistencies, conflicts, and errors. This has been exacerbated because only one individual has performed these duties. Also, determining when cross-references should be added to imported authority records has required supplementary training.

The Cumulative Record Total Report generated by our Automation Department also provides information that reveals the savings due to the implementation of post-cataloging authority control (see table 2). In the November column of the table, the initial impact of post-cataloging authority control is indicated by a substantial decrease (56%) in the total number of authority records—both those newly added to the database as well as those recently deleted. This decrease in large part reflects the reduction in duplicate authority records, which had been previously estimated to be around 40%. Under the new procedures, fewer duplicates were added to the database, so fewer needed to be deleted.

Even though both methods of authority control were used during the investigation period, continued savings were realized because Authority Control has relied primarily on the reports to manage current workflow. Additional savings were indicated by the decrease in OCLC exporting charges over the same period (see

TABLE 2
NOTIS Authority Records: Monthly Totals
August 1994–April 1995

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>3,219</td>
<td>2,804</td>
<td>2,119</td>
<td>706</td>
<td>1,752</td>
<td>1,863</td>
<td>3,461</td>
<td>1,518</td>
<td>728</td>
</tr>
<tr>
<td>Deleted</td>
<td>5,346</td>
<td>4,703</td>
<td>4,626</td>
<td>2,227</td>
<td>397</td>
<td>882</td>
<td>938</td>
<td>1,168</td>
<td>1,844</td>
</tr>
<tr>
<td>Total</td>
<td>8,565</td>
<td>7,507</td>
<td>6,745</td>
<td>2,933</td>
<td>2,149</td>
<td>2,745</td>
<td>4,399</td>
<td>2,686</td>
<td>2,572</td>
</tr>
</tbody>
</table>

*Initiation of Post-Cataloging Authority Control test.

TABLE 3
OCLC Export Charges
August 1994–April 1995

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Export Charges ($)</td>
<td>434</td>
<td>450</td>
<td>381</td>
<td>191</td>
<td>195</td>
<td>243</td>
<td>269</td>
<td>256</td>
<td>199</td>
</tr>
</tbody>
</table>

*Initiation of Post-Cataloging Authority Control test.
table 3). Export charges decreased during and subsequent to the test despite additional activity that resulted from 3 new facets of authority control: (1) the processing of the Conflict and Error reports; (2) the authority work generated by a retrospective government documents cataloging project; and (3) the impact of all government documents being subject to authority control for the first time (see figure 5).

The reduction of duplicate authority records could have been accomplished by a modification of existing front-end authority control procedures, i.e., searching NOTIS for existing authority records prior to exporting records from OCLC. However, that modification would still have necessitated the redundancy of searching NOTIS manually, which is exactly what the New Headings Report is designed to do automatically. Consequently, this was not deemed to be a viable alternative.

As mentioned above, government documents received attention in the area of authority control for the first time since the inception of the tapeloading of government documents records at Ball State. In the past, the library itself had been unable to provide authority control for specially purchased tape loads such as government documents and major microform products. Based on the success of the post-cataloging authority control process upon the government documents records, it is evident that any tape purchased and loaded by the library would receive adequate authority control easily accommodated by the post-cataloging procedures. Since the test, separate New Headings Reports of 300 and 800 pages have been provided for two tape loads of major microform sets.

**IMPLEMENTATION OF NEW PROCEDURES**

Given these results, the decision to implement was quickly made. The head of Cataloging and the Authority Control Librarian devised preliminary procedures and
policies for implementation. These drafts were reviewed first by the professional librarians. After further revisions, the results of the test and the new policies and procedures were presented to the staff for comments and questions.

The head of Cataloging Services and the Authority Control Librarian reviewed local policies to determine which headings would require authority records in the local system. The decision was made to continue to export all authority records found in OCLC (both full and partial matches), and to create local authority records for headings requiring cross-references, headings added to bibliographic records by local catalogers, and headings on new or locked records. The decision about which OCLC authority records to import and when local authority records would be required was based both on the automated system and on cataloging distinctions that would be easy to understand and remember. We decided that differentiating between types of OCLC authority records, e.g., those with and without cross-references, was not useful in our situation (and would be confusing for the students doing the bulk of the exporting). We decided to accept the authority work done by other libraries whether or not an actual authority record existed in OCLC. Thus we would not add local authority records for headings on OCLC member copy unless there was a perceived need for cross-references. However, for headings for which we were responsible, i.e., original cataloging, we wanted a way to indicate that proper authority work had been done by a cataloger regardless of whether cross-references were required. This required that local authority records be made for those headings. It became apparent after working with the authority control module that any other local authority records that lacked cross-references or notes would serve no purpose in the online catalog. In terms of staff use, these authority records were either confusing or ignored, so this type of local authority record was eliminated.

The new procedures mandated that catalogers accept the form of all name and subject headings on LC and member copy. Corrections to the form are made during the review of the New Headings Report. However, catalogers are still responsible for subject analysis and determining whether a particular subject heading on the bibliographic record is justified. For new and locked records, all headings are verified during the cataloging process. Authority work for series and uniform titles continues to be performed during the cataloging process. There has not been any debate about the decision for uniform titles, but the possibility of using the New Headings Report to control series headings will be re-examined in the future.

In addition to the currency gained with the use of the New Headings Report, the ability to provide authority control for government documents and other tapeloads, and the time freed up for other authority control projects, there were also significant gains in cataloging productivity for LC copy. This was a benefit that was not anticipated when the decision to implement was made. One year after implementing post-cataloging authority control, the average number of books with LC copy cataloged per hour by the TCAs in Cataloging Services increased by 1.05. This has allowed more time for special projects and for handling a greater variety of tasks.

**Concluding Remarks**

With post-cataloging authority control in place, it is easy for catalogers and TCAs to forget the situations (series and uniform titles) in which they are still required to verify and create authority records. Currently one staff member is doing the majority of work on the New Headings Report, which is rather arduous, although she is glad to be free of the printouts. The post-cataloging system and the New Headings Report are not yet well understood by all catalogers and TCAs, underscoring the need for effective follow-up and communication about the details of the new system. In part because of this lack of understanding, some have had trouble letting go of old work habits. After years of being trained to create "perfect" records and to be skeptical of the work of others, catalogers are now being told to accept and trust not only the cataloging done.
at other institutions but also the ability of the machine to identify headings to be reviewed for authority control. This study has demonstrated that the local system will produce a list of new headings that the authority control unit can then review to determine where authority records are needed.

In the end, the greatest benefits of the implementation are the reliability of the system-produced list of headings and the increased efficiency gained from post-cataloging authority control that has provided people with the time to perform the more complex tasks and to focus on the judgments that machines cannot.

WORKS CITED
Notes on Operations

Consortium Use of the OCLC/AMIGOS Collection Analysis CD: The SUNY Experience

Wanda V. Dole and Sherry S. Chang

In 1989, the OCLC Online Computer Library Center, Inc. (OCLC) introduced a microcomputer-based evaluation tool, the Collection Analysis CD (CACD). The tool is marketed and supported by AMIGOS, the independent OCLC network serving the southwestern United States. Since its introduction, the CACD has been used by librarians at a number of libraries to measure their collections against those of peer libraries. This article is the first published report of the use of the tool by a consortium of large research libraries to evaluate consortium holdings and to facilitate resource sharing.

SUNY Centers' Cooperation

Created in 1948, the State University of New York (SUNY) is the youngest and largest state university system in the United States. SUNY evolved from a mixture of teachers' colleges, private institutions, and technical schools into a complex public educational system. SUNY currently enrolls 391,706 students at 29 state-operated campuses that consist of 4 doctorate-granting university centers (2 with medical schools), 13 liberal arts colleges, 3 specialized colleges, 2 stand-alone medical schools, 6 two-year colleges of technology and agriculture, and 1 upper division institute of technology. SUNY also encompasses 35 community colleges and 5 statutory colleges.

The University Centers (SUNY Albany, SUNY Binghamton, SUNY Buffalo, and SUNY Stony Brook) are doctorate-granting institutions, each with distinct academic strengths and research missions. The combined holdings of their libraries total approximately 8.2 million volumes. The distance between the centers (100 to 500 miles) makes it a challenge for the libraries to cooperate or even to bring staff together to discuss cooperation. In 1989, the directors of the four University Center Libraries developed a set of shared goals (SUNY, University Center Libraries 1990); this enabled the four centers to secure outside funding from the Council on Library Resources (CLR) for several projects that provided practical experience and the basis for further cooperation (Dole and Smith 1995).

In 1991-92, four studies were undertaken to provide supporting data for planning and policy development. Two studies...
focused on the libraries' journal collections; in the others, authors examined interlibrary loan and faculty need for electronic information resources. The final report (SUNY, University Center Libraries 1993), combined with articles by SUNY Center librarians (Adams and Bonk 1995; Dole and Chang 1996; Dole and Smith 1995; Naylor 1993, 1994) provide detailed information on each study.

Until 1996, little effort had been made to evaluate the monograph collections of the four SUNY University Center Libraries. Evans, Gibrod, and Franz (1977) used OCLC archival tapes to conduct overlap studies of all SUNY Libraries. Dole (1994) used the CACD to evaluate SUNY Stony Brook's monograph collection against the collections of a set of 27 Association of Research Libraries peer libraries and of a mythical peer group, which was reported on as well in a second report by Dima et al. (1993). The evaluation was conducted to investigate whether the collecting patterns at Stony Brook's libraries matched overall university priorities.

Although there is a growing body of literature on overlap studies (Potter 1982, 1986; Noffsinger 1992) and electronic collection analysis tools such as the CACD (OCLC 1992, 1993; Gyeszly, Allen, and Smith 1992; Joy 1993; Vellucci 1993; Webster 1995), there is little published on the use of this tool in evaluating consortium holdings. AMICOS Library Liaison Officer Shannon Sanko (Sanko 1996) reported that there have been only two consortium purchases of the tool: an Illinois statewide consortium (in 1993) and the SUNY Centers (in 1995). Alan Nourie, project coordinator of the Illinois study, confirmed that a consortium of the 27 largest academic and research libraries in Illinois had received a grant to purchase the CACD in 1993 (Nourie 1996).

Nourie reported that the consortium has based some resource sharing decisions on the results of the study, but has not yet issued a report or publication of the group project (Nourie 1996). To our knowledge at the time of writing (October 1996), the literature contains no serious studies on the use of the CACD in comparing consortium holdings the size of the SUNY University Centers for the purpose of cooperative collection development.

**SUNY Centers' Cooperative Collection Development**

Collection development officers of the four University Centers meet on a regular basis to plan and conduct resource sharing and cooperative collection development projects. The group began discussing methods for evaluation of the monographic collections in September 1994. They discussed the Conspectus, a collection analysis instrument developed in the late 1970s by the Research Libraries Group (RLG). Libraries use this instrument to evaluate their collections, subject by subject, and assign rankings of 0 to 5 to approximately 7,000 subjects, usually corresponding to small segments of the Library of Congress (LC) classification. Dole rejected the use of the Conspectus as a tool for evaluating the collections of the SUNY Center Libraries because it was labor intensive and subjective. At her suggestion, the group discussed the CACD as an alternative method, examined demonstration copies, and met with representatives of AMICOS.

At a January 1995 meeting, they agreed that a collection evaluation project using the CACD would enable the four University Center Libraries to compare monographic holdings in much the same way that the CLR grant had enabled them to compare journal holdings. They expressed hope that the project would inform collection development efforts by providing an empirical measure of the strengths and weaknesses of the collections across the centers and that it would also help to unite the centers by providing them with both common and comparative bodies of data that could be updated at regular intervals.

In April 1995, the group wrote to the directors of the SUNY Center Libraries and recommended that each campus invest approximately $6,000 in the CACD database and software. They believed that comparison of ten years of monographic
purchases at the four centers would identify subject areas where they could target future resource-sharing efforts. They hoped that the results of the study would assist them in reassessing local collection policies and fiscal allocations by comparing existing collection investments to system-wide administrative data on degree programs and enrollments.

In the fall of 1995, three member libraries (Albany, Buffalo, and Stony Brook) purchased the system. They included holdings data for all four member libraries in the study.

CADC: DESCRIPTION

The standard CADC package includes one compact disc with a database of 2.1 million short bibliographic records drawn from the OCLC Online Union Catalog for a ten-year publication period (usually two years behind the current date). The records included are selected on the basis of having an LC classification number in the record. The tool includes holdings records for 14 standard peer groups, software for statistical analysis, and the subscriber’s holdings data. The 14 predefined peer groups included in the standard version are OCLC-member academic and research libraries that have actively cataloged during the decade covered by the database. The peer groups are based on factors such as collection size and academic degree programs.

The CACD system provides three levels of analysis: collection metrics, subcollection metrics, and bibliographic lists. The collection metrics level is structured on the 33 divisions of the LC classification schedule. The subcollection metrics level corresponds to the National Shelf List 500 count, a subcomponent of the LC class divisions. In both the collection and subcollection levels, there are six statistical reports or tables. The system is menu-driven and simple to use. In addition to standard reports generated by the system, customized reports can be produced by transferring data to spreadsheets or other programs.

The edition used in the SUNY Centers project included book titles published between 1984 and 1994. Serials, government documents, and dissertations were excluded. Each record selected for the database must contain an LC classification number and be held by at least one academic or research library. The three SUNY Center Libraries that participated in the study each purchased a standard package and then added four peer groups: the three other consortium members individually and an aggregate of those three. For Stony Brook, the additional peer groups were Albany, Binghamton, Buffalo, and the combined records for Albany, Binghamton, and Buffalo.

The participating libraries (Albany, Buffalo, and Stony Brook) met in December 1995 to plan analyses based on the CACD and assign responsibility for those analyses. Analyses completed to date include:

1. A preliminary spreadsheet combining the collection metrics for all four Center Libraries, which was produced by Albany.
2. Graphs comparing the joint acquisitions of the Center Libraries to those of several standard peer groups, which were produced by Stony Brook (see figures 1 and 2).
3. A graph comparing the total acquisitions of the Center Libraries, produced by Stony Brook (see figure 3).
4. A subcollection-level comparison of subject areas and allocation units, produced by Stony Brook (see figures 4–6).

STONY BROOK CACD STUDIES

In doing the analyses for which Stony Brook had taken responsibility, we spent February and March 1996 using the CACD to analyze the combined acquisitions of SUNY Center Libraries against standard peers and Stony Brook’s acquisitions against those of the other Center Libraries. We input the figures into a spreadsheet program and produced graphs. We compared the combined acquisitions of the University Centers for the period 1984–94 to the following four CACD standard peer groups:

1. All ARL libraries on OCLC (80 libraries)
2. ARL-1: The 18 largest ARL libraries on OCLC
3. ARL-2: The following 23 largest ARL libraries on OCLC
4. Large Academic Libraries: The largest 99 academic libraries—libraries with holdings of 1 million or more volumes

**Findings**

We found that during the period 1984–94, the Center Libraries together had acquired 730,746 titles, fewer than the average member of the all-ARL-OCLC peer group (1,716,494), the ARL-1 peer group (1,438,403), and the ARL-2 peer group (1,020,834) (see figure 1). During the decade 1984–94, the Center Libraries also acquired fewer titles than the average member of the Large Academic Libraries peer group (see figure 2), which we attribute to their having fewer resources to devote to monograph purchases than did the members of these four peer groups. When we compared the total acquisitions of the SUNY Center Libraries (see figure 3), we found that Binghamton had acquired more titles than the other three libraries. Our analysis of acquisitions by broad
subject category (see figures 4–6) showed that Binghamton acquired more humanities and social sciences titles than the other three, and Stony Brook acquired more science titles. This acquisitions pattern is consistent with the distinct missions of the two institutions. Binghamton has a strong undergraduate mission and program strengths in the humanities and social sciences, while Stony Brook has a strong graduate mission in the sciences.

We used the Subcollection Proportions mode of the CACD to compare specific call-number ranges of Stony Brook's 1984–94 acquisitions to those of the other Center Libraries. We produced 38 graphs comparing the acquisitions by department or library fund code. The graphs are being used at Stony Brook and the other campuses to illustrate the strengths and weaknesses of the collections to library selectors, teaching faculty, and administrators.
CONCLUSIONS

The results of SUNY's CACD project enabled the four University Center Libraries to compare monographic holdings in much the same way that previous studies had enabled them to compare journal holdings. The project provided an empirical measure of collection strengths across the centers and helped to unite the centers by providing them with a common and comparative body of data that can be updated at regular intervals.

By combining the data from the CACD system with simple programs such as spreadsheets, we were able to produce easy-to-understand graphic measures of the collections. The graphs are useful tools for explaining the collections and allocations to local faculty and administrators.

Although the graphs confirmed that in most areas the SUNY University Center Libraries acquired materials at the levels stated in their collection development policy statements, there were some nota-
ble exceptions. In some areas, one or more of the libraries purchased materials at a higher level than that stated in the collection policy. This information, combined with data on enrollment and degrees obtained from SUNY's Central Administration will be used to revise collection development policies and to discuss resource sharing agreements. SUNY Centers Libraries may be asked to take on primary collecting responsibilities for subjects in which they have strong collections and graduate programs.

We recommend the use of computer-based tools for the evaluation of the collections of library consortia. Such tools can analyze rapidly, accurately, and inexpensively a vast amount of data. The necessary data can often be obtained as an incidental spin-off from another source, such as a circulation system or online public access catalog, making this type of study practical in libraries.

Works Cited


THE MUSIC LIBRARY ASSOCIATION
PROUDLY ANNOUNCES THE PUBLICATION OF
Cataloging Musical Moving Image Material
Edited by Lowell Ashley
$28.00 ($22.40 to MLA Members)

Cataloging Musical Moving Image Material is a guide for catalogers in all types of libraries who work with videos and films of musical performances and presentations. The guide also addresses the cataloging of videos and films of multifaceted performances and presentations where music is an important component of the production (such as ballet performances) as well as videos and films of musical performances per se.

Both descriptive cataloging, based on AACR2r and LCSH, and subject cataloging, based primarily on LCSH, are treated in detail. While controversial questions involving descriptive cataloging are acknowledged and possible inadequacies in current cataloging rules are presented, the guide attempts to adhere to current standards and takes no position on the possible resolution of some issues currently in dispute.

Forty-two examples of bibliographic records appear in MARC format. Every example includes an LC classification number, LC subject headings, and genre terms from Moving Image Materials: Genre Terms.

The guide was a project of the Music Library Association’s Working Group on Bibliographic Control of Music Video Material, consisting of five experienced music and audiovisual materials catalogers, with input from numerous individuals and organizations interested in the cataloging of moving image media and music. The Working Group was appointed by the Music Library Association to report to the MLA Bibliographic Control Committee.

Editor Lowell Ashley, who chaired the Working Group, is Principal Cataloger at Virginia Polytechnic Institute and State University. He has cataloged music, sound recordings, and audiovisual materials for many years and has served on the Cataloging Policy Committee of Online Audiovisual Catalogers, Inc.

This report is available from The Music Library Association, Inc., P.O. Box 487, Canton, MA 02021, or from library booksellers.
Book Reviews

Gregory H. Leazer, Editor


Information technology facilitates the easy acquisition and distribution of large amounts of information. This makes the acquisition and management of information a problem in many disciplines. Strategies for framing or pursuing solutions to information service problems might be more readily found in a discipline that is different from the one in which the problems exist. Much has been written in the field of library science about information services and the degree to which they can help meet the needs of information seekers. How can knowledge about information services be transferred and diffused into technology-enabled organizations to facilitate change while minimizing reinvention?

Information Services for Innovative Organizations is a timely presentation that addresses this question by illustrating the supporting roles that information services can play in organizations that must innovate. At first glance, the book might appear oriented towards the reader concerned with corporate innovation. There are many references to the business literature, largely because much of what has been written about innovation rests in the business domain. However, much is borrowed from other domains such as technology and science policy, economics, communications, and information technology. Not only is this interesting, but it is consistent with the tenor of the book that the glue for bonding information services and innovation is derived from disciplines other than business and library science. Though this is the case, seldom does the discussion in this text stray too far from these foci. The book is dense, drawing on many perspectives to illustrate how these two topics interrelate, and the authors do a superb job of maintaining the flow of their presentation. This is not an easy task given that there are multiple definitions for information and innovation and many ways to associate them.

In the first chapter, innovation is defined and presented from historical, political, economic, and management perspectives. In particular, the authors highlight the multistage model of innovation by Roberts and Frohman (1978) that describes the interaction between technology and the marketplace and that is characterized by input/output behavior and feedback. Information is explicitly a central element in this model, and it is easy to see why it is referred to later in the final chapter. Next is a discussion that defines information and information services and includes economic and social perspectives. Information is mostly illustrated as the output of one or more information services that inform innovative processes. Last of all, information and innovation are connected, previewing the remaining five chapters.

Innovation and information services are explored separately in the second chapter. Innovation is discussed in significant detail, and ways in which it is perceived and addressed within organizations are presented. Outlined, among other things, are Drucker's (1985) seven signals of change which, from an entrepreneurial perspective, denote opportunity for innovation. As the entrepreneurial and organizational themes of innovation are developed, information seeds the discussion. At
various checkpoints throughout the chapter (and the book), the concepts of information and information services always provide the context for examining innovation. Technology themes are also present throughout the explorations of innovation and information, and the role of technology as a catalyst is often presented.

The third chapter introduces information services as a means to acquire and create information within an organization. Information services are traditionally viewed from the perspective of libraries, but in this book, in a refreshing departure, they are generalized (along with the appropriate lexicon) to apply to modern organizations that are responsible for and dependent upon information. Evidently, the authors believe that this point is fundamental to their thesis and that information service functions need to be part of every organization that wishes to respond to change. The case for information being at the center of change is further argued in their outline of information systems, technology, sources, resources, products, services, and goods. The tone of the discussion is economic, and this makes sense: value is often fiscally determined. I agree with this perspective in that, for many organizations, the impetus to develop information services (or anything new) must be preceded by added value and cost benefit. The link between information and economics is fundamental when an organization is being downsized, rightsized, reengineered, or otherwise changed.

The fourth chapter deals with the sources of information needed to support innovation. The theme here is information management, and a rather nifty model for categorizing information is presented as an information-sources matrix, with dimensions of origin of information (internal and external), form of information (formal and informal), and stage of innovation (awareness, interest, evaluation, trial, and adoption). The result is a taxonomy of information sources related to innovation. These sources might provide bases for discussions of information needs that could result in rationales for developing information services within organizations. The remainder of the chapter expands on these ideas, mostly along the dimensions of origin and form, and includes a detailed case example.

The pace slows somewhat in the fifth chapter as the authors provide a historical and functional review of information technology: computer hardware, software, networks, and telecommunications. This chapter might have appeared at the beginning of the book, but its position here reestablishes the focus on information services, not information technology. Two-thirds of the way through, the discussion shifts back to information services and innovation. The reader is presented with a point of view that is human centered as well as organization centered and puts the previous review of technology into context. The chapter concludes with a section that describes several broad trends that have resulted from advances in technology and science, including content, interoperability, disintermediation, globalization, convergence, entropy, "technostress," outsourcing, information transfer, and end-user computing. These trends are buzzwords that appear in the popular media, but they are also important terms that relate people, information, and organizations in the scholarly and trade literature.

The sixth and final chapter of the book attempts to coalesce many of the ideas and concepts presented so far into several sets of propositions and design principles for the creation of information services that can support innovative organizations. While there might be an urge to consider them as recipes, they serve more as guidelines based on the authors' examination in previous chapters of innovation, organizations, technological change, information user behavior, and information services. The propositions and design principles provide several points of departure that will help a current or budding change agent design information services that support innovation and are themselves innovative.

This very well written book offers practical perspectives on information services and ways in which they might transform organizations. It takes up an old and enduring notion that information is
the basis for innovation. An information service, as the authors suggest, is an important element of any plan to manage change. But change in organizations is sometimes slow and, because people are involved, often difficult. For this reason, there are two points that the book could have stressed further and thus increased its utility to change practitioners and professionals.

First, people are the innovators in organizational transformation processes. While the technology review of chapter 5 was useful, this chapter was an excellent place to explore various sociocultural themes of information services in innovative organizations. Though social and cultural issues appear throughout the text, they might have been introduced in the second section of chapter 1, where the various perspectives of innovation are discussed and detailed. Maybe sociocultural themes are woven too tightly with the existing material to unravel into a separate chapter or section, but it would have been interesting to see the result. Pointers to the information technology literature could have provided a sufficient review without loss of continuity.

Second, because the book itself is innovative, implementing the design principles or adopting the propositions from chapter 6 might be difficult to achieve in some organizations. Some who wish to use these ideas might find resistance in moving from awareness to adoption of these concepts. The information sources matrix of chapter 4 would have been a useful tool for illustrating how the principles and propositions could be introduced to an organization that seeks to be innovative. This reviewer would have benefited from an illustration of how the principles and propositions could be put into practice using some of the strategies suggested. Maybe other readers would benefit similarly. Nevertheless, this book is a great addition to the Academic Press Library and Information Science Series. I sincerely hope that it is not that last that moves library and information science knowledge into professional domains that are constantly being redefined by the rapid evolution and deployment of information technology.—Anthony B. Maddox, Department of Library and Information Science, University of California, Los Angeles.

WORKS CITED


Karen Drabenstott is the most prolific researcher of Library of Congress Subject Headings (LCSH). Using Subject Headings for Online Retrieval synthesizes various studies that she has published, often jointly with other researchers.

The book begins with an introduction to LCSH. The intended audience might be library systems programmers who have not studied cataloging. The assumed prior knowledge of the reader is not defined, but the explanation of syntactic structure is inadequate for novices: the codes are defined, but the semantic relationships are not presented clearly.

Chapter 2 provides a detailed description of machine-readable LCSH. Experienced catalogers can learn much here about the coding of subject authority rec-
ords. The subsequent chapter includes data on subject terms in bibliographic records covering all fields from which topical terms can be derived. The compatibility of the Library of Congress (LC) subject authority file and bibliographic files is treated in chapter 4, which lists the types of headings found in the latter that are not in the former.

Chapters 5 through 10 describe research on user queries, using the unobtrusive method of transaction log analysis. There are honest accounts of the difficulty of demarcating search sessions and of distinguishing gibberish from serious searches. The authors' use of the term "access point" (p. 246) for "search argument" blurs the distinction between subject terms provided by catalogers and those in user queries. Drabenstott and Vizine-Goetz limit their explanation to subject searching because they "are reluctant to generalize these normalization techniques to other access points because [they] encountered so few queries for corporate names and uniform titles in our study" (p. 243); i.e., system designers should put effort into solving common problems of searching, not rare ones.

In going through chapters 5 through 10, I found it frustrating to read descriptions of search failure followed by frequent references (e.g., on p. 181) to chapter 11, in which a new approach is described. A more satisfying structure would have been the description of a problem followed by a proposed method for dealing with it. Once you get to chapter 11, the recommendations are not startling. The authors, who earlier described the limitations of browsing alphabetical arrays of subject headings, propose the use of search trees, a sequence for system parsing of queries (first looking for exact matches and reporting the results, then summarizing subdivisions), and finally presenting options for browsing related terms.

The phrase "related terms" (p. 251) covers broader, narrower, and related terms. I disagree with the recommendation that "[i]f twenty or fewer related terms are available, it . . . makes no sense to divide them into separate screens for narrower, broader, and related terms" (p. 251). A hierarchical display of subject headings helps orient users to the structure of the vocabulary (Weinberg 1993). Numerous search arguments reported in the book are names of broad disciplines. In a high percentage of cases, users actually require terms many levels narrower, but none of the system enhancements proposed addresses multilevel hierarchy.

The excessive number of "related terms" for a single subject heading often emanates from LC's failure to follow thesaurus principles (NISO 1994). For example, "Libraries and Television," a narrower term of "Television" in LCSH, fails the "is a" test; the compound expression is not a type of television. Numerous cases of search failure reported in the book result from poorly formulated headings or missing cross-references in LCSH.

The authors present excellent suggestions for enhancing subject authority records, e.g., to identify headings that follow a pattern. I hope that LC staff members will study the book carefully and make necessary changes to LCSH. Some of the recommendations for change, such as refining the coding of subdivisions in LCSH, would increase the complexity and hence the inconsistency of MARC databases. These recommendations are made under the rubric "exact approach," which might better have been termed "categorized approach." "The Future of Subject Headings for Online Information Retrieval" is treated in chapter 14; the consensus is that "LCSH is here to stay" (p. 332). The authors are not sanguine that the system will be revamped, however.

The book covers the research literature on subject headings well; sometimes the original source of an idea is not credited. For example, the authors cite Chan's 1972 paper, which "suggested modifications to period subdivisions to help automated systems file them in the proper chronological order" (p. 189). Harris (1970, 170-71) proposed such modifications earlier. The authors cite papers from the information science literature that deal with LCSH and OPACs. Studies of searching thesaurus descriptors in online serial databases are potentially relevant.

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but not cited; conversely, Drabenstott’s work is relevant to that genre.

In data-rich chapters, information overload is mitigated by the “Synthesis and Summary” at the end of each chapter. Some of the tables present data in strange ways: terms for variable data fields are in the right-hand column of table 2.2, with statistics on the left. The tables summarizing findings on subject searching in various online catalogs show the totals in the center column and data for individual systems on the right (e.g., table 7.2).

The anonymous index is substantial but has numerous flaws. First, it is incomplete: important topics, such as double posting, are not represented. The index is inconsistent in two ways: some topics do not have a complete set of locators, and the arrangement of headings alternates between word-by-word (Form subdivisions; Format integration) and letter-by-letter (Online catalogs; Online catalog use studies).

Many of the problems with subject searching discussed in the text inhere in the index: (a) excessive postings: the entry “Retrievals, too many” has 26 locators, including ranges, covering 39 pages—more than 10% of the book; (b) deblinding cross-references: the index has chains of references, e.g., “Local formats, see Internal formats; Internal formats, see Processing formats,” and many of the headings to which the reader is sent are not exact matches to those in the cross-reference; (c) lack of access to all words in headings: “Subject Heading System/Thesaurus Codes” (p. 50) is not indexed under “Thesaurus,” the most important term in the string; (d) poor syndetic structure: there is no link, for example, between NACO and National Coordinated Cataloging Operations. Also complicating the reader’s use of the index is the lack of double posting, the conversion of see references to entries for headings with one locator. There are formatting flaws as well, notably bad breaks—pages that begin with subheadings, without continued lines for headings.

This is an important book with much valuable data. It deserved more careful editing and especially a more thorough index, to enhance the reference value of the work. I believe that it will be used primarily by researchers to check the prior literature and to compare their methodology with that of the authors. The back cover describes the book as “an indispensable tool for online system designers.” I hope this group will read it; Crawford (1996) describes the process of development of the Eureka end-user interface to the Research Libraries Information Network (RLIN): a bunch of people sat around and brainstormed. Consultation of the research literature is not mentioned.

The most recent work cited in the book is 1992. The technical reports describe subsequent research and include more current references. There is something anachronistic about the relationship between the two reports. The earlier one, Enhancing, cites the later one, with a 1994 date and a slight variation in title: Testing a New Design for Subject Searching to Online Catalogs (p. 87, 101, 146). Logically, testing would precede enhancing. The first report (p. 70) uses enhanced search trees from Testing and discusses the later report’s results.

Both reports are largely redundant with the book in terms of background and literature citations. Enhancing focuses on subject queries for which online systems are unable to produce retrievals, using the same data—and some of the same figures—as in the book, plus new data from MIRLYN, the University of Michigan’s online catalog. Some of the old queries are reclassified in the later study (p. 10), underscoring the human interpretation involved.

The authors note the different meanings of postings data in the various systems—bibliographic records or subject headings (p. 20). The variation in the way commercial systems parse queries is a major trap for end-users and librarians. Bruce Croft (personal communication) has observed, however, that such systems should not be standardized while experimentation is still going on.

Table 4.8 includes satisfaction categories, and table 4.9 shows the difference in meaning between what users input and
what they really want, but interviews are not mentioned in the description of research methods. The information seems to be inferred from subsequent search arguments. The book makes this clear in a section called “Match Satisfaction” (p. 145–46). Table 4.18 shows that search arguments frequently match title words, but not LCSH, underscoring the need to review the adequacy of that controlled vocabulary.

The authors call for additional research “to help users and systems differentiate queries for subjects . . . from queries for personal names” (p. 91, 100). Borderline cases between subject and personal names, such as eponyms, justify the merger of subject and name authority files—a simple solution that would not require users to do the triage. Testing (p. 291–92) reports that when users are prompted to make the distinction between name and subject, they sometimes answer incorrectly. This problem is an extension of user difficulty with divided card catalogs. The authors suggest (Enhancing, p. 97) that subject headings for fictional characters be processed in two indexes: personal names and subjects. Merging the indexes would obviate the need to do this.

Classification schemes are discussed in chapter 7 as a means of reducing large retrievals. Captions from the classification scheme were displayed to users, and the number of records retrieved was reduced in accordance with the selection of the appropriate discipline. Statistical association techniques between classification and subject heading systems are of limited value for subject indexing, in my opinion, because LCSH and bibliographic classification schemes have such different structures—one has concrete topic as the initial element, while the latter selects discipline as primary facet—the association of the two means little. Furthermore, multiple LC subject headings can be analytical, while a class number designed for shelving cannot be. If you retrieve the most frequent class number, you haven’t solved the problem of too many hits, as the authors note for “Pornography”—90% in class HQ. Truncation of class numbers, the authors suggest, retrieves even more records. The data show how inconsistent the two major schemes are in placing a concrete topic within a discipline: Dewey classes the majority of works on acid rain in the social sciences, while LC puts most of them in technology (Enhancing, p. 117). Noting that the titles assigned a subject heading might all have different class numbers, the authors conclude that this is a “hit or miss proposition” (p. 136).

Third-level classification captions are considered as a device for narrowing searches, although first-level narrower terms were the only technique employed for LCSH. Using classification to increase retrieval simulates a well-known user strategy: search a term, find a call number, and go to the shelf.

Chapter 8, “Highlights of Project Activities,” is followed by numerous appendices listing the class numbers associated with selected subject headings. No feature headings (captions) are provided. Rank order (high to low frequency) would have been more appropriate than alphanumeric order by class number, given the focus of the study.

Testing a New Design for Subject Access to Online Catalogs reports on an experimental online catalog called ASTUTE (A Search Tree Underlying the Experiment), designed to implement Drabenstott’s ideas and test their retrieval effectiveness. The catalog included bibliographic records and subject authority records. Diacritics were deleted in the former because they “could adversely affect retrieval” (p. 27); multiscript online catalogs are currently being marketed, but accents on Latin characters still present problems.

The project team had to clean up the records, which included incorrect tags and canceled subject headings. Not correcting these problems would have created a more realistic environment for experimentation: catalog maintenance is seriously neglected today. The researchers created a new category for form subdivisions, separating them from topical subdivisions. They converted coded data from the 008 control field (e.g., illustrations, biography) to English-language equivalents that could be used in subject
searching. They also wrote a program to generate reciprocals of broader terms in LC authority records and add them as narrower terms to the appropriate records. The assumption of the study is in the introductory sentence of chapter 4: "The subject terms users enter into online systems possess certain characteristics that reveal the subject searching approaches most likely to succeed . . . ." If this were true, there would be a higher success rate.

Chapter 5 enumerates the desired features of the relational database management system sought for ASTUTE, with speed of retrieval the main consideration. FoxPro 2.0 was selected. ASTUTE was composed of two catalogs: the Blue Test System, governed by search trees, and the Pinstripe System, in which subject searching approaches were selected randomly. The flow diagrams for search trees found in the book are reproduced in the report. In ASTUTE, broader term and narrower term relationships are misleadingly called "synonyms" (figure 5.3). The handling of related terms is not described. The term specialized subtopics, which is used for subdivisions (p. 69–70), implies narrower terms.

In contrast to the prior studies based only on transaction log analysis, in ASTUTE, users were informed that they were participating in an experiment. They were asked three presearch questions relating to their frequency of use of computer systems and their major field of study, as well as eleven postsearch questions comparing the performance of the Blue Test and Pinstripe systems. The authors review prior studies that compare online systems, and they detail the reasons for rejecting human intermediaries as interviewers—essentially cost (p. 102). Librarians as well as end-users tested the system; the former were interviewed. Users were given three values for relevance rating: "useful," "possibly useful," and "not useful" (p. 111). Elsewhere the values "very useful" and "somewhat useful" were given (p. 167), which could be interpreted differently.

A pretest of the comparison search experiment was conducted on library science students (not representative of end-users), and changes were made to the interface and questionnaires. Owing to user tampering, the system crashed soon after installation at the first site. This affected the reliability of the data, and a second, less tamperable system was installed (p. 123–24). At the second site, users also played with the system; many searches were considered corrupted, and the data from the first collection period was disregarded. The life of a researcher is not easy.

The second data collection period resulted in 50% usable queries (p. 127). Quite late, it was discovered that when users typed an r, the system interpreted it as an i, resulting in many erroneous terms. Numerous postsearch responses were suspect: users repeatedly hit the Enter key, selecting the same number for all questions. Many queries were unusable because they were out of scope: one test site was limited to works on science and engineering; the second, to history. This detracts from the real-world nature of the experiment: the challenge of information retrieval using LCSH is finding relevant documents in a multidisciplinary database. The problem of homographs is much smaller in a database limited to one discipline.

The researchers' honesty about their errors and failures is laudable. They admit having "erroneously included main- and added-entry fields for personal names" (p. 134), when only names as subjects were within the scope of the project. Still, users rated such records "very useful," indicating that they were not sure of the difference between an author and a subject. Users selected names unrelated to those they had input and rated the records "very useful" (p. 134, 146), indicating the complexity of user-based relevance measures.

The researchers in fact categorized many queries as "playing" and "meaningless" (p. 135–36). The early Cranfield experiments were criticized for not having real users' questions. The disheartening reports of vandalism of an experimental system and meaningless queries that waste a researcher's time almost warrant a return to artificial tests on serious users.
The usable data for this study increased when library staff participated.

The examples on page 147 show that users selected personal name headings other than those in the query, but in the same alphabetical neighborhood. At an ASIS Annual Meeting, Drabenstott observed that if users don’t find the term they are seeking, they think that the one alphabetically adjacent to it will deal with the desired topic. (Bring back the human intermediary!) The researchers express their discouragement and skepticism about the reliability of end-users’ relevance assessments (p. 149).

One possible reason for the preponderance of “very useful” assessments is the ease of pressing the Enter key. Alternative methods of eliciting a deliberate selection of a rating are suggested (p. 150). Users also repeatedly selected the first-listed response on the postsearch questionnaire and even on the presearch questionnaire; the researchers found the number of computer science majors searching the history database suspect (p. 156).

The finding that “the longer queries were, the less likely the experimental systems would make a match” (p. 163) contrasts with studies of indexing and searching that have found that the more words you put in, the greater the likelihood of hits. The reason for the opposite in the online catalog environment must be the implied Boolean AND. Other interesting findings: users displayed more titles when fewer were retrieved (p. 166) and gave inconsistent relevance assessments for titles displayed twice. The assessments were more positive when the records were redisplayed, and it was decided to accept the final one.

Chapter 9 explains calculation of the precision ratio: the number of “very useful” ratings divided by the number of displayed titles. Results were higher for the Blue System at one site and for Pinstripe at the second. For those defending human indexing, this finding is significant: precision scores for controlled vocabulary were much higher than for free text in both systems. The estimated recall statistics are suspect, but the authors could not examine every document in the collection to get a true measure. From an analysis of the postsearch questionnaire it was found that most users preferred the Blue System.

Failure analysis of searches is discussed in chapter 10. User display of too few titles is one cause; another is that users terminated searches too early, before all the exact search options were pursued. The researchers speculate that the results were too complex for users to understand, and they were confused about which option to pursue (p. 205). On pages 214–17, user frustration with a series of searches that took 30 seconds each is described.

In discussing specificity of user queries, the researchers express surprise that titles containing the term in the query received negative relevance assessments. They speculate that “the topic that users had in mind was not quite the same as the subjects of the queries” (p. 206). Under-scoring a point made above, I recommend that the hierarchy of subject headings be displayed before the exact match. A case in point is on page 267: A user searching “heat transfer” gave negative ratings to all 42 titles displayed for an exact match on this cross-reference, but rated as “useful” a high percentage of titles by the narrower term “Heat exchangers.” I believe that many users don’t understand that LCSH does not provide detailed indexing. Enhancing, table 5.3, presents data on multiword searches in subject-specific databases, such as Medline, but the authors note that some queries still got no hits.

After analyzing searches that failed as a result of vocabulary problems, the researchers call for automatic truncation, best match, and removal of punctuation. The discussion of search failures attributable to multiple factors is particularly interesting. It is commendable that the researchers admit that an alphabetical display of subject headings adjacent to the search argument would be better in some cases than search trees (p. 213), and recommend that some of the exact-search option menus be skipped—just show the user some titles (p. 217). The authors’ admission of an oversight in the design of
the experimental catalogs—double posting of hyphenated words was not implemented (p. 312)—is in contrast to the glowing reports one generally reads of such systems.

Repeatedly, the authors express surprise that users did not select the “Display titles general works” menu option after the system led them to a specific term that seemed right on target. I think users misinterpreted this option as taking them back to the beginning, rather than as a heading without subdivisions. In the table summarizing the reasons for unsuccessful searches, “Vocabulary of user queries” (p. 231) has the highest percentage after database failure (i.e., topic out of scope) in the system based upon controlled vocabulary. The authors recommend adding a go/see list bearing alternative terminology (p. 316). The Art & Architecture Thesaurus (1994) includes variant word forms in its syntetic structure; so could LCSH.

Displaying titles was the most frequently selected browsing option; few users took advantage of the offer of broader and narrower terms or subdivisions (p. 259). The researchers admit that the Expand option might have been misinterpreted by some users (p. 268); they recommend experimenting with understandable terminology and the design of simple menus (p. 272). The authors observe that users might not have known how to backtrack; a general principle of interface design is that such instructions should always be displayed.

I think it was a mistake not to separate the results for librarians from those for end-users. In any case, the librarians’ comments and suggestions are very interesting. Particularly notable is the observation, “‘Expand’ capability seems like a ‘black box.’ I sure would like to know what it is doing” (p. 300). This is another basic principle of search interface design: tell users how they got there. The recommendation for automatic spelling correction (p. 307) violates this principle.

This report is must reading for anyone designing a study of end-user searching. The “suggested system improvements” (p. 303–4) serve in part as a list of what not to do in a study. Chapter 12 concludes with redesigned search trees, except for personal-name subject queries.

The spiral-bound, desktop published reports are attractively formatted, with well-positioned running heads. With few editorial flaws, they are easier to read than the typeset book. Regrettably, however, neither of these reports is indexed, and they both have only end-of-chapter references. Few people read technical reports, and Drabenstott recognizes the need to republish such gray literature in order for the work to get attention.

One of the goals of the project was to disseminate the research findings through publications in the professional literature. The Testing project was described by Drabenstott and Weller (1994) before the testing was actually done. A paper called published by Drabenstott in 1996, cites Testing but not the Enhancing report. That journal article does not seem to be a summary of the report with the same title because it does not deal with classification. When research is republished in multiple versions, it is important to indicate when a paper is a summary of a technical report (and, if so, cite it), whether it reports new information, etc.

Drabenstott and her coauthors present a detailed analysis of subject heading structure and display in the published works. These works show how complex a single general precoordinate system is. Linking it to multiple specialized thesauri designed for postcoordination is extremely complex. As the Internet grows, I hope that this research will be applied to enhance end-user subject searching, without eliminating the human cataloger, indexer, or search intermediary.—Bella Hass Weinberg, Division of Library and Information Science, St. John’s University, Jamaica, New York.

**Works Cited**


Librarians looking for a textbook introduction to the main issues involved in providing information services using geographic information system (GIS) technology will want to look elsewhere before tackling this volume. With some exceptions, this is a book that will best serve those with prior knowledge of GIS. At its best, it makes a valuable contribution to the advanced literature of digital libraries and fills a gap in the literature for the more experienced practitioner, whether librarian, GIS specialist, or other interested party. At its weakest, it suffers from the same faults as many edited proceedings; overall, the chapters do not come together to form a cohesive whole, and there are a couple of papers that contribute little to the volume. The chapters include reports of original research, accounts of practical experiences, and descriptions of important initiatives. The contributors include some of the top names in the field.

Thanks to last year’s flurry of publishing activity, both newcomers and more seasoned veterans to GIS services in libraries have an array of resources from which to choose to increase their knowledge of this burgeoning field. As editors Linda Smith and Myke Gluck acknowledge in their introduction, the Thirty-Second Annual Clinic on Library Applications of Data Processing coincided closely with the publication of three special journal issues related to the same topic (p. 1). Of these three journal issues, papers appearing in special issues of *Information Technology and Libraries* (Lutz 1995b) and in *The Journal of Academic Librarianship* (Hernon 1995) provide the basic introduction to GIS and libraries necessary for an appreciation of many of the chapters in the volume under review. All these sources define the basic terms and concepts needed to understand GIS technology.

*Geographic Information Systems and Libraries* opens with the clinic’s keynote address by Mark Monmonier. Author of the 1985 book *Technological Transition in Cartography*, Monmonier looks back at each chapter of his book. In doing so, he gives a concise and clever overview of cartographic advances and policy issues, and he reiterates his frequently on-the-mark predictions related to the impacts of technology and policy on mapping. In addition to being an advocate of getting people to realize that the main product of mapping is information, not a printable image, Monmonier is one of the few people to mention the challenge of preserving electronic cartography. This is an issue of much concern to archivists, but little discussed in the GIS literature related to libraries. Monmonier states, “I am not aware that any library or archive is systematically preserving late twentieth-century electronic cartography. Yet the challenge is enormous because an adequate historical record would include not only maps, data, software, and other artifacts but also information on how people . . . are using cartographic data” (p. 12). Archivists do understand the challenge Monmonier describes, and this is an area ripe for cooperation between librarians and archivists. Like some other papers in the volume, Monmonier’s chapter reads like the script of an oral presentation, which, unfortunately, does not always make for an
equally good translation to the printed page.

The remaining papers are grouped by the editors into four general themes: organization and description of spatial data sets, system design and user needs for access, GIS applications, and issues in implementing GIS. The book would have benefitted from introductory essays to each of the four sections to tie the individual papers into the larger context of GIS applications and services. As it is, most papers stand separate from the others, and readers are left to make their own connections between them. The brief introduction given by the editors at the start of the volume does not serve this need; thus, it is difficult for newcomers to form a picture of the large and complex world of GIS.

Mary Lynette Larsgaard, a participant in Project Alexandria, one of the National Science Foundation’s (NSF) Digital Library Initiatives (DLI), starts off the first section by describing her experiences in trying to use traditional cataloging methods to catalog spatial data. Her chapter, “Cataloging Planetospatial Data in Digital Form: Old Wine, New Bottles—New Wine, Old Bottles,” outlines specific problems she has encountered adapting USMARC and Anglo-American Cataloguing Rules to catalog what she refers to as “planetospatial” data in digital form. Anyone wrestling with such issues will benefit from the experience and intelligent insight shared by Larsgaard. In “Finding and Accessing Spatial Data in the National Spatial Data Infrastructure,” Michael Domaratz discusses the federal initiatives that have spurred action in organizing and providing access to spatial data. These initiatives are important to an understanding of the current interest in spatial data, and such a discussion certainly belongs in a volume on this subject. What is lacking in the chapter is a clear description of the relationship between the National Spatial Data Infrastructure, the National Geospatial Data Clearinghouse, and the Federal Geographic Data Committee’s (FGDC) Content Standard for Digital Geospatial Metadata, and the impact these initiatives have had on the activities of the library community. Experienced library practitioners will find the chapter adequate, but newcomers to the field would be better to first read papers by Marilyn Lutz (1995a) and Elizabeth Mangan (1995) published in the special issue of Information Technology and Libraries.

William Moen’s chapter, “The Government Information Locator Service: Discovering, Identifying, and Accessing Spatial Data,” describes another federal initiative. The Government Information Locator Service (GILS) provides Internet access for the public to search for and retrieve information about federal agency information resources, including spatial data. Moen provides a detailed description of GILS and how the ANSI/NISO Z39.50 standard for information retrieval is being implemented in GILS. The figures and appendixes he includes are useful in illustrating his discussion. This is one of those chapters that anyone, not just librarians, interested in the technical details of GILS would find useful. I could not help wondering, though, what relationship there is between GILS and the other efforts to organize and catalog spatial data, and how much duplication of effort exists between these systems. In an introductory chapter to each section, the editors could have asked such questions, thrown light on such issues, or in some other way provided the cement to hold the chapters more closely together. Finally, Barbara Buttenfield, another participant in Project Alexandria, ends this first section with her chapter, “Geographic Information Systems and Digital Libraries: Issues of Size and Scalability.” Buttenfield’s contribution is an interesting discussion of how allometric principles might be applied to spatial data collections in digital libraries. She theorizes that “as more information becomes available, it becomes more difficult to access, retrieve, and catalog . . . . The effectiveness of digital libraries will be based in part upon the ability of library scientists to ‘scale up’ operating procedures” (p. 70).

Retrieval of geographic information in digital libraries is covered in chapters by Ray Larson and Linda Hill. Larson’s
"Geographic Information Retrieval and Spatial Browsing," the volume's longest chapter as well as its most graphically rich, covers a lot of ground. Problems and prospects for the retrieval and indexing of geographic information, the characteristics of such information, the systems for automatic indexing and spatial browsing, and examples of Geographic Information Retrieval systems available over the Internet are all discussed. Close study of the chapter, combined with visits to listed Internet sites, would provide a solid education in these areas to those with a strong interest.

In "Spatial Access to, and Display of, Global Change Data: Avenues for Libraries," Linda Hill describes retrieval of geospatial information in the context of the U.S. Global Change Data and Information System (GCDIS). She then compares the characteristics of an ideal geospatial retrieval system with five existing systems. Hill finds the current systems lacking, but promising, and encourages librarians to participate in building these systems. Librarians interested in knowing more about the GCDIS will want to supplement Hill's chapter with a look at the recent special issue of Library Hi Tech (Rand 1995) on the role of libraries in global change research. The third paper in this section takes a different but no less useful tangent, and provides some baseline information to feed into the design of geographic information services in libraries. It is also the first of a split string of papers related to public libraries. "Geospatial Information Needs of the General Public: Text, Maps, and Users' Tasks," by Myke Gluck, is based on a series of exploratory experiments conducted to determine the geospatial information needs of the general public and the role the public library can play in filling these needs. This, as well as nice companion chapters by Dean Jue and Christie Koontz that appear later in the book, is useful for librarians at all levels of the GIS learning curve. The chapter by Gluck aids forming an understanding of how people go about finding answers to "What's there? and Where's that?" (p. 155). In doing so, it provides convincing reasons for public libraries to consider expanding their geographic information services.

The editors present papers by Robert Lee Chartrand and Christie Koontz as examples of GIS applications. Chartrand's paper, "Emergency Preparedness and Response Challenges for Special Libraries," attempts to persuade special librarians of the need to adopt GIS services because of the technology's critical role in emergency management. Although the opinion might be valid, the chapter adds little to the literature; nor does it provide much insight into how librarians might implement such services. Koontz is more successful in describing how a GIS can be used to create a profile of library markets. Using the Evansville-Vanderburgh County public library system as a model, she walks the reader through the problems and potentials of adapting GIS technology for an important library use. Koontz goes beyond merely detailing an application of the technology by describing the problems and issues that arise in implementing a GIS.

The volume's last section covers GIS implementation and begins with Dean Jue's paper, "Implementing GIS in the Public Library Arena." Jue surveyed staff in all types of libraries that have successfully or unsuccessfully implemented GIS services and then analyzed the responses to determine the factors leading to success. Jue then applied this data to create a decision flowchart for public libraries to use in evaluating the level of GIS service (minimum, medium, or maximum) that should be provided. Not surprisingly, perhaps, Jue found that "the highest priority for a library contemplating introducing GIS to their patrons is to evaluate the number of staff and the ability of that staff to support the GIS without unduly impacting the rest of the library's users" (p. 200). In "The St. Louis Public Library's Electronic Atlas: A Successful GIS Application in the Public Library Environment," Anne Watts theorizes about what made the St. Louis Public Library Electronic Atlas Project a success. Her experience highlights the importance of partnerships, clearly defined goals, and low cost. The final paper of the volume, a four-page description of a CD-ROM of digital spatial data produced by the Illinois Department of Energy and Natural Re-
sources, adds little to the advancement of understanding of GIS in the library environment and provides a lackluster ending to the book.

The editors and publisher are to be commended for getting the book out within one year of the clinic. This rush might have exacerbated the volume's weak points, which include a lack of cohesiveness among the papers, varying utility of the contributions, and a couple of papers that could have been cut or replaced. Yet it remains a unique source on this subject because it reports research efforts and advanced practical experience. As a result, it moves GIS service in libraries forward. The volume also demonstrates how cooperative efforts between librarians and other professionals lead to better service for users. Readers who dip into the volume selectively, based on their interests, will be satisfied and challenged by its contents.—Ann Zimmerman, John Van Oosten Library, National Biological Service, Great Lakes Science Center, Ann Arbor, Michigan.

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