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Silver Anniversary Issue

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CONTENTS

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Information Technology and Libraries

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Introduction to the Silver Anniversary Issue

Thomas W. Leonhardt

Putting this issue of *ITAL* together has been fun, informative, and frustrating. The fun has been in recognizing the names of the early contributors and editors and leaders in ISAD/LITA and in noting the reliance on flowchart diagrams that were so important in that punched card environment. The trip back to volume 1, number 1 of *JOLA* up through the change in title and beyond really was fascinating, and I recommend it to you. Sue Martin, who played a very important role in *JOLA* in its early days, had the same feeling I had in looking backward, except that her memories of those days and of the colleagues she worked with are much more than recognizable names.

The informative aspects are the articles themselves. We are still dealing with many, if not all, of the same issues, albeit in later stages, that have occupied library automation over the past twenty-five years. Many of the articles reprinted in this issue of *ITAL* will serve, I hope, to remind us of how far we have come in twenty-five years and how far we have to go. We can learn from the past, but only if we know it, study it, and understand it. In addition

JOLA and ITAL Editors	**Volume(s)**	**Year(s)**
Journal of Library Automation (JOLA)		
Frederick G. Kilgour	1–4	1968–71
A. J. Goldwyn	5	1972
Susan K. Martin	6–10	1973–77
William D. Mathews	11–12	1978–79
Susan K. Martin	13	1980
Brian Aveney	14	1981
Information Technology and Libraries (ITAL)		
Brian Aveney	1–2	1982–83
William Gray Potter	3–8	1984–89
Thomas W. Leonhardt	9–14	1990–95

to reprinting noteworthy articles, there is a need for librarians and others working in the automation/information technology areas to analyze our past through our past literature and share that analysis with us. There are some primary sources yet to be tapped, including thoughtful, informed interviews with the giants and the moving forces in this field. Happily, this is still a young field and most of those pioneers are still around.

The frustrating part of assembling this special issue has been making the selections. Four former editors were very helpful in selecting articles from their tenures (and even before or beyond). We were, unfortunately, unable to solicit input from two former editors, A. J. Goldwyn and William Mathews. To round out the issue and fill in the gaps that remained, I also selected articles that I felt were representative of the best of *JOLA* and *ITAL*.

It seemed pointless to reprint articles from my own current tenure because of their recent appearance. This is not to say that there are none worthy of special note; there indeed are. The special series (featuring many notable authors) on the tenth anniversary of MELVYL comes to mind, as do the reports on digital imagery for preservation and access by Michael Lesk and M. Stuart Lynn. The special section, "Report from the OCLC/RLG Seminar," in the June 1991 issue of *ITAL* provides some continuity to some of the articles reprinted in this issue that give some early background on OCLC, BALLOTS (now RLIN), and WLN.

Excepting the present editor, the list of past editors is representative of the history of ISAD/LITA and library automation. A look at the tables of contents of the *Journal of Library Automation* impresses one with the close ties the journal and the division had with early (primitive if you will) library automation efforts. Those efforts may be viewed as primitive now, given the tools that we currently have to work with, but the ideas were far from primitive then. They were imaginative, innovative, creative, and far-sighted. Many of the authors have retired or have left the field, but others are still around and active, even retirees like Henriette Avram and Fred Kilgour.

For the article(s) he or she selected, each editor has written a short piece explaining his or her choice(s). The articles they have selected represent the range of library automation topics covered by *JOLA* and later *ITAL* and reflect how the field of library automation has changed and grown over the years. In their explanations, several editors also reflect on their experiences as editor and the changes the journal has undergone.

We are celebrating our Silver Anniversary with this retrospective issue, and we hope that you enjoy our offerings. If you do, or even if you don't, we would like to hear from you. We solicit you to suggest your own nominations for classic status from within our very rich literature.

Frederick G. Kilgour—*JOLA*, 1968–71

An Experiment in Information Searching with the 701 Calculator. By Harley E. Tillitt. Reprinted from *JOLA*, vol. 3, no. 3 (September 1970).

My choice is Harley E. Tillitt's article, "An Experiment in Information Searching with the 701 Calculator." Its first printing is on pages 202–6 of issue 3 of volume 3 for September 1970. The short explanation for my choice, as you put it, is indeed short: "When Tillett gave his paper in May 1954, it was the first description of computerized retrieval."—*Mr. Kilgour is Distinguished Research Professor at The University of North Carolina at Chapel Hill.*

Susan K. Martin —*JOLA*, 1973–77, 1980

Institutional Political and Fiscal Factors in the Development of Library Automation, 1967–71. By Allen B. Veaner. Reprinted from *JOLA*, vol. 7, no. 1 (March 1974).

Proceedings of the 1977 ISAD Institute on a National Bibliographic Network. By S. Michael Malinconico and Joseph A. Rosenthal. Reprinted from *JOLA*, vol. 10, no. 2 (June 1977).

What a trip it is to go back to the *JOLA* issues of the mid-1970s to look at the articles that I edited! The article I chose is by Allen Veaner, in the March 1974 issue, titled "Institutional Political and Fiscal Factors in the Development of Library Automation, 1967–71." This article is a thoughtful treatise of library automation, for the most part within the academic environment, since that's really where automation was happening at the time. Allen made some predictions of what might happen in the future that turn out to have been remarkably accurate. It's the kind of article that should have been cited widely.

The issue is the June 1977 issue of *JOLA*, which represents the proceedings of the ISAD (read "LITA") institute on the topic of a national bibliographic network. Speakers at the institute included Mike Malinconico (I believe he was the institute organizer), Joe Rosenthal, John Lorenz (at that time he was at ARL), Mitch Freedman, John Knapp, Steve Silberstein, Henriette Avram, Lucia Rather, Peter De La Garza, Al Trezza, and Bob Wedgeworth. This institute occurred at the time when we were still debating whether or not there should be a national bibliographic network; the institute was exciting, the *JOLA* issue reflects that star-studded excitement, and it encapsulates concerns and problems that still exist, although now they are even more complicated and worrisome.

People who were important during my tenure as editor were, in addition to Don Bosseau, Don Culbertson, who was the first ISAD executive secretary, then Don Hammer (why all these Dons?). Peter Graham was book review editor at the time, and Eileen Mahoney and the CPU staff were always wonderful.

Does the ledger book that Eleanor Kilgour used to log incoming manuscripts still exist? I used it during my entire tenure as editor, and then passed it on to Bill Mathews. It would be a wonderful historical record if it hasn't been discarded.

Other notable experiences: changing the name from *JOLA* to *ITAL* (I'm still sorry that was done); changing the size of the journal and the problems associated with changing the color from Fred's pumpkin color to a different color for each volume; and deciding to solicit our own advertising. Such memories!—*Ms. Martin is University Librarian, Georgetown University*

Editor's Note: Space considerations prohibit us from reprinting the whole issue that Sue refers to, but we can print the introduction by Michael Malinconico and the lively introductory piece by Joe Rosenthal. It is an issue worth reading or rereading, as the case may be. Networking is still very much an issue today and the insights and observations of these very important colleagues (what a program that must have been) still speak to current issues, despite some of the changes that have occurred in the sixteen years following publication of those papers.

Brian Aveney — *JOLA*, 1981, and *ITAL*, 1982–83

Thus Spake the OPAC User. By Karen Markey. Reprinted from *ITAL*, vol. 2, no. 4 (December 1983).

Timeliness and obsolescence are boon companions. Reading the old ITAL issues was somewhat like reading old newspapers. I remember when many of the pieces were cutting-edge. But yesterday's cutting-edge is today's history.

I'm proud to have nagged Walt Crawford to produce "Long Searches, Slow Response: Recent Experiences on RLIN" (June 1983)—less because of its content than because it was the first publication by one of today's most prolific library automation writers. I thought often of Farooq A Khalid and "Automation in a Special library in Kuwait" (December 1983) during the invasion of Kuwait, and hoped he wasn't caught up in the horrors of that war. Your recent sections on MELVYL brought back the times working on similar sections in December 1982 and March 1983.

I finally selected "Thus Spake the OPAC User" by Karen Markey (now Karen M. Drabenstott) from December 1983 for reprinting, because I think that many of her rather wide-ranging, user-oriented observations are still relevant today. I hope that your current readers, who may not be familiar with this piece, will find it a useful checklist of problems that have been successfully addressed and those that remain challenges to the library profession.

Historical Note

The decision to change the title of the journal was taken at the prodding of Bea Kenney after ISAD merged with the various other technology junkie groups in ALA to become LITA. I urged the LITA Publications Committee to adopt Journal of Library Technology, which made a playful acronym (JOLT) and would have kept it relatively close in alphabetic listings. The Committee felt that if it were to be changed (many were averse to the idea), they might as well go whole hog and chose the current title, Charlie Husband's suggestion, to a large extent because it is an anagram of LITA. The journal certainly deserved the Snake in the Grass Award, but honest Mom, it wasn't me!

Willian Gray Potter —*ITAL*, 1984–89

Electrons, Electronic Publishing, and Electronic Display. By Edwin B. Brownrigg and Clifford A. Lynch. Reprinted from *ITAL*, vol. 4, no. 3 (September 1985).

Librarians have been wrestling with the concept of "electronic publishing" for many years. Most writers have used the storage format, or the medium, as the basis for determining if a publication is electronic or not. They saw video and audio tapes, floppy disks, and CD-ROMs as examples of electronic publishing. In this article, Edwin Brownrigg and Clifford Lynch take a different view, specifically that it is the means of distributing the information and not the artifact that the information is stored upon that defines electronic publishing.

Publishers are drawn to CD-ROMs and other physical media in part because they are very similar to books in how they are packaged, marketed, and distributed. Much time and energy are still devoted to handling a physical item. True electronic publishing is defined by the means by which information is transmitted; not as information encoded on an artifact like a book, a tape, or a CD-ROM, but rather as electrons moving from one point to another. This distinction was refreshing when Brownrigg and Lynch made it in 1985, and it is still refreshing, and increasingly relevant, today as we face the emerging national network and consider its possibilities as the channel for electronic publishing.

Public-Access Computer Systems: The Next Generation of Library Automation Systems. By Charles W. Bailey, Jr. Reprinted from *ITAL*, vol. 8, no. 2 (June 1989).

The June 1989 issue of *ITAL* was a special issue devoted to the then unusual practice of loading databases into a local online library system. Typically, the search engine used to drive the library's online catalog was adapted to search indexes to journal articles.

Contributions to that issue covered the experiences of several academic libraries that had loaded these databases, including Georgia Tech, Vanderbilt, Carnegie Mellon, Penn, Dartmouth, Cal Tech, Arizona State, and the Colorado Alliance of Research Libraries. These articles were solicited and then reviewed by members of the editorial board.

Coincidentally, Charles Bailey submitted an article that attempted to define the "next generation" of online systems. This article received enthusiastic reviews from the editorial board and worked in well with the topic of the special issue. Bailey defines and categorizes several types of public-access computer systems for libraries, moving beyond systems that provide bibliographic information to ones that instruct, consult, confer, and deliver. He presents an energetic vision of how automated library systems can evolve.—*Mr. Potter is University Librarian at the University of Georgia in Athens.*

Thomas W. Leonhardt—*ITAL*, 1990–95

The Shared Cataloging System of the Ohio College Library Center. By Frederick G. Kilgour, Philip L. Long, Alan L. Landgraf, and John A. Wyckoff. Reprinted from *JOLA*, vol. 5, no. 3 (September 1972).

Stanford University's BALLOTS System. By Project BALLOTS and the Stanford University Libraries. Reprinted from *JOLA*, vol. 8, no. 1 (March 1975).

The Washington Library Network's Computerized Bibliographic System. By Mary Jane Pobst Reed. Reprinted from *JOLA*, vol. 8, no. 3 (September 1975).

Although the names have changed for all three of these networks, you will recognize two of them right away, even if you weren't around in the early and mid-1970s. The third, whose name and initials both changed, has also undergone a significant change in scope and mission from its early days although it envisioned extending its features to a national network environment early on, as evidenced by the summary statement at the end of the descriptive article.

The Ohio College Library Center is now OCLC, Inc., the Washington Library Network is now the Western Library Network and is a not-for-profit entity separate from the Washington State Library, and BALLOTS is now RLIN and is owned by the Research Libraries Group. Each organization has grown and changed and struggled over the past twenty or more years. It is more than interesting to note the evolution that has allowed them to survive and it is more than interesting to compare the services that each offers today with the visionary services that they offered way back when.

Automation and the Library Administrator. By Eleanor Montague. Reprinted from *JOLA*, vol. 11, no. 4 (December 1978).

William D. Mathews edited *JOLA* from 1978 to 1979. Despite several leads and attempts to find him, we don't know where Bill Mathews is. Bill, wherever you are, we are presuming to select a representative article from your era. If you should see this, know that you are not forgotten and that your colleagues remember you fondly.

Our selection, "Automation and the Library Administrator," by Eleanor Montague originally appeared in the December 1978 issue of *JOLA*. It contains many observations that seem as apt today as they were in 1978. Eleanor was a member of the BALLOTS team at Stanford and after a stint with WICHE (Western Interstate Commission on Higher Education), became the university librarian at the University of California, Riverside. She is now a vice-chancellor at the Claremont Colleges in Claremont, California.

It would be interesting and we think of value to the profession if Eleanor brought her thoughtful and insightful essay up to date. What have we learned, Eleanor, and what part of your message did we miss altogether? What advice do you have for us now after your predictions have come to pass almost fifteen years after they were made?

Expanding the Online Catalog. By William Gray Potter. Reprinted from *ITAL*, vol. 8, no. 2 (June 1989).

Bill Potter, in his introduction to the piece by Charles Bailey, mentions the "special issue devoted to the then unusual practice of loading databases into a local online library system." While that practice may not be so unusual now, we may not always keep in mind what it is we are trying to accomplish by loading those databases.

In that special issue, Bill leads off by introducing what follows and by reminding us of why we have catalogs in the first place and what they are supposed to do. We reprint this paper as background to encourage you to look at the other articles in that issue and, more to the point, we bring it to your attention again for the issues that it raises so that we might have some help as we consider the amazing and ever-growing number of choices that we have available to us today. ■■

LITA's First Twenty-Five Years: A Brief History

Stephen R. Salmon

The Library and Information Technology Association is celebrating its Silver Anniversary. The association, a division of the American Library Association, began as a small, pioneering discussion group. However, its roots go back even further, to the years when libraries—and their national association—first became exposed to the wonders of computers. This article traces the growth of the organization from those beginnings to the present.

THE EARLY YEARS

There were isolated experiments with punched cards as early as 1936 (by Ralph Parker at the University of Texas), but it was not until the early 1960s that libraries became interested in the possibility of using computers for library work. The MEDLARS project at the National Library of Medicine, the pioneering work in serials control at the University of California at San Diego, and Southern Illinois University's landmark circulation system all began in 1961, and were merely the first in a growing number of library applications.

The American Library Association was quickly alerted to the new trend and its possibilities. Joe Becker, who was then working on library and information tasks for an unmentionable government agency and would later become LITA's second president, suggested that ALA participate in the upcoming Seattle World's Fair in 1962 with an exhibit using computers. ALA agreed, and Al Trezza, then head of the Library Technology Project at ALA, worked with Joe to get corporate sponsors. Univac and others contributed almost a million dollars in equipment and services, and some twelve million people came to

Stephen R. Salmon, Chairman of the Board of Carlyle Systems, Inc., since 1983, founded and served as first president of ALA's Information Sciences and Automation Division (now Library and Information Technology Association) in 1966–67.

see the "Library 21" exhibit that resulted. The idea was repeated in 1964 at the "Library USA" exhibit during the fair in New York City.[1]

COLA

In April of 1964, over fifty libraries sent representatives to the second Clinic on Library Applications of Data Processing at the University of Illinois in Urbana. Many attending recognized that they were pioneering a new field, and the discussions in the halls were animated and enthusiastic. Most of us, in fact, found the chance to talk with people doing similar work in other libraries the most valuable part of these conferences, but it was an impromptu, hit-or-miss proposition, since there was no organized way of identifying others with similar interests. Ann Curran of Harvard's Medical Library, however, suggested that we try to assemble those librarians who were interested in automated serials control systems, a hot topic at the time. We found a room with a table, assembled a small group, and a lively discussion of nuts-and-bolts problems ensued.[2]

The value of the meeting impressed all who were there, and Howard Dillon, then at Ohio State University, was convinced that some way should be found to hold such meetings on a regular basis. Clinics and institutes were usually restricted in attendance and often came at times and locations that made it difficult for many interested persons to attend, so we agreed to meet informally again at the ALA Annual Conference in St. Louis that summer. At that second gathering, Howard took on the task of organizing future meetings and maintaining a mailing list for the group. I agreed to explore the possiblities of formalizing our meetings by becoming an organized part of a larger body.[3]

Elizabeth Rodell, executive secretary of the Resources and Technical Services Division (RTSD) of ALA, was helpful in explaining our group's options, such as becoming a discussion group or a round table. However, the issue of becoming a part of ALA was complicated by the fact that automation crossed over various organizational lines that existed within the Association at that time. Acquisitions, serials control, and cataloging fell within the responsibilities of RTSD, but circulation and general management came under the Library Administration Division. There were also information retrieval or "documentation" committees in several divisions and an Interdivisional Committee on Documentation.[4]

Meanwhile, Howard had persuaded the American Documentation Institute to provide facilities for a two-day meeting of "the Dillon committee" in October, prior to the Institute's annual convention in Philadelphia. During the meeting, I reported on what I had learned about becoming an organized part of ALA, and after discussion the group voted, by a large majority, to remain autonomous.

That resolved the question of affiliation, but it didn't solve a problem that was of growing concern for many of us. The Committee on Library Automation (COLA), as it now decided to call itself, insisted on restricting membership to individuals actually involved in developing or operating library systems. The group was never larger than about thirty-five, but once its existence became known, we were flooded with applications for membership. It was clear that large numbers of librarians who didn't meet COLA's standards for membership were in need of information on library automation and wanted leadership. Since there was no membership unit in ALA with the sole responsibility for library automation, there was no effective way for these librarians to communicate or to learn from each other, and since responsibility for the area (to the extent that it had been recognized at all) lay fragmented among various units within ALA, there was no effective way for the national professional association to provide guidance to its members. It was also clear that if ALA did not provide leadership, it would be found outside the Association, a development many of us thought would be unfortunate and should be avoided.

The Detroit Meeting

Fortunately, Elizabeth Rodell understood these concerns and suggested that I meet with the Interdivisional Committee on Documentation to pursue the matter. Jesse Shera of Western Reserve University, chair of the committee, graciously invited me to attend the committee's next meeting, during ALA's 1965 Annual Conference in Detroit.[5] The committee, in turn, was convinced of the importance of the problem and scheduled a public discussion of the issue later that same week.

The turnout for the discussion, on such short notice, was greater than expected; on July 8, 1965, several hundred librarians jammed an evening meeting to hear the first public review of the issue. Ed Heiliger, then at Florida Atlantic University, presented an impressive inventory of library automation problems, highlighting numerous areas requiring either research or concerted action by the library community. Following that, I urged the need for leadership by ALA; much of the current activity in library automation, I argued, was badly planned, imperfectly executed, and unnecessarily expensive, simply because there was very little opportunity for librarians to exchange information or learn from the experience of others. A major organizational unit was needed that would provide a forum for discussion, undertake a vigorous program to disseminate information, foster studies and research, and promote the development of appropriate standards.

After reviewing the pros and cons of round table, sectional, or divisional status, I concluded that only a division would have sufficient scope and authority to address the array of problems demanding attention and to carry out the programs mentioned. During the discussion that followed, many of those in the audience urged immediate action, and a resolution was overwhelmingly passed requesting that the committee "petition the ALA Committee on Organization to investigate possible division status for library automation activities."[6]

The ALA bylaws, however, require the submission of a petition containing the signatures of not less than five hundred members of the Association as a prerequisite to the formation of a division. Accordingly, in the fall of 1965, I mailed a petition form, a report on the Detroit meeting, and a cover letter to a number of larger libraries, asking that they circulate them to their staffs. Librarians at smaller institutions were notified of the petition through a notice in the *ALA Bulletin*.[7] Several members of COLA (notably Fred Kilgour, then at Yale Medical Library) helped collect signatures, and by December 1965, 863 librarians had signed a total of sixty-four copies of the petition. The signed petitions and the required draft statement of responsibility for the division were then forwarded to Hannis Smith, then chair of the ALA Committee on Organization.

The committee handled the issue with complete fairness. Mr. Smith solicited opinions from all existing divisions and from other interested parties and allowed verbal as well as written arguments to the committee. As the report of the committee later put it, there turned out to be "a wide variation of opinion" on how to handle this "matter of grave concern."[8] Opponents argued that there were too many divisions already, that automation should be the responsibility of an existing division, or that automation was only a "tool" that did not deserve a separate organizational unit. In response, I argued that the question of a new division should be decided on its merits, rather than on the basis of the number of existing divisions, that giving responsibility to an existing division would tend to prejudice the legitimate interests of other divisions, and that the division should be concerned with automated library systems, not equipment per se, and should not consider automation merely a means of doing differently the same things libraries have always done. Most important, however, was the argument that only a division would have the scope and authority to get the job done.

Midwinter 1966

On the morning of January 27, 1966, the Committee on Organization heard presentations by a number of divisional representatives, some of whom endorsed the proposal for a separate division and some of whom said merely that they would not oppose it. The Resources and Technical Services Division (RTSD) and the Library Administration Division (LAD) each suggested the establishment of a new section within their respective divisions, although LAD said it would not oppose a new division. Following this testimony, the committee considered the issue at length and by the afternoon session of council had prepared a report. It recommended the establishment of an Information Science and Automation Division (the Reference Services Division had urged the inclusion of "information science" in the name), gave the proposed statement of responsibility, and listed the matters needing immediate attention. The matter then went to the full, prestigious ALA Council, and I remember waiting nervously for this august body to hand down its judgment. The council's discussion, however, was brief, consisting only of a slight amendment to the proposed statement of responsibility. The council then approved the recommendation, after which Wesley Simonton, RTSD's president, made a statesmanlike pledge of support to the new division. ISAD was born.

Getting Started

Although the division was now legally and formally established, it did not immediately become a functioning reality. For one thing, it had no money. Fortunately, however, ALA's involvement with the world's fairs had produced a modest surplus, and Al Trezza suggested to Executive Director David Clift that the balance—some $20,000—be used to get ISAD started.[9]

The division also had no members. Naively, I had hoped that those who had already sent in their dues for 1966 could elect additional membership in the new division, and that those who had not yet paid their dues could sign up when they did. Correspondence with headquarters, however, indicated that this was impractical; a special mailing to ALA members would cost too much, and ALA membership records and procedures could not be adapted to accommodate the new division until the next membership and dues cycle, when ALA members renewed their memberships and designated their divisional choices—i.e., in January 1967, a year later! There was a suspicion that this state of affairs ironically resulted from the use of automatic data processing equipment by ALA headquarters.[11]

Meanwhile, there was much to do. ALA President Robert Vosper asked me to chair an Organizing Committee consisting of Joe Becker, Henry Dubester of the National Science Foundation, Paul Fasana of Columbia University, Fred Kilgour, Frazer Poole of the University of Illinois at Chicago Circle, and Melvin Voigt of the University of California at San Diego, all of whom had been active in promoting and forming the division. Dubester, Fasana, and Voigt wrote the draft bylaws; Kilgour, Poole, and Becker recommended a slate of "provisional" officers to serve until elected officers could take over in July 1967; Kilgour, Poole, and I drafted a budget request; and a fourth subcommittee of Voigt, Becker, and Fasana reported on the desirability and feasibility of establishing a division journal. The full committee met in St. Louis on June 3, 1966, adopted the report of each subcommittee, voted to request a full-time executive secretary, and drew up an agenda for an organizational meeting of the new division at the ALA Annual Conference in New York.

New York 1966

Several hundred people attended the organizational meeting on July 14, which marked the beginning of the division as a functioning reality. The bylaws were adopted, and officers were elected—Carl Jackson of Pennsylvania State University as vice-president, Howard Dillon as secretary, Ralph Parker (then at the University of Missouri) as ALA Council representative, and Charles Bourne of Programming Services, Paul Fasana, and Frazer Poole as members of the Board of Directors, in addition to myself as president. Procedures for obtaining membership in the division were reviewed, and a form for expressing interest in the division was distributed. The fields of interest and responsibility for ISAD were outlined, and the initial plans of action and programs were then announced: a newsletter or journal, a clearinghouse for information about library automation projects, development of computer programs for use in library operations, a Preconference Institute in San Francisco in 1967, regional conferences for training librarians in automation, and appointment of committees to consider such matters as the development of a library programming language and appropriate standards. Suggestions from the floor concerned issues such as library access to machine-readable data, standardization of indexing vocabularies, and distribution by the division of MARC tapes.[12]

IMPLEMENTING THE PROGRAMS: INTO THE 1970s

Planning began at once for the Preconference Institute in San Francisco. It was intended as a state-of-the-art review, with papers covering acquisitions, cataloging, serials, circulation, and book catalogs. A brief course in library systems analysis and design was included, as were special papers on information retrieval and the implications of the Library of Congress systems study and the MARC Project, and a joint session with the LAD Library Buildings Institute on architectural implications of library automation. More than seven hundred librarians attended the three days of meetings (from June 22 to 24, 1967), and the proceedings were later published by ALA as *Library Automation: A State-of-the-Art Review*.

Publication of a journal to draw together the results of research and study in the field was also an urgent priority. At its first meeting in January 1967, the Board of Directors asked Fred Kilgour not only to continue as chair of the Publications Committee, but to be the editor of the journal. Plans were also made to seek a grant to cover the costs for the first two to three years. The Council on Library Resources later awarded a grant of $20,000 for start-up costs, Kilgour agreed to be editor, and in March 1968 the first issue of the *Journal of Library Automation* (*JOLA*) appeared. Four volumes followed under Fred's editorship, containing seventy-three articles and ninety book reviews, and reaching more than eleven hundred subscribers.[13]

An interim newsletter, called *Interface*, was published in January 1968 and again in May, followed in October 1969 by *JOLA Technical Communications*. Edited by John McGowan through 1971, and by Don Bosseau beginning in 1972, *Technical Communications* became a bimonthly in 1972 and was eventually subsumed into *JOLA* in March 1973.[14]

The board also gave immediate attention to the task of finding a full-time executive secretary. Candidates were interviewed, and on September 1, 1967, the first executive secretary of the division, Don Culbertson from Colorado State University, began work. He served until 1973, when he left to join the Argonne National Laboratory, but he continued to be active in ISAD affairs until his untimely death in 1980 .

Regional Institutes, Seminars, and Tutorials

To help meet its educational goals, ISAD from the beginning tried to reach librarians who were unable to attend annual conferences, but who still needed the kind of information presented at the first Preconference Institute. In January 1968, the board approved ten regional institutes "to tell the Project MARC story in technical detail to processing personnel throughout the country." IBM agreed to underwrite the initial planning with a grant of $3,000, and the Library of Congress (LC) agreed to release key staff members to participate.[15] Nine of these MARC Institutes (as they came to be called) were held this first year alone. They attracted thousands of participants. The "faculty" consisted of Henriette Avram and colleagues from LC (including Lucia Rather, Lenore Maruyama, Peter Simmons, and Kay Guiles) and representatives from the institutions that were the earliest experimenters with MARC records (notably, Hillis Griffin from Argonne National Laboratory, who for a time distributed the tapes for LC; Josephine Pulsifer from Washington State University; Foster Palmer and Susan Martin from Harvard University; David Weisbrod from Yale University; Paul Fasana from Columbia University; John Kennedy from Georgia Institute of Technology; and Frederick Ruecking from Rice University). The MARC Institutes continued to be held regionally, several a year, until 1972, when the torch was passed to the library schools and local or regional associations.

In the meantime, to meet the needs of librarians who felt that the MARC Institutes were too complex to understand without a basic introduction to library automation, a series of library automation tutorials was inaugurated. The faculty for the tutorials was composed of some of the most prominent people in the emerging field: Barbara Markuson, Diana Delanoy, Heike Kordish, Susan Martin, and Ray DeBuse, assisted usually by other local experts. By the early 1970s, the needs of librarians had changed, and there were increasing demands for in-service training sessions dealing with specific applications. In response, ISAD instituted a series of seminars on applications of various types, held almost monthly in various parts of the country. There were seminars on acquisitions, circulation, serials control, "the catalog" and "closing the catalog," authority control, networks, school library automation, telecommunications, administration and management aspects, specifications and contracting, and (later) microcomputers. Again the association drew on the expertise of members who willingly gave time to the enterprise, among them Michael Malinconico, Joseph Rosenthal, John Knapp, Brett Butler, George Abbott, Hugh Atkinson, Michael Bruer, and Helen Schmierer, in addition to many of those who had been involved in the earlier series.

By the mid-1980s, over 13,500 people had attended some seventy-five different institutes and seminars. There was a great feeling of adventure and excitement among those who prepared and presented these traveling road shows. Henriette Avram remembers the friendly and welcoming atmosphere they found everywhere, as well as the pervading sense of excitement. It cost the LC members more than time as well; the practice was to hold the institutes in reasonably nice hotels and for the team to eat in fairly nice restaurants, splitting the bill—but the LC contingent received a per diem allowance of only $16! Maurice (Mitch) Freedman, ISAD President in 1977–78, remembers the "intellectual joy" of being associated with "the best minds in cataloging and automation," and Michael Malinconico, ISAD President in 1980–81, recalls the seminars and institutes as being stimulating forums for the discussion of issues such as the future of the catalog and the CONSER project. There was often a feeling that those involved were living through momentous events, and sometimes these feelings were acted out. Susan Martin remembers an institute in Hawaii when Henriette Avram received the news that the first MARC tape had been successfully issued, at which she promptly ran into the ocean to celebrate—fully clothed!

Conferences

The most ambitious educational project in these earlier years was an impressive conference on networking, which was formally known as the Conference on Interlibrary Communications and Information Networks, but more familiarly as the "Airlie Conference." A grant of $125,000 from the U.S. Office of Education enabled the project staff, headed by Joseph Becker, ISAD's second president, to commission thirty-one papers and distribute them to over two hundred people in attendance. The conference itself was a full week of working group meetings, plenary sessions, and discussions, held from September 28 through October 2, 1970, at Airlie House, in Warrenton, Virginia. The proceedings, which stood as a landmark of the literature on networks for many years, were published in a unique way: transcribers put phonetic symbols on magnetic tape cartridges, which were then converted by computer to English text. After editing, the magnetic tapes were then used to drive a photographic typesetter to produce galley proofs of the pages.[16]

A second important conference was a cooperative effort with the Library Education Division and the American Society for Information Science (ASIS). Titled "Directions in Education for Information Science: A Symposium for Educators," it brought together representatives from thirty-five accredited library schools in November 1971 to discuss future trends in information science education. From this conference came a comprehensive curriculum development program, call the DISC Project.[17]

Publications

In addition to *JOLA*, *Technical Communications*, and the publications resulting from the conferences mentioned above, ISAD also pursued its educational mission with other publications. In 1970, the division published *MARC Manuals*, reproducing the manuals used at the Library of Congress, and *Format Recognition for MARC Records*. The division also produced three editions of the *Bibliography of Library Automation*, which appeared in *American Libraries* (then called the *ALA Bulletin*).[18] The institutes on "The Catalog" resulted in two publications, and cassettes of the proceedings of other conferences and institutes were also popular.

By 1970, *JOLA* had run into difficulties from two sources. In an economy move, ALA's Publishing Board abolished the editorial assistant position and cut *JOLA*'s budget, ignoring U.S. Post Office regulations that an amount equal to 50 percent of the outside subscription price had to go from dues receipts to the journal's budget.[19] By the next year, without the necessary staff support, Fred Kilgour had resigned in protest.[20] A new editor was unable to produce any issues of *JOLA* for almost two years, and threats from the post office were increasing. Continued failure to supply issues to subscribers, the post office said, would constitute fraud. Fortunately for all concerned, Susan Martin agreed in early 1973 to take over as editor.[21] By that time, *JOLA* publication was seven issues in arrears, and the Post Office had imposed a deadline of December 1973 for the journal to be current again or lose its mailing permit. To the relief of the board and with the gratitude of all concerned, Sue managed to publish all the required issues by the end of the year.[22] She continued as editor until 1977, when she was succeeded by William Mathews.

A *LITA Newsletter* was reestablished in 1979, and edited successively (and successfully) by Pat Barkalow, Carol Parkhurst, and Walt Crawford.

Advisory Services and the Executive Secretary

The "clearinghouse for information on library automation projects" became, as expected, a responsibility of the executive secretary in ALA headquarters and grew into a more general advisory service. Requests were frequently received from librarians, equipment manufacturers, and others for information about various aspects of the library automation field.[23]

After the first executive secretary, Don Culbertson, resigned in 1973, there was a brief hiatus while a search was conducted for his replacement. Later that year, Don Hammer was selected, much to the consternation of Fred Kilgour; Don had also been elected as ISAD president to succeed Fred, and his appointment as executive secretary meant that Fred had to serve as president for two full years. Don's long and fruitful service as executive secretary (later executive director) lasted thirteen years, until 1986. After another brief hiatus, Linda Knutson became the third executive director in February 1987.

MARC

One of the strongest supporters of ISAD from its beginning was Henriette Avram of the Library of Congress, "Mother of MARC" and ISAD's president in 1975–76. In 1967, Henriette suggested that ISAD might be the mechanism for distributing the new MARC tapes, but the arrangement foundered on objections by ALA's attorney.[24] Henriette also suggested that the division create a committee to study the proposed MARC II format (then under development) and consider approving it and supporting it.[25] The Resources and Technical Services Division and the Reference Services Division were asked to participate in the study, and a meeting of representatives from the three divisions was held in November 1967 to review the format and marshall professional opinion and support. At its Midwinter meeting in January 1968, the committee and the board endorsed the format as a national standard.[26]

That same year, the Machine Readable Cataloging format committee, chaired by Allen Veaner, worked with the Library of Congress to develop a standard character set for use with the MARC format. These characters, which became known as the "ALA character set," were designed to permit representation of any language that uses the Roman alphabet or any language that can be transliterated into the Roman alphabet.[27] The characters were incorporated into *Specifications for Library Print Train Graphics*, which was then forwarded to manufacturers of computer printers. IBM then produced a print train with the characters, which became known as "the ALA print train."[28]

In 1969, Paul St. Pierre of the New York Public Library proposed a MARC Users Discussion Group to coordinate the activities of those libraries beginning to use the tapes and to discuss any technical problems.[29] The group became an important forum for communication about MARC for many years.

The MARC format committee also continued to review and recommend action on proposed changes in the MARC format. Its formal name—the RTSD/ISAD/RSD Interdivisional Committee on Representation in Machine-

Readable Form of Bibliographic Information—proved to be a jawbreaker, so in 1973, committee chair Velma Veneziano suggested the acronym MARBI (Machine-Readable Bibliographic Information), a more convenient tag by which the group has been known ever since.[30]

Other Early Activities

In 1967, the division joined the Resources and Technical Services Division in creating a committee to study a proposed Universal Numbering System for publications.[31] The committee, chaired by C. Donald Cook, eventually recommended endorsement of what came to be known as the International Standard Book Number (ISBN).[32]

Other standards activities were also undertaken around this time. A Library Systems Standards Committee was established and later became the Technical Standards for Library Automation (TESLA). The committee identified the need for various standards, reviewed standards as they were developed, and forwarded them, when appropriate, to standards-making bodies. The committee also presented several programs to alert librarians of the need for standards.

Things That Didn't Work

Not all of the initial programs of the division were successful, of course. An ad hoc Committee on a Library Programming Language was formed, with computer programming experts as well as librarians, to determine the need for a special library programming language. Experts cautioned that such a development would be a very large task, and that it might be best to examine existing languages first.[33] A subcommittee began evaluating existing languages, while the parent committee became bogged down in questions about how generalized the language should be, how it would be kept up to date, and whether it should be a programming language or a query language. After a year or two, the idea was quietly dropped.

ISAD founders had also envisaged a central collection of library computer programs and documentation that could be exchanged with other libraries interested in the same applications, following the model of IBM's SCOPE (Software and Computer Program Exchange).[34] Copies of these programs and materials were to be made available at cost, and indexes by type of application, type of equipment, and type of institution were to be compiled periodically and published. Lois McCune of the Library of Congress persuaded IBM to accept library programs into SHARE and to make free copies available, and Fred Ruecking of Rice University agreed to index them by application, institution, programmer, and language. It appears, however, that few if any programs were ever contributed and attempts to establish such a collection at ALA headquarters foundered on concerns about space and time requirements.[35]

The more general proposal of serving as a clearinghouse for information about library automation projects lasted somewhat longer. The Clearinghouse Subcommittee had difficulty understanding its charge, and in 1968 the board merged it, the SCOPE subcommittee, and the Library Programming Language Committee into a single Computer Programming Committee.[36] Seven years later, the idea was revived, but Executive Director Don Hammer pointed out that in a more general sense he was already providing such a service.[37] In 1981, Hammer suggested creating a formal "directory of library systems in use" and a database.[38] The matter was referred to the Publications Committee, which reported a year later that they did not understand the intended audience or the scope, and the board tabled the matter.[39] Hammer pursued the idea for another year, but then reported that he had been forced to drop it for lack of time.[40]

ORGANIZATION AND REORGANIZATION: MOVING FROM THE 1970s TO THE 1980s

Originally, ISAD's organization was very simple. There were no sections, and only a few standing committees (for nominating, bylaws, program planning, and the like). The activities of the division were carried out through ad hoc committees that were supposed to disappear when their functions had been carried out. Some, however, such as the MARC Format Committee mentioned above, the Standards Committee, and the Telecommunications Committee, proved to have permanent value and have been continued.

Discussion Groups

To meet the needs of members who wanted a forum for exchanging information but did not need a more formal organizational structure, the division established "discussion groups." As mentioned earlier, the division actually started as a discussion group—COLA—which continued as a separate entity, then became a discussion group within ISAD in 1970.[41] Five years later, the group changed its name to the Library Automation Discussion Group,[42] and in 1981 it merged with the MARC Users Discussion Group to become the Library and Information Technology Discussion Group.[43] This group lasted until 1984, when it was disbanded because of low attendance.[44] Other discussion groups established early were the Educational Technology Discussion Group (for discussion of nonprint media), the COM Catalogs Discussion Group, the Online Catalog Discussion Group, the Retrospective Conversion Discussion Group, and (in the 1980s) the Vendor/User Discussion Group and the Consultant/User Discussion Group.

New Objectives

With a mischievous twinkle in his eye, Ralph Shoffner, ISAD's president for 1972–73, asked me to chair an Objectives Committee to review ISAD's objectives and activities over the past five years, with the working hypothesis that "the division has fulfilled its objectives and thus should be disbanded."[45] The committee included others who had been involved with the division since its beginning: Henriette Avram, Fred Kilgour, John McGowan, John Knapp, Joseph Treyz, and Pauline Atherton. The committee's report, submitted in July 1973, concluded that the division's educational functions, publications, advisory services, forums for discussion, and promotion of standards had all been worthwhile and should be continued.

New Sections

During the hearings held by the committee, two groups asked for a broadening of ISAD's activities and objectives to include (1) management and production of audiovisual materials, or "media," and (2) video and cable television. The committee noted that these interests were closely related to ISAD's traditional activities, that there was no existing "home" for them in the ALA structure (apart from a number of committees in various other divisions), and that the affinity or "chemistry" between these groups and ISAD's current membership and activities seemed good. In its final report, therefore, the committee recommended that the division's "area of responsibility include audiovisual and related educational technology."[46]

In January 1975, the board formalized the relationship by creating two new sections: the Audio-Visual Section (AVS) and the Video and Cable Communications Section (VCCS).[47] The earlier activities of the division were organized into the Information Science and Automation Section (ISAS), and the chairs of each section were given seats on the board.

A New Name

Expansion of the division's scope inevitably raised the question whether the name of the division should likewise be broadened. A bylaws committee, headed by Lois Kershner, recommended that the name be changed to Library and Information Technology Association (LITA),[48] and the board then referred the issue to division members. A special mail ballot was sent to all members with the proposed new name and a revised function statement. More than 75 percent of the membership approved, and ISAD formally became LITA.[49]

The final loose end was not tied up until five years later. In 1981, Charles Husbands, chair of the Publications Committee, recommended that the name of the journal be changed in 1982 to *Information Technology and Libraries*, to reflect the new name of the division.[50]

ALA Reorganizes

Meanwhile, the parent organization was itself being reorganized, and much less smoothly. The prolonged debate about the relationship of ALA to its divisions occupied LITA's officers as much as those of other divisions, and there was particular concern about how the finances of the division would be handled. Henriette Avram, president in 1975–76, remembers long, hard fights to get money back from the seminars and institutes, and Brigitte Kenney, president in 1981–82, remembers the strife continuing. For the first time, all of the division presidents met "to discuss common problems and to work out positive solutions to some of the internal strife."[51]

LITA Reorganizes

President Kenney took the first step that led to another reorganization of the division. Feeling that "committees and sections seemed too confining, too rigid,"[52] she appointed a Goals and Long-Range Planning Committee in June 1981.[53] The committee reported a year later with radical recommendations, among them the abolition of sections and most committees, and the establishment of numerous "interest groups" to carry out the division's objectives. The matter was then turned over to a Long-Range Plan Implementation Committee to propose a detailed reorganization.[54] The committee was chaired by Nancy Eaton, who fortuitously was elected president for 1984–85 and thus had the opportunity and responsibility for carrying out whatever changes emerged.

A draft of the committee's recommendations was printed in the *LITA Newsletter* preceding the Midwinter Meeting, and two open hearings on the proposals were held during Midwinter. Revisions suggested during these hearings were incorporated into additional drafts that were widely circulated. The committee's final report was issued on May 29, 1984, and constitutes an important milestone in the division's history. As suggested by the earlier committee, the sections were abolished. Committees were divided into administrative committees (such as bylaws, nominating, publications, and awards) and functional committees (MARBI, standards, education, and so forth). The main thrust of the reorganization, however, was the establishment and encouragement of "interest groups," which were "intended to reflect topics of current interest to members and to have a structure which allows for easy creation and easy elimination as interests and technology change." Interest groups could be formed by petition from as few as ten LITA members and were empowered to plan and present programs, institutes, and preconferences, and even to prepare publications of their own.[55]

The rationale was more involvement in LITA on the part of its members, but the major reason behind the reorganization, from the board's point of view, was financial. Revenues were down significantly, seminars were seeing lower enrollments, there were fewer programs being presented, and the division was losing members. The board felt that the reorganization would revitalize the division by making closer connections with its members.[56]

By all accounts, the reorganization has been remarkably successful. Membership has steadily increased, and the division is now restored to health financially. More importantly, its members are much more active in LITA's programs. Lois Kershner, president during the year the reorganization was implemented, remembers getting the new interest groups started as soon as possible and the excitement that was generated as more and more people began to participate.[57] Linda Knutson, who became executive director of LITA in February 1987, has also been impressed by the increase in the level of participation and by "the tremendous energy that the players have; they want to contribute, and they plunge in with both feet!"[58] Sherrie Schmidt, president from 1988–89, remembers how the interest groups "took off" and generated so many programs that the ALA offices couldn't handle them.[59]

The interest groups have indeed "taken off"; there are now interest groups for Adaptive Technologies, Artificial Intelligence and Expert Systems, Authority Control in the Online Environment, Customized Applications for Library Microcomputers, Desktop Publishing, Distributed Systems and Networks, Electronic Mail and Electronic Bulletin Boards, Emerging Technologies, the Human/Machine Interface, Hypertext and Hypermedia, Imagineering, Library Consortia Automated Systems, MARC Holdings, Microcomputer Support of Technical Services, Microcomputer Users, Online Catalogs, Optical Information Systems, Programmers and Analysts, Retrospective Conversion, Serials Automation, Small Integrated Library Systems, Telecommunications, and Vendors and Users—a total of twenty-three in all! Lest they outlive their need or the interests of members, there is also a "sunset" law; each interest group must resubmit a petition and be reapproved every three years or be dissolved.

The PLA Challenge

There was one other significant organizational event in the late 1980s and early 1990s: a direct challenge from the Public Library Association (PLA) to LITA's responsibility for automation and library technology. In 1989, the PLA Board voted to establish a Technology in Public Libraries Section, creating a direct overlap with LITA's responsibility for technology in all forms of libraries. The LITA Board asked ALA's Committee on Organization to let the two divisions work together to meet the perceived need in some other fashion.[60] President Carol Parkhurst also wrote the president of PLA and suggested a Joint Task Force as a specific means of addressing PLA's concerns. PLA endorsed the concept, and the matter was thus—after two years of discussion—resolved.[61]

NEW PROGRAMS

In addition to the increased involvement of members, new financial stability, and the excitement of specialized, forward-looking interest groups, there were other signs of the division's increased vitality in the 1980s and early 1990s: a new lecture series, new awards, and most significantly, a series of three national conferences.

The Distinguished Lecture Series

In 1982, President Carolyn Gray proposed a "distinguished lecture series" as a means of adding quality and distinction to LITA's programming,[62] and succeeded in gaining financial support for the series from the F. W. Faxon Company.[63] The program was an immediate success and has become a hallmark of LITA's conference programming.

LITA Awards

In 1978, LITA established the "LITA Award for Achievement in Information Technology" to recognize outstanding achievement in library and information technology.[64] In 1982, Gaylord Brothers offered to subsidize the award,[65] and it has hence been known as the LITA/Gaylord Award.

Following the untimely death of Hugh Atkinson, one of the original members of COLA and ISAD, and an outstanding member of the profession, the division established the Hugh C. Atkinson Memorial Award to honor his life and accomplishments by recognizing the outstanding accomplishments of an academic librarian who has worked in the areas of library automation or library management.[66] Responsibility for the award is shared with the Association of College and Research Libraries, the Library Administration and Management Association, and the Association for Library Collections and Technical Services.

In 1992, a third award was established with the financial assistance of the periodical *Library Hi Tech*. The LITA Library Hi Tech Award is for a work, or a body of work, that shows outstanding achievement in educating practitioners within the field of library and information technology.

LITA Scholarships

LITA's awards have also taken the form of scholarships for deserving students. In 1983, CLSI, Inc., offered to support a scholarship in the area of information technology, since known as the LITA/CLSI Scholarship.[67] The award is intended to encourage the entry of qualified persons into the library automation field.

In 1990, the board established the LITA Minority Scholarship,[68] and later secured agreement from OCLC, Inc., to support it. The scholarship, known as the LITA/OCLC Minority Scholarship, provides support for a member of a minority group who shows a strong commitment to the use of automation in libraries.

The National Conferences

In 1980, Kaye Gapen, chair of the Program Planning Committee, reported to the board that the committee was considering new ways to provide high-level continuing education, among which was the idea of a "technology fair."[69] This idea developed into the concept of a national conference: not a preconference, but a separate LITA-only conference, to be held at a different time and location than the ALA Conference, implicitly taking advantage of the new, more independent relationship between ALA and its divisions.

By 1981, a planning committee had been appointed, with Berna Heyman as chair, the site and date of the conference had been picked (Baltimore in 1983), and the purpose and format had been established.[70] Much like the very first preconference, the program would "bring together in one forum current and anticipated developments in library and information technology" and "present and share the state-of-the-art in a concise and concentrated manner." The format would permit much broader and more diverse programming than was possible during a regular ALA conference or a LITA institute, and would include demonstrations, speeches by experts, contributed papers, and workshops.

In the intervening years, planning proceeded on multiple fronts and in multiple committees. The conference was held on September 17–21, 1983, and was a great success, both intellectually and financially. Over fifteen hundred people attended, there were 97 booths of exhibits, and the budget ended up substantially in the black. The final format included four keynote speakers, seventeen contributed papers, six panels, nine state-of-the-art papers, a preconference tutorial, two postconference workshops, six bus tours, an exhibitors' seminar, a video nightcap, five hands-on technology shops (called "hotshops"), and a midnight cruise!

The "hotshops" proved to be very popular activities. The Microcomputer Software Swapshop allowed participants to copy and trade software; the Electronic Mail Message Center allowed participants to send messages at no charge; the Video Swapshop allowed them to copy and exchange video tapes of material originally recorded by themselves or their libraries; the Teleconference Showcase allowed them to "meet" each other from two different places; and the Demo/Expo allowed thirteen libraries to demonstrate their locally developed systems.[71] Panel discussions and exhibits also received great praise.[72]

LITA's second National Conference, on October 2–6, 1988, in Boston, was even bigger. Almost twenty-three hundred people attended, there were 123 exhibit booths, and the conference again made a profit. While there were only two keynote speakers, other program activities were enlarged: there were six technology seminars, forty technical sessions, forty-six "professional showcases," twenty-four new product reviews, ten tours, and a total of six postconference workshops. Over one thousand people jammed the Boston Public Library for the opening reception, and almost as many attended a "New England Clambake" later in the conference. A total of thirty-five volunteers, led by the steering committee chair, Carol Parkhurst, worked long hours over a two-year period to make it a success.[73]

Encouraged by the success of the first two, a third National Conference was scheduled for September 13–17, 1992, in Denver. Attendance was just over two thousand. Held in the depths of a recession, the planners, led by Chair Betty Bengston, had expected (and budgeted) for fewer and were thus pleased at the turn-out, and at the financial success of the conference as well. Major speakers included a keynoter and three "featured speakers" on challenging and futuristic topics and the program included five workshops (essentially tutorials on topics ranging from retrospective conversion to desktop publishing); a huge total of fifty-six separate programs on the full range of information technology topics, from artificial intelligence to information policy, from viruses to staff management; "talk tables," which allowed participants to discuss hot topics during the lunch hour; "showcases," where people could demonstrate projects of their own design and making; and "research forums" to present status reports and results of studies and projects. The conference also included an opening reception at the Denver Museum of Natural History and a banquet at the famous Flying W Ranch in Colorado Springs.

A LOOK TOWARD THE FUTURE

LITA is now a mature, well-established organization. Its membership has grown steadily, from the initial roster of 2,334 to a total of 5,802 as of February 28, 1993.[74] The division also has a full-blown strategic plan, begun in 1989 under President Carol Parkhurst, and updated each year since then.[75] The current four-year plan "envisions a world in which the complete spectrum of information technology is available to everyone," restates the mission of the division ("to provide . . . a forum for discussion, an environment for learning, and a program for action on the design, development, and implementation of automated and technological systems in the library and information science field"), and sets forth three main goals ("to provide opportunities for professional growth and performance . . . to influence national and international initiatives. . . . [and] to strengthen the association and assure its continued success"), under which are listed a series of specific objectives and strategies.[75]

Clearly, LITA has a firm grip on what it is, what it does, and where it is going. The greatly increased involvement of members and the democratization of the association will give LITA the strength needed to sustain its many initiatives and programs. Even more importantly, its new organization, built around the mechanism of specific interest groups, will allow it to grow and change in the future, discarding gracefully those organizational elements that are obsolete and no longer needed, and acting swiftly to meet the new and emerging needs of its members and the profession.

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2. Much of the information in this and the following paragraphs is from a brief article, "Information Science and Automation; the Newest Division," *ALA Bulletin* (June 1967): 637–42.
3. I hope the reader will forgive the immodest use of the personal pronoun (in lieu of the more awkward "this writer" or "the author") and its frequency in the next few paragraphs. As in all human affairs, events in this history happened largely because people made them happen, and I have tried to name as many of the key individuals as the documents and memory will allow.
4. Letters, Salmon to Rodell, July 22, 1964; Rodell to Salmon, August 4, 1964; Salmon to Rodell, August 14, 1964; Rodell to Salmon, August 20, 1964; Salmon to Rodell, August 27, 1964.
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19. Minutes, Board of Directors, July 1, 1970, p.11.
20. Minutes, Board of Directors, January 18, 1971, pp. 2–3.
21. Minutes, Board of Directors, January 29, 1973, pp. 3–4.
22. Minutes, Board of Directors, January 23, 1974, pp. 14–15.
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26. Minutes, Board of Directors, January 10, 1968, pp. 3–4.
27. Minutes, Board of Directors, June 27, 1968, pp. 7–8.
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33. Donald S. Culbertson, Report of a meeting of a subcommittee of the Committee on a Library Programming Language.
34. Stephen R. Salmon, *Information Science and Automation Division Annual Report, 1966–1967*, p. 3.
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36. Minutes, Board of Directors, Midwinter Meeting 1968, p. 7.
37. Minutes, Board of Directors, January 27, 1975, pp. 7–8.
38. Minutes, Board of Directors, June 29, 1981, p. 3.
39. Minutes, Board of Directors, January 27, 1982, p. 15.
40. Minutes, Board of Directors, June 28, 1983, p. 14.
41. Minutes, Board of Directors, July 2, 1970, p. 9.
42. Minutes, Board of Directors, July 2, 1975, p. 9.
43. Minutes, Board of Directors, February 2, 1981, p. 5.
44. Minutes, Board of Directors, June 23, 1984, p. 1.
45. Hammer, *Information Science*, p. 6.
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47. Hammer, *Information Science*, p. 3.
48. Minutes, Board of Directors, February 3, 1977, p. 11.
49. Minutes, Board of Directors, January 22, 1978, p. 3. Lest there be confusion on the matter, the board ruled that the official pronunciation of the name would be "leeta."

50. Minutes, Board of Directors, June 30, 1981, p. 10. The question of whether it should be printed in ITALics was apparently suppressed.
51. Letter, Kenney to Salmon, September 16, 1992.
52. Ibid.
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56. Telephone conversation with Nancy Eaton.
57. Telephone conversation with Lois Kershner.
58. Telephone conversation with Linda Knutson.
59. Telephone conversation with Sherrie Schmidt.
60. Minutes, Board of Directors, June 27, 1989, pp. 13–14.
61. Minutes, Board of Directors, January 5, 1990, pp. 5–7, 18; September 20, 1990, pp. 5–6.
62. Minutes, Board of Directors, July 13, 1982, p. 11.
63. Minutes, Board of Directors, January 12, 1983, p. 8.
64. Minutes, Board of Directors, January 24, 1978, pp. 12–14; January 25, 1978, p. 20; June 26, 1978, p. 4.
65. Minutes, Board of Directors, July 12, 1982, p. 2.
66. Minutes, Board of Directors, January 19, 1987, p. 6.
67. Minutes, Board of Directors, January 7, 1984, p. 3; January 11, 1984, p. 14.
68. Minutes, Board of Directors, January 5, 1990, p. 5.
69. Minutes, Board of Directors, July 2, 1980, p. 12.
70. Minutes, Board of Directors, February 2, 1981, p. 8.
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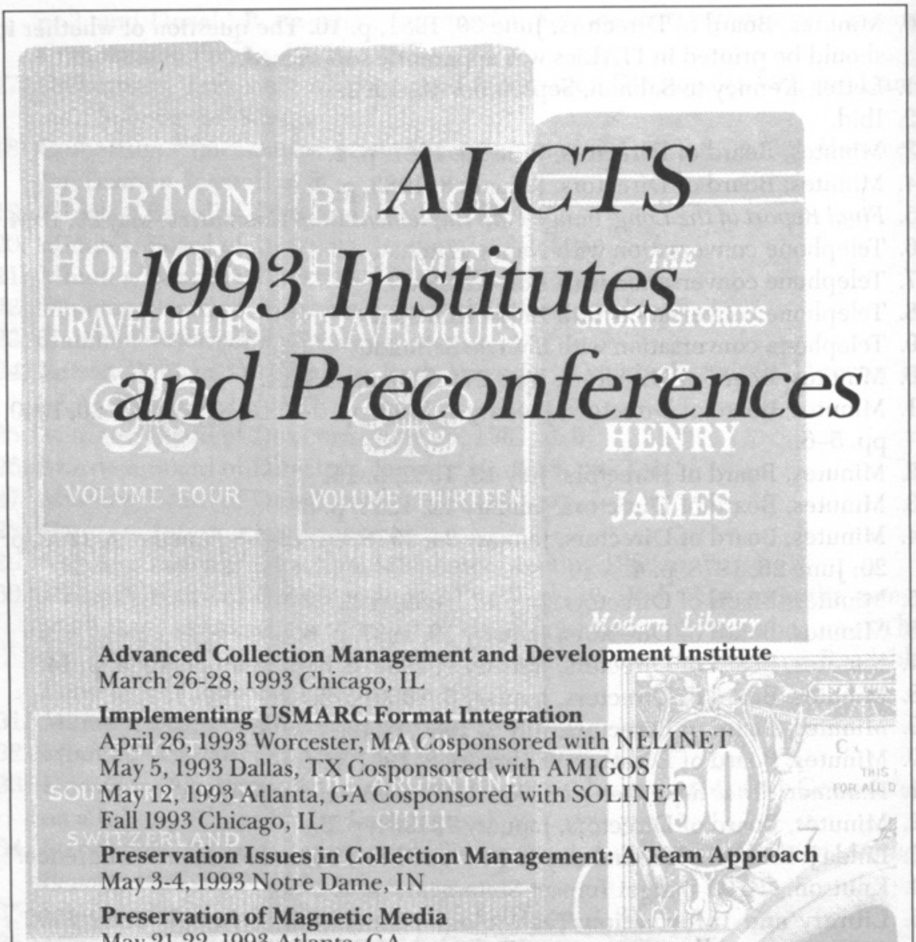
72. Minutes, Board of Directors, January 7, 1984, p. 3.
73. Linda J. Knutson, "Preliminary Report on LITA's Second National Conference."
74. Knutson, "FY93 Budget Impact Statement," p. 3.
75. Library and Information Technology Association, *Strategic Plan 1992–1995*.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ISAD/LITA PRESIDENTS AND EXECUTIVE DIRECTORS

ISAD/LITA Presidents with affiliation during term

1966–67	Stephen R. Salmon	Library of Congress, Washington, D.C.
1967–68	Joseph Becker	EDUCOM, Bethesda, Md.
1968–69	Russell Shank	Smithsonian Institution, Washington, D.C.
1969–70	Robert M. Hayes	Institute of Library Research, Berkeley, Calif.
1970–71	Richard DeGennaro	University of Pennsylvania, Philadelphia
1971–72	Jesse H. Shera	Case Western Reserve University, Cleveland, Ohio
1972–73	Ralph M. Shoffner	Richard Abel & Co., Portland, Oreg.
1973–74	Frederick G. Kilgour	Ohio College Library Center, Columbus
1974–75	Frederick G. Kilgour*	Ohio College Library Center, Columbus
1975–76	Henriette B. Avram	Library of Congress, Washington, D.C.
1976–77	Joseph A. Rosenthal	University of California, Berkeley
1977–78	Maurice J. Freedman	School of Library Service, Columbia University, N. Y.
1978–79	Susan K. Martin	University of California, Berkeley
1979–80	Barbara E. Markuson	Indiana Cooperative Library Services, Indianapolis
1980–81	S. Michael Malinconico	New York Public Library
1981–82	Brigitte L. Kenney	Infocon, Inc., Golden, Colo.
1982–83	Carolyn M. Gray	Brandeis University, Waltham, Mass.
1983–84	Kenneth Dowlin	Pikes Peak District, Colorado Springs, Colo.
1984–85	Nancy L. Eaton	University of Vermont, Burlington
1985–86	Lois M. Kershner	Peninsula Libraries Automated Network, Belmont, Calif.
1986–87	Raymond DeBuse	Woodward Bay Company, Lacey, Wash.

* Served two-year term because president-elect Donald P. Hammer accepted position as LITA Executive Director.

1987–88	William Gray Potter	Arizona State University, Tempe
1988–89	Sherrie Schmidt	Texas A&M University, College Station
1989–90	Carol A. Parkhurst	University of Nevada, Reno
1990–91	Jo-Ann Michalak	University of Pittsburgh, Penn.
1991–92	Paul Evan Peters	Coalition for Networked Information, Washington, D.C.
1992–93	Walt Crawford	The Research Libraries Group, Inc., Mountain View, Calif.

ISAD/LITA Executive Directors

1967–73	Don S. Culbertson
1973–86	Donald P. Hammer
1987–	Linda J. Knutson

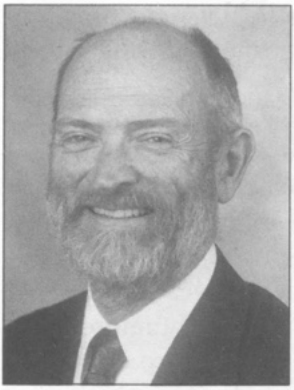
Below are photographs of most of LITA's (and ISAD's) past presidents and journal editors and the past and current exeuctive directors. This is our way of placing faces with names, so that perhaps during the next ALA Conference you will recognize some of our leaders.

Stephen R. Salmon, 1966–67

Stephen R. Salmon, Chairman of the Board of Carlyle Systems, Inc. since 1983, founded and served as first president of ALA's Information Science and Automation Division (now Library and Information Technology Association).

Salmon earned his B.A. and M.L.S. from the University of California, Berkeley, and began his library career at the St. Louis Public Library. From there he went to the Library of Congress, where he held positions three separate times during his career. He also served at George Mason University as Librarian, at Washington University as Associate Director of Libraries, and at the University of Houston as Director of Libraries. He worked for the Xerox Corporation as president and general manager of two Xerox library subsidiaries and was the Assistant Vice-President of Library Plans and Policies immediately prior to starting Carlyle Systems.

He is the author of numerous books and articles on library automation and was honored as an outstanding alumnus by the University of California, Berkeley, Library School.



Ralph M. Shoffner, 1972–73

Ralph Shoffner, President of Ringgold Management Systems, Inc., received a Doctor of Library Science from the University of California, Berkeley; an M.S. in industrial administration from the Carnegie Institute of Technololgy; and a B.S in business and engineering administration from the Massachusetts Institute of Technology. From 1974 to the mid-1980s, he led over fifty studies, including: redesign of ILL for New York State; a twenty-year projection of Kent (Wash.) Public Library space needs; crossover library usage between Seattle Public Library and KIng County Library Systems; and a review of higher education libraries, with respect to their ability to meet their missions, for the Idaho State Board of Education. He has led Ringgold in providing acquisitions and circulation control software; their current new software is a full MARC-based public access catalog running under the Windows graphic user interface.

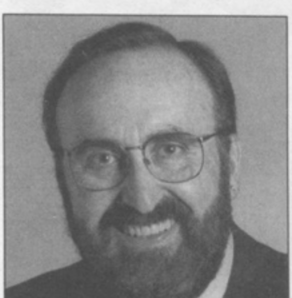
Henriette B. Avram, 1975–76

Henriette Avram retired from the Library of Congress (LC) in January 1992, where she had served as Associate Librarian for Collections Services since October 1989. In this position, she was responsible for the administration and professional direction of thirty-four divisions and offices comprised of over seventeen hundred staff positions. Collections Services, the largest unit in the Library, includes acquisitions, cataloging, classification, collection policy, preservation, processing and servicing special format materials, collection services automation planning and liaison, MARC standards, networking, technical services research, and technical processing and automation instruction.

Other LC positions she held were Assistant Librarian for Processing Services, 1983–89; Director for Processing Systems, Network and Automation Planning, 1980–83; Director of the Network Development Office, 1976–80; Chief of the MARC Development Office 1970–76; Assistant Coordinator of Information Systems, 1967–70; and supervisory information systems specialist, 1965–67. Prior to joining the Library, she held various programming, analyst, and management positions at the Department of Defense and the Datatrol Corporation.

Avram has been the recipient of many awards, including Library of Congress Superior and Distinguished Service Awards, the Margaret Mann Citation, the Federal Woman's Award, Academic Research Librarian of the Year Award, the Library and Information Technology Award, the Melvil Dewey Award, the Joseph W. Lippincott Award, the Senior Executives Association/Professional Development League's Executive Excellence Award, Special Libraries Association Professional Award, the John Ames Humphrey/Forest Press Award, and the ANSI Meritorious Award. She was also elected an Honorary Fellow of IFLA and a Fellow of NISO.

She has written many articles in the fields of automation, networking, standardization, bibliographic control, and others. Her professional involvement included participation in ALA, ARL, ASIS, ACM, ANSI, IFLA, ISO, UNESCO, EDUCOM Board of Trustees, Commission of Preservation and Access Board of Directors, and the Federal Network Council Advisory Committee, and serving as chair of the LC Network Advisory Committee.



Maurice J. (Mitch) Freedman, 1977–78

Mitch Freedman has spent most of his career in automation and/or technical services work. He started at the Library of Congress in 1965; from 1968–69 he worked for a tiny (and now extinct) company, Information Dynamics Corp., the creator of the Micrographic Catalog Retrieval System.

From 1969–74, he was head of technical services and was responsible, along with Jerry Pennington, for automation at the Hennepin County Library. He then served as head of technical services at the New York Public Library and was later a professor at Columbia University's School of Library Services. Since 1982, he has been director of the Westchester Library System in New York.

Susan K. Martin, 1978–79

Susan K. Martin has been University Librarian at Georgetown University since July 1990. Before that she was executive director of the National Commission on Libraries and Information Science in Washington, D.C.

From 1979–88 she was director of the Milton S. Eisenhower Library at Johns Hopkins University. Prior to that she was systems librarian at the Harvard University Library and Head of the Library Systems Office at the University of California, Berkeley.

Martin has a B.A. in Romance Languages from Tufts University, an M.L.S. from Simmons College, and a Ph.D. from the University of California, Berkeley.

The focus of most of Martin's writings has been library automation and networking, and her dissertation was on the governance of automated library networks. She received the 1976 Simmons College Distinguished Alumni Award.

S. Michael Malinconico, 1980–81

Michael Malinconico has a B.S. in physics from Brooklyn College and an M.A. in physics and an M.S. in library science from Columbia University.

Malinconico was a lecturer in the Department of Physics at Brooklyn College from 1965–1967, while a doctoral candidate in physics at Columbia. He was then a data systems analyst for NASA at the Goddard Space Flight Center before holding several automation and technical service positions at the New York Public Library, including Associate Director for Technical and Computer Services from 1969–87. He was also an adjunct instructor at the Columbia University School of Library Services before going to the Pratt Institute to serve as Dean and Professor, School of Computer, Information, and Library Science. He has been the EBSCO Professor of Information Studies at the University of Alabama since 1989.

Malinconico is the author of many books and articles, mainly on library automation. He has been active in ALA, especially in RTSD (the division awarded him the Esther J. Piercy Award in 1978) and LITA.

Brigitte L. Kenney, 1981–82

Brigitte L. Kenney studied music and English at the University of Graz in Austria before earning her M.A. in library science from the University of Chicago Graduate Library School. She began her library career with the Tombigbee Regional Library in West Point, Mississippi, and subsequently held positons elsewhere in Mississippi and at Northwestern University before beginning a teaching career at Drexel University's College of Information Studies. Her later career took her to the University of Denver and the University of North Carolina at Chapel Hill. Before she retired in 1989, she was president of INFOCON, Inc., in Golden, Colorado.

In addition to serving as LITA president, Kinney was the founder and first chair of the ISAD Telecommunications Committee.

Carolyn M. Gray, 1982–83

Carolyn Gray received her M.L.S. from the School of Library Science, University of Oklahoma in 1976 and her Ph.D. from the Florence Heller School of Social Policy, Brandeis University. Her dissertation is entitled *Information for Management, Planning, and Decision Making in Nonprofit Organizations*. Her work experience includes: Associate Director, Brandeis University Libraries, 1982–present; Coordinator of Automation and Cataloging at Western Illinois University Library; Assistant to the Director, AMIGOS Bibliographic Council, Dallas, in the late 1970s; adjunct lecturer at the University of Oklahoma Graduate School of Library Science; and stints as a high school librarian and an English teacher in Missouri and Arkansas.

An active member of the American Library Association since 1976, she has focused most of her energies on activities in the Library and Information Technology Association, serving as president in 1982 and serving on the Board for a three-year term. Her current professional focus is "freedom and access" issues related to electronic technology. She is chair of LITA's Technology and Access Committee.

Kenneth Dowlin, 1983–84

Kenneth Dowlin is City Librarian for the City and County of San Francisco. He directs twenty-seven facilities, with a $21-million operating budget and oversees a capital improvements budget in excess of $160 million to create a new main library and to renovate twenty-one branch libraries. Mr. Dowlin has an international reputation in the field of library technology and has been cited by *Library Journal* as one of the top sixteen leaders in the library profession. He holds an M.A. in public administration from the University of Colorado and an M.A. in library science from the University of Denver. His goal is to continue to improve library service to citizens through state-of-the-art technology and to create political organization and community leadership to move public libraries to the forefront of public institutions in the twenty-first century.

William Gray Potter, 1987–88

William Gray Potter has been Director of Libraries at the University of Georgia since 1989. Prior to this position, he was an Associate Dean of Libraries at Arizona State University. Before that he held a number of positions in the library at the University of Illinois at Champaign-Urbana.

Potter has written extensively and given many presentations on the use of technology in libraries, always with the central idea that computers should be used to simplify libraries for their users.

In addition to serving as president of LITA, he is a past president of the OCLC Users Council. He edited *Information Technology and Libraries* from 1984–1989 and currently serves on the editorial boards of *OCLC Micro* and *Library Hi-Tech*.

Sherrie Schmidt, 1988–89

Sherrie Schmidt is the Dean of University Libraries at Arizona State University (ASU). She began her tenure at ASU as Associate Dean for Library Services and served as Interim Dean. Most recently she spent four years at Texas A&M University as the Assistant Director for Collections and Bibliographic Services. She worked in various capacities at the University of Texas at Austin, the FAXON Company, the University of Texas at Dallas, AMIGOS, the University of Florida, and Ohio State University.

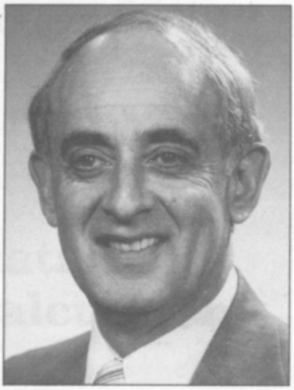
Most of her professional activities relate to the use of technology in libraries. In addition to LITA activities, she has served on boards and committees of AMIGOS and the OCLC Users Council. She currently is a member of ALA's Committee on Accreditation. She was a UCLA Senior Fellow in 1989.

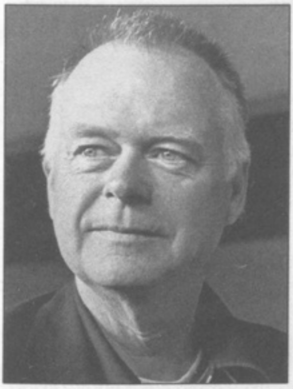
Jo-Ann Michalak, 1990–91

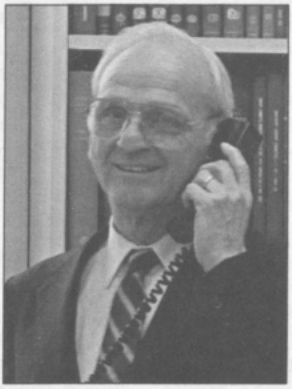
Jo-Ann Michalak has an M.S.L.S. from the University of Illinois and an Advanced Certificate in Librarianship from Columbia University. She has held a variety of positions in academic libraries over the last twenty-five years—in technical services, automated services, and public services. Currently, Michalak is Assistant Director for Public Services for the Arts and Sciences Library at Tufts University. Her current project is planning public services for a new library building at Tufts.

ISAD/LITA Presidents


Joseph Becker
1967–68


Russell Shank
1968–69


Robert M. Hayes
1969–70


Richard DeGennaro
1970–71


Frederick G. Kilgour
1973–75

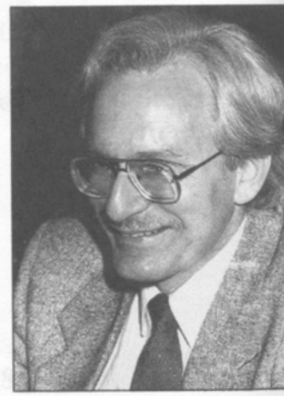

Barbara E. Markuson
1979–80


Nancy L. Eaton
1984–85


Lois M. Kershner
1985–86

ISAD/LITA Presidents (continued)

Carol A. Parkhurst
1989–90



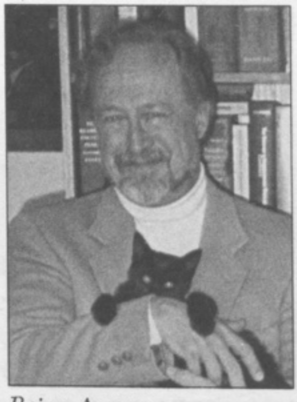
Walt Crawford
1992–93

ISAD/LITA Executive Directors

Donald P. Hammer
1973–86

Linda J. Knutson
1987–

***JOLA/ITAL* Editor, 1981–83**



Brian Aveney

Pictures not available:

Jesse H. Shera
Joseph A. Rosenthal
Raymond DeBuse
Jo-Ann Michalak
Paul Evan Peters
Don S. Culbertson

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An Experiment in Information Searching with the 701 Calculator

Harley E. Tillitt

Harley E. Tillitt began experiments on storage and searching of a coordinate index using an IBM 701 Calculator soon after the machine arrived in September 1953 at the then Naval Ordnance Test Station, China Lake, California. By April 1954 Mr. Tillitt's program was operational, searching the library's coordinate index, which had been converted to a truncated machine readable form. In early May 1954 Mr. Tillitt presented the following paper, describing his system, at an IBM Computation Seminar at Endicott, New York. The paper is believed to be the first report on library-related computerization and is here printed for the first time because of its historic importance.—Ed.

At the U. S. Naval Ordnance Test Station, an attempt has been made to use the 701 Calculator as a tool in the task of searching library files for documents referring to special subjects. The present system includes only reports which have been written in certain agencies throughout the country and does not include periodicals or books. Furthermore, the subjects are for the most part related to the development and testing of items of naval ordnance.

In any organization that includes research and development in its functions, it is economical in both time and money to be able to determine what has been done in a field before new programs are started. Scientists and engineers, therefore, are anxious to learn what is in the literature prior to starting some new task. Frequently, however, the labor of searching library files is so great or so unprofitable that it is either not done, or done very incompletely.

One of the reasons for the difficulty in searching is that the cataloging of reports may be such that important aspects of their contents are obscured. For example, the following report, *Equilibrium Composition and Thermodynamic Properties of Combustion Gases*, could logically be cataloged under one or more of several subject headings, which might or might not be appropriate, depending somewhat upon the technical skill of the cataloger. This particular report was filed in the China Lake Technical Library under two subjects: Gases and Physics. Both of these are standard Library of Congress subject headings, and are more or less descriptive of the report.

However, under each subject heading there were found to be several hundred other reports filed, in itself a situation that could discourage searching. More serious, however, was the fact that scientists interested in such a category of ordnance development might be equally likely to search under the subjects of Combustion or Physical Chemistry. Most serious, however, was the fact that there was no indication in the cataloging process that one of the main contributions of the report was to describe a numerical method by means of which the thermodynamic properties were computed. As a result, for one reason or another, the report was, in certain respects, lost, as far as many interested individuals were concerned.

To avoid some of the difficulty of cataloging documents by subject heading, a system can be used that depends upon a document being described by several single terms called descriptors.[1] In the library application of this system, there is a card for each descriptor. As a document comes to the library it is given an acquisition serial number and this number is entered upon as many different descriptor cards as seem necessary to describe the document.

In the example above, if the serial number of the report had been 1234, this number might have been entered on the following cards: Thermodynamics; Combustion; Gases; Computation; Fuel; Impulse; Pressure; Temperature; Entropy; Enthalpy; Adiabatic. Some descriptors do not seem related to the title, but could have been assigned after a brief inspection of the contents by the cataloger. To use such a system when information of a certain type is desired, an individual would list descriptors that would, in his opinion, describe his needs. These descriptor cards would then be pulled from the files and be visually compared for numbers that matched on the several cards. Reports corresponding to these matching serial numbers would then be withdrawn.

The original purpose of the 701 program to be described was to mechanize the above procedure with a view to the possible establishment of a daily schedule for library searching.

In designing the 701 system, attention was given to the current size of the file and the expected growth during the next five years. The two quantities considered were the expected total number of serial numbers and the total number of descriptors. It was estimated that during the next five years there would be no more than 30,000 serial numbers nor more than 5,000 descriptors. Furthermore, it was estimated that in searching for documents on a particular subject no more than eight descriptors would be listed and that any one of these would not have more than 1,000 serial numbers associated with it.

This coordinate index system has only recently been put into use at the Naval Ordnance Test Station, and at the time the 701 programming was started there had been established a list of approximately 2,500 descriptors. New descriptors are being added at the rate of about 100 per month, with an anticipated upper limit of 5,000. On these 2,500 cards there had been recorded a total of about 20,000 numbers describing nearly 4,000 documents, indicating that each serial number was recorded on an average of five different descriptor cards.

At the present time, additions are being made to the system at the rate of about 500 documents per month. This currently represents approximately 4,000 additional entries of serial numbers per month, since the catalogers are becoming more experienced with the system and are now using about eight descriptors per document.

The 701 operations are quite simple and go through nearly the same steps as are required in a normal hand search. These steps are as follows:

1. Install the master tape reel on which the file has been written. (The present arrangement of information on the tape is that each descriptor and associated report serial numbers form a unit record. The unit records are on the tape in order of increasing descriptor number.)

2. Load the searching program, plus from 1 to 20 cards on each of which are punched the 2 to 8 descriptors, called K's, that describe the subject of interest. (After loading, transition is made to the search program itself.)

3. Report serial numbers that appeared under all selected descriptors are printed

The following brief descriptions show the purpose of several programs used in the system.

Program A: Read into electrostatic storage as many decimal cards as required for a descriptor group.

Program B: Compute a check sum for a descriptor group and write it plus the group on tape.

Program C: Read a group, including its descriptor, from tape and match the descriptor against the 2 to 8 K's.

Program D: If a group descriptor matches any K write the group on drum.

Program E: After either 8 groups have been written on drum, or all of the K's exhausted, read the first two groups from drum and match report serial numbers. Store the matches where the first group had been.

Program F: Read subsequent groups from drum one at a time and continue to match those that remain with each new group, storing these where the first group had been.

Program G: When all groups have been read from drum and matched, print the final matches that remain.

Program H: Read a group from cards. Determine whether this is an addition to a group already on the tape or a group having a descriptor not previously used.

Program I: If the group in H is an addition to an old group, produce a new check sum for the old group plus the addition. If the group in H is new, produce a check sum for it. In either case collate the new information with that on the tape and write it on a second tape.

It can be seen that A and B will be used only once, when the system is started; C through G whenever a search is made; and H and I when additions are made as required by the continued acquisition of documents.

One of the objectives of the experiment is to attempt to reduce the amount of time spent in entering new serial numbers onto cards. This is a hand job requiring manipulation of the file and the recording of numbers, which is a slow process as well as a source of interference with individuals wishing to use the file at the same time. With the use of programs H and I, the system can be kept up to date without the need for hand operations except for the listing of additions on the sheet of paper, as contrasted with making card entries.

A second objective is to attempt to establish a daily schedule for document searching. Presumably, this would eliminate conflicts that arise when more than one person happens to want to use the file at the same time. Also, it is possible that if the mechanics of searching are such that scientists and engineers can delegate the task to their secretaries (and the 701), the general use of reports will be increased, with presumably beneficial results. At the present time from ten to twenty searches are made per day.

Although there are cases when an individual may wish to search immediately, it is believed that most such "urgent" needs can be planned to meet a schedule, especially if such a schedule would include two periods, such as 11:30 a.m. and 4:00 p.m. There has been no real experience on this part of the experiment as yet.

At present only one search can be made at a time; this is because the system is built to accommodate eight descriptors per search, each of which might contain up to 1,000 serial numbers. However, as indicated above, up to twenty searches can be made to follow in order with only one loading.

An improvement planned but not yet in effect is that of searching for 8 K's but also printing those serial numbers that match for 7, 6, 5, 4, 3, or 2 K's.

It is difficult to estimate the 701 time required for what may become a typical scheduled searching period. This depends upon several factors, including the total number of searches to be made in one period, the number of K's, the number of serial numbers per descriptor, and the location of the descriptor groups on the tape.

The time required to load the cards, which include the program and the K's, plus the pushing of card reader and load buttons, is about 10–15 seconds. A search for 8 K's through 300 groups, with from 5 to 40 serial numbers each, all located at the front of the tape, requires about 10-15 seconds. The minimum time of search, therefore, is in the range of 20-30 seconds.

As the file increases in size, by new descriptor groups being entered and new serial numbers being added to old groups, the time per search will approach that required to read the tape.

If the present estimate of 4,000 new entries per month proves to be correct, there will be about 240,000 plus the present 20,000 in five years. Since these are recorded as half words, there would be room to load the file on one 1,200-foot tape. Therefore, a maximum search would require about the time needed to read 1,200 feet of tape, or approximately 4 minutes. The China Lake Technical Library staff suggests that if the labor of putting entries on cards is reduced, the number of descriptors assigned to a document may be greatly increased, perhaps by a factor of two. If this should happen, a single tape might not be sufficient.

In summary, this paper describes a method by means of which the 701 Calculator can perform certain library searching tasks. Depending upon several variables, a single search may require as little as twenty seconds or as much as four minutes. The system is at present in the nature of an experiment, and whether or not it will prove to be economical or practical remains to be seen.

REFERENCE

1. One discussion of this type of system is given in a series of eight technical reports by Mortimer Taube of Documentation Incorporated, Washington 6, D.C. These reports were prepared under Contract No. AF 18(600)-376 for the Armed Forces Technical Information Agency in the period July 1952 to March 1953. ■■

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Institutional Political and Fiscal Factors in the Development of Library Automation, 1967–71

Allen B. Veaner

This paper (1) summarizes an investigation into the political and financial factors which inhibited the ready application of computers to individual academic libraries during the period 1967–71, and (2) presents the author's speculations on the future of libraries in a computer dominant society. Technical aspects of system design were specifically excluded from the investigation. Twenty-four institutions were visited and approximately one hundred persons interviewed.

Substantial future change is envisaged in both the structure and function of the library, if the emerging trend of coalescing libraries and computerized "information processing centers" continues.

SUMMARY OF MAJOR FACTORS WHICH INHIBITED THE APPLICATION OF COMPUTERS TO LIBRARY PROBLEMS, 1967–71

Major factors which inhibited the application of the computer to the library during the period 1967–71 can be categorized under three broad headings: (1) Governance, organization, and management of the computer facility; (2) personnel in the computer facility; and (3) deficiencies in the library environment.

Governance, Organization, and Management of the Computer Facility

1. Uncertainty over who was in charge of the computer facility. This problem was partly attributable to the fact that the goals and objectives of the facility were imprecisely stated or not stated at all. Often there was no charter, no systematic procedures for establishing priorities, and excessive autonomy by the computer facility. These factors often permitted the facility to operate as a self-directing, self-sustaining entity, responsible to no informed, upper-level manager.

2. Effect of high-level administrative changes. In a few instances, the library automation effort was instigated by the president of the institution. He could, in effect, personally direct the allocation of resources. However, whenever a high administrative official leaves, the resulting vacuum is quickly filled by other interests, the atmosphere changes, and his personal program goals dissolve.

3. Management inadequacies. The effects of domination by a technician or special interest group are described below in more detail. Although more and more organizations are putting together influential user groups to point the way toward better management,

The paper is based on a CLR Fellowship Report to the Council on Library Resources, Inc., for the period January–June 1972.

decision-making responsibility and authority continued to be misplaced in a few institutions that vested authority for technical decisions in a committee of deans who were somewhat remote from current trends in computing because of their administrative responsibilities. (In one institution, it was half-jokingly stated that a dean in any hard science could be characterized as suffering from a minimum technological time-lag of two years.)

4. Lack of long-range planning inclusive of attention to community priorities. Few facilities visited had any written long-range plans, either for the acquisition of hardware, the conversion of older programs, or the involvement of users in systems design. Ad hoc arrangements were prevalent.

5. System instability. This was more the rule than the exception, especially in software, operating systems, hardware configuration, and pricing. Wherever an academic computing facility was used for library development, the same broken record always seemed to be playing: the facility was always being taken apart and put together again. Of course library development was not the only user affected; complaints arose from all users.

6. Biased pricing algorithms. In the academic facility, student and research use were competitive. Hence systems were typically geared to distribute computing resources around the clock in some equitable and rational way. For instance, short student jobs were sometimes given a high priority for rapid turnaround, while long, grinding calculation work was pushed off to the evening or night shift by means of variable pricing schedules or algorithms. A pricing algorithm is basically a load leveling device to smooth out the peaks of overdemand and the valleys of underutilization which would have occurred in the absence of such controls. Devising pricing algorithms is by no means a simple task, since many factors must be taken into account: the kinds of machine resources available, their respective costs, the data rates at which they can function, market demand, hardware and software available, and system overhead, to name but a few.

Library jobs tended to suffer in both batch and online processing. In the former case, because batch jobs on large databases took so much time, library work generally could not be done during the prime shift; in the latter case, an online library system made substantial demands upon a facility's storage equipment and telecommunications support, and competed with all other online users.

7. Sense of competition with the library for hard dollars. This problem, which is related to pricing bias, is detailed later.

8. Scheduling problems. Many of the institutions visited had systems or charts for scheduling production, development, and maintenance. But conversations with system users often verified that schedules were either not met or had been unrealistically established. This was especially the case with development work.

Personnel in the Computer Facility

1. Selection and evaluation. Inasmuch as the library often did not have the competence to judge personnel or the ability to generate meaningful specifications, there was generally very little protection from incompetence in this area.

2. Elitism: The notion that the masters of the computer are inherently superior to and have better judgment than computer customers. Elitism is a paradox: it can be positive or negative— positive when the best brains produce software designs of true genius with respect to function, performance, economy, and reliability but in its negative manifestation, reminiscent of the girl with the curl in the middle of her forehead: "When she was good, she was very, very good; when she was bad, she was horrid."

During the boom years when computer facilities were expanding faster than the supply of competent staff, elitism seemed fairly common in the computer center. The excitement of rapid development, the seemingly unlimited intellectual challenge presented by the powerful apparatus, and high-strung dispositions sometimes caused tempers to flare or immaturity to sustain itself beyond a reasonable time. Strange hours, strange habits, bizarre behavior, all seemed to conspire against ordered and rational development. Fortunately, as the field matures, the negative aspects of elitism are dying; managers now can concentrate on staff development work to turn top intellectual talents toward productive achievement.

3. Disinterest. This factor may be allied to elitism. In some instances, the computer center's staff gave considerable attention to the library during the period immediately fol-

lowing machine installation, when utilization was low. Later, the staff's keen interest became "dulled" at the thought of operating a production system. "More interesting jobs" were challenging the programmers and beginning to fill up the machine.

4. Fear of the unknown big user. It was recognized early that the library could be among the computer facility's largest potential customers, perhaps the largest. In some facilities, this recognition may have induced a fear of being taken over or overwhelmed by the user, who would then be in a position to dominate and dictate the direction of further development and operations.

5. Fears of an unknown production environment. Simply expressed, a production environment removes much of the stimulus for creative approaches to problem solving unless continuous development is maintained for new systems and new applications. Many of the best programmers did not wish to lose their freedom to innovate and actively resisted participation in establishment of a production environment, with its concomitant requirement of "dull" maintenance support work.

Deficiencies within the Library Environment

1. Failure to understand in full detail the current manual system. Even where the manual system was understood, there was often an inability to describe it in the clear, unambiguous style essential to system design work. These deficiencies were further compounded by the unwillingness of some librarians to learn how to communicate adequately with computer personnel.

2. Inability to communicate design specification. Many did not understand how to put together a specification document; particularly, they did not know how to account exhaustively for all possible cases or alternatives. Librarians were unaccustomed to defining their data processing requirements quantitatively or with precision—both absolutely indispensable to the computer environment. Also, as much as the computer facility changed its software environment, many library development efforts were constantly changing their system requirements—a condition which made it all but impossible to program efficiently.

3. Failure to understand the development process. Development is a new phenomenon in libraries. Most librarians were not educated to comprehend development as an iterative process, characterized by experimentation, error, feedback, and corrective measures. Accustomed to the relative stability of long-established procedures—some of which had stood for generations, even centuries—some librarians were baffled by the rapidly changing new technology, others showed impatience and a low tolerance for frustration. Many expected development projects to resemble turnkey operations, and the failure of the process to accommodate these expectations produced disappointment and an inability to cope with the computer environment.

4. Failure to recognize the computer as a finite resource. Both librarians and early facility managers seemed to look upon the computer as an inexhaustible resource, the former through lack of sophistication and the latter apparently through myopia or possibly ambition. Some managers must have told their users that there was "no way" their equipment could be saturated in the foreseeable future. Apparently some library users were naive enough to believe that.

5. Excessive or unrealistic performance expectations. Few library users understood the relationship between the system specifications and functional results, and fewer still understood the significance of performance specifications. The situation was not assisted by notions of "instantaneous" retrieval pushed by salesmen or the popular press. (The writer recalls vividly how one salesman told him the library could have a CRT device for $1 a day! And indeed, the device itself *was* $1 per day if one cared to do without the keyboard, without cables, installation, control units, teleprocessing overhead, a computer, software, etc.)

6. Lack of an established tradition of research and development (R&D) and the lack of venture capital in the library community. The challenge of the computer may have been largely responsible for activating research and development as a serious and continuous effort in librarianship. Inexperience in raising and managing funds for R&D, as well as a general lack of knowledge of computer cost factors inhibited progress or tended to make the development effort inefficient and full of surprises.

7. Human problems. Some libraries having prior experience with small batch systems underestimated the scale of effort for

contributing to the design of the large system, selling it to the users, installing it, and training the users.

8. Insufficient support from top management. In some instances, library management did not accord the automation effort the kind and degree of support essential to success. In particular, some librarians seemed to feel that automation was a temporary affair, definitely of less importance and significance than current manual operations. Some did not recognize the sacrifices in regular production that would be necessary and some did not appreciate the *continuing* nature of development work.

BACKGROUND

Two important prerequisites to progress in library automation were money and technical readiness. The government supplied the first, industry the second. The announcement by IBM in 1964 of its System 360 occurred at a fortunate time for the American library community. President Johnson's administration had launched enormous programs in support of education. The Library Services and Construction Act was soon to channel millions of dollars into library plant expansion and, perhaps more significantly, the Higher Education Act of 1965 was to sponsor research, which until then had only the support of limited funds from the Council on Library Resources, Inc., and the National Science Foundation (NSF). (Support from the National Science Foundation was largely, although not exclusively, directed toward discipline-oriented information services; one of the largest NSF grants went to the University of Chicago Library.)

It was the right time to invest in library automation. Important milestones were already behind the library community: the National Library of Medicine's MEDLARS program was well underway, the Airlie Conference on library automation had been held and its report published ("the White Book"), and the Library of Congress automation feasibility study ("the Red Book") had appeared.[1,2] The first MARC format was being tested in the field.

In computer technology, third generation equipment represented major increases in computing power, processing speed, reliability, and capacity to store data in machine-readable form. IBM's sales force was successful beyond imagination in getting System 360s installed in large universities, as well as in business and government. IBM promised a new kind of software—time-sharing—which would virtually eliminate the tremendous mismatch of data-processing speed between the human being and the machine. The new methods of spreading computer power through teleprocessing and time-sharing promised to make the computer at least competitive with and possibly an improvement over "antiquated" manual systems of providing rapid access to large and complex data files.

Within this relatively unknown environment, universities and libraries entered the software development process, which, if successful, could enable them to catch up where they had been hopelessly falling behind. Circulation, book purchasing, and technical processing loads in many libraries seemed to double and triple overnight as the country's schools and their programs grew to accommodate expanding enrollments. Manual systems that had been reasonably workable and responsive in environments characterized by slow growth demonstrated significant and disturbing defects—the inability to deal with peak loads, or rapidly changing loads. The same effects were felt in administrative and academic computing: a bigger and more complex payroll, more students to register, construction contracts to monitor, more research grants which demanded bigger computers, and so on. These were truly boom years.

But in the academic community there was still another force developing which was ultimately to be of even greater significance for libraries than the inconveniences of being unable to handle the housekeeping load: a dramatic rise in the expectations of patrons, especially in the academic community, where computers already abounded. Libraries had come to be felt by some as strongholds of conservatism and expensive luxuries; librarians were faulted for not "putting the card catalog onto magnetic tape," for not implementing automated circulation systems, or otherwise failing to take advantage of new and powerful data-processing techniques. The libraries were caught amidst a variety of sometimes conflicting, sometimes complementary factors: the visionary ignorance of the computer salesman, the senior academic officer possessed by the computer *dybbuk*, a lack of sympathy or understanding among some computer center managers, a lack of appreciation by students and faculty of the complexity of identifying, procuring, and cataloging unique copies of what must be the least standardized product known to man, and their own lukewarm commitment to undertake the hard work required to learn how to use the computer resource. Anxieties about job displacement caused some library staff to look upon computers with trepidation, thus further placing the librarian in a defensive position. While these forces were taking shape, the library's bibliographic activities continued to be seriously hampered by inadequate international bibliographic control.** Some essential computer hardware, especially the programmable CRT terminal with an adequate character set, was either nonexistent or totally unsuitable to library applications. In this institutional context librarians entered the world of computers and data processing.†

PURPOSE

It is the purpose of this report to examine in some detail how internal institutional factors affected the *development* of computerized bibliographic systems, and especially to consider nontechnical, negative factors: What slowed down or inhibited the applications of computers in librarianship? This report is *not* concerned with the merits or demerits of specific systems or their features; indeed, the investigator did not inquire about system specifications. Major questions centered around the factors that fostered or hindered the *development process,* regardless of the merit of a project or system.

SCOPE

Investigation was limited almost solely to those institutions considered likely to have large-scale, in-house development projects using third generation computer equipment. The majority of places visited were large academic libraries. The time span included in the survey begins approximately in 1967 and ends in 1971. A total of twenty-four institutions was visited and some one hundred persons interviewed; a list of the institutions visited is in appendix A.

METHODOLOGY

Site Visits and Interviews

Arrangements were made to visit four types of individuals: the director of libraries, the head of the library's system development department, the director of the computation center, and whatever principal institutional officer was managerially and/or financially responsible for campus computing. Considerable variation was found in the type of person assigned this last responsibility—it could be the provost, the vice-president for academic affairs, or the vice-president for business/financial affairs. Choice of the major institutional official to be interviewed was often determined by the pattern of computing in a particular institution, or the facility that supported the development effort.

At first the investigator attempted to utilize a structured questionnaire for interviewing. This very quickly broke down, as the interviewees were generally voluble and ranged widely over many related topics or items which they would have been asked about later. Accordingly, after the first few interviews, the formal questionnaire approach was dropped and a simple checklist of major questions kept on a few cards to make sure that each major issue had been addressed. Every interviewee received the investigator graciously and none was unwilling to talk; indeed, if anything the opposite was the case—most persons seemed to be eagerly waiting for an opportunity to air their views.

Visits and interviews occurred during the period January–April 1972.

Literature Searches

Searching the literature on this topic has been extremely frustrating. In the literature of computer science and management, there are many articles on pricing algorithms, machine resource allocation schemes, and issues of managing the computer facility, but none specific to the topic of this report. Besides scanning professional literature, the author has regularly conducted for the past year monthly computer searches via the UCLA Center for

**Implementation of the Library of Congress' Shared Cataloging Program under Title II of the Higher Education Act of 1965 was soon to alter this situation dramatically.

†The painful trauma libraries and librarians experienced in getting into computers is too well documented to summarize here. Perhaps the best summary has been done by Stuart-Stubbs.[3]

Information Service's SDI Service. Abstracts and citations were searched in *Research in Education* (*RIE*) and *Current Index to Journals in Education* (*CIJE*). With respect to problems faced by the library in acquiring computer services, the results have been nil in both cases. The author reluctantly concludes that no major recent studies have yet been published in this sensitive area, although two papers by Canadian librarians are very helpful.[4,5] The National Academy of Sciences/Computer Science and Engineering Board's Information Systems Panel appears to have come closest to identifying the issues in its report, *Library and Information Technology: A National Systems Challenge.* Still, the comments in that report are highly generalized and do not grapple with specifics.[6]

STRUCTURE OF EDUCATIONAL COMPUTING

Most of the visited institutions maintained separate facilities for administrative and academic computing, while a few ran combined facilities or were in the throes of consolidating their facilities. The differences between administrative and academic computing have historical roots deeply embedded in institutional soil. Administrative computing is usually an outgrowth of punched card installations first set up for payroll and financial reporting. Academic computing, on the other hand, has its origins within the institution's instructional and research programs. Typically it has been supported by external grants and contracts and has been oriented toward the "hard" sciences. Until the recent dropoff in federal support of higher education, academic computing was a money-maker (through the overhead on grants and contracts) while administrative computing was a money spender.

ADMINISTRATIVE COMPUTING

Typically very little computational work is done in administrative applications; most of the computer work is associated with input, update, reading records, writing records, and printing reports. Except for the payroll application, the consumer group has tended to be somewhat smaller and less transient than the academic group. But to university administrators the computer could do much more than write checks and pay bills. Many significant administrative applications had already been installed on second-generation equipment: faculty-staff directories, inventories of space, supplies, and equipment, records of grades, course consumption reports, etc. All these tended to expand the user group, increasing competition for the resource. The advent of third-generation equipment made it attractive for administrators to think about applications centered around the so-called "integrated database." This led to a demand for further new services for the registrar, fund-raising and gift solicitation, student services, purchasing, etc.

Conventional administrative computing—particularly that part of it which generated regular reports—lent itself naturally to batch processing and indeed many of the early computer installations actually continued established punched card operations, merely using the computer as a faster calculator and printer. The administrative computing shop is typically characterized by (or hopes to be characterized by) great systems stability and dependability, a cautious and measured rate of innovation, and in the opinion of some academic computing types, not much imagination. File integrity, backup and recovery, and timely delivery of its products are prime goals in an administrative computing system. The administrative computing facility very much resembles the library in two important aspects: (1) it is a production system; and (2) it is almost entirely an overhead function, i.e., there is little or no attempt at cost recovery from system users for its services.

ACADEMIC COMPUTING

Academic computing is a much different world. It serves a large, vociferous, influential, and mostly technological user community, many of whom are not only competent in programming, but more importantly, possess ready cash. But this is changing: as academic computing expands to service users in the humanities and social sciences rather than mainly those in the "hard" sciences, the user group is growing and it will probably not be long before it embraces the total academic community.

In hard science applications, the academic facility typically performs an enormous amount of computing ("number crunching") with a relatively small amount of output. System backup and recovery is important to the academic computing facility, but file integrity responsibility may often be assigned to the user since such a center sometimes does not maintain the database but merely provides a service for manipulating it. The main components of academic use are department- or discipline-oriented research and student instruction, the latter being particularly strong if there is a well-established computer science department.

Software development has customarily played a major role in academic computing and the usual practice was to actively seek out imaginative systems programmers for whom change and system improvement are food and drink. Consequently, *instability*, both in hardware and software, has been more the rule than the exception in the recent past, although as the management of computer facilities matures, this too is changing.

CURRENT TRENDS AND STATUS

It is obvious from the above that admimstrative and academic computing have been characterized by diametrically opposed machine and managerial requirements. Where they have been combined in the same facility, tensions have prevailed and neither user was happy. In a few instances known to the writer, such combinations have been abortive and a reversion made to divided facilities. But as computing matures it is becoming evident that operational stability is needed for *all* types of computing, not just administrative computing. Additionally, the financial crises now prevalent in institutions of higher education have brought more realistic attitudes to the fore in understanding just what kinds of facilities can be afforded, and how they should be *managed*. Additionally, the economies of scale, the increasing flexibility of hardware and growing sophistication of software are now combining to form an environment that can better satisfy all potential users of computers. There are clear indications that a unified, well-managed shop with competent staff might now economically and efficiently serve a variety of applications—including administrative and academic—on the same facility. However, this is a *developing trend* and does not correspond with what the writer actually observed during his visits. *In situ* he saw much evidence that Anthony Oettinger's observations of some years ago were still valid:

> . . . routine scheduled administrative work and unpredictable experimental work coexist only very uneasily at best, and quite often to the serious detriment of both. Where the demands of administrative data processing and education require the same facilities at precisely the same time, the argument is invariably won by whoever pays the bills. Finances permitting, the loser sets up an independent installation.[7]

Indeed, it would not be unreasonable to conclude from the interviews that in most places visited, computing during the period 1967–71 was in a state of disarray. There is abundant and disagreeable evidence of technical incompetence, lack of management ability, ill spent money, communication failures, and naive and disillusioned users.

But it would be a mistake to conclude that the failures in library automation are attributable primarily to computer-oriented personnel or hardware problems—librarians in their own way displayed many of these same failures.

It would be another mistake to dwell excessively on the high failure rates observed. In any complex technological endeavor, the rate of failure is dramatically high at the beginning; there is ample evidence here from the aircraft and space industries. Indeed, the likelihood of a first success in anything complex—library automation is complex, as we have learned the hard way—is practically nil.

ORGANIZATION AND MANAGEMENT PROBLEMS: THE ACADEMIC COMPUTING ENVIRONMENT

Early academic computing facilities were typically run by faculty members in engineering, applied mathematics, computer science, or related fields. This arrangement was satisfactory when computers were small, relatively primitive, and the user community was confined to those few people who could program in machine language or assembly language. As equipment became bigger and more powerful, and as higher-level programming languages developed, more and more people learned programming. Correspondingly, the task of managing the computer facility grew rapidly in size and scope. The budget of a large computer center in a modern university can easily run to several millions of dollars annually. The manager must balance seemingly innumerable, complex forces: personnel, management, government and vendor relationships, demands from vocal users, establishing priorities, the challenge of hardware advances, marketing, pricing services, balancing the budget, etc. It soon became clear that few faculty members possessed either the multifaceted talents or the experience required for effective management.

As the center's budget grew, and particularly as the shift was made from second to third generation equipment, the faculty member tended to be replaced by the technician as manager. Unfortunately for many of the facility users, the technician tended to promote his own technical interests in software development or hardware utilization. In some instances, the user community felt that the facility was being run more for the benefit of the staff than for the users. The technician-manager often looked at the computer as his personal machine, much as some faculty members had earlier felt the computer to be their own private preserve. The vice-president of one university expressed the view that the technician-manager doesn't really have an institutional loyalty tied to the goals and objectives of the academic programs; he is more loyal to the machine or the software. In a school with a long history of computer utilization, there had been no technician in charge of the computer facility for a decade. Yet in a school not too far away, an officer indicated that his institution had "made the same mistake twice in a row" by hiring a technician to manage the computer facility.

The technician-manager represents a highly personalized management style, one in which goodwill, friendship, or personal interest is the key to effective service. It can hardly represent an arrangement for the successful development and implementation of computerized bibliographic systems.

In the third and current organization and management phase of academic computer facilities, the professional manager is in charge. Schools are now beginning to see the need to develop formal charters for their computing centers, quasi-legal instruments which will lay out their specific responsibilities as *service agencies*. A professionally managed service agency eliminates one of the most irritating elements in the allocation of computer resources: personal judgment by the faculty or technician-manager as to the worth of a project, which was so prevalent during earlier management stages. At the time of the interviews, very few institutions actually had such charters, but their need was being recognized. It is now universally accepted that the computer center can no longer be the plaything of the faculty nor the expensive toy of the technician.

ORGANIZATION AND MANAGEMENT: THE ADMINISTRATIVE ENVIRONMENT

Because of its historical development, the administrative computing facility was usually first run by someone with an accounting or financial background. (Academic computing persons occasionally put disparaging labels on such people as "EDP-types" or characterized them as having a "punched card mentality.") The nature of the workload virtually meant that the administrative shop would be set up mainly for batch processing and any database services provided for other users would involve printed lists. Such facilities were found satisfactory by a number of libraries even for applications such as circulation, which produced gigantic lists—probably because it represented a vast improvement over an antiquated, poorly designed, or overloaded manual system.

However, there was at least one major technical consideration which had direct political and financial implications for the library that turned to the administrative computing facility for its computer support. This was the library's need to support and manipulate a database with nearly every data element of variable length—a requirement that was practically non-existent in administrative computing. Some facilities were unable or unwilling to meet this requirement.

The move from tape-oriented systems to mixed disc and tape systems on third-generation equipment necessitated an upgrading of programming staff, and brought into the administrative shop the same clearcut distinction between *system* programmers and *application* programmers that had emerged earlier in the academic shop. This change in turn demanded appointment of more knowledgeable facility managers, many of whom were drawn from business and industry rather than the ranks of in-house accounting staff.

This transitional period was characterized by two enormously challenging parallel efforts: the conversion of existing programs to run on third-generation equipment and the development of new applications. To an extent these responsibilities were competitive, and from this viewpoint it was certainly not a propitious time to embark upon anything as complex as bibliographic data processing. Yet numerous workable systems emerged for circulation, book catalogs, ordering and accounting systems, and serials lists.

These were not accomplished without anguish as the library did not control the machine resources and often did not control the human resources—the facility manager tended to make his priority decisions to please his boss who was certainly not the librarian. Besides, no application could really take precedence over payroll or accounting in the administrative shop. To the librarian it was more like borrowing another person's car than renting or owning a car: when the resource was urgently needed someone else had first call.

ORGANIZATION AND MANAGEMENT: THE LIBRARY AUTOMATION ENDEAVOR

A detailed study of this subject is not within the scope of this investigation. However, it will be useful to note that the organization and management of library automation activities demonstrate development phases that closely parallel those in the computing environment:

1. A stage in which the *user himself* (cf. accountant or faculty member) undertakes to perform the activity. In this stage individual librarians learned programmmg, did their own design work, wrote, debugged, and ran programs themselves. (This was possible in the "open shop" environment prevalent in many early computer facilities.)

2. A stage in which the *technician*—in this case a librarian with appropriate public service expertise (for circulation applications) or technical processing knowledge (for acquisitions, cataloging, or serials)—took charge of an organized development effort, hired his own programmers and systems analysts, and negotiated directly with the computer facility.[1]

3. A stage in which the *professional system development manager* is hired to oversee the total effort. Such a person is sometimes drawn from business or industry, is a seasoned project manager, and has broad knowledge of computers, especially in the area of costs. Such an appointment is more common in the large library, the consortium, or network.

HUMAN PROBLEMS ASSOCIATED WITH RAPID CHANGE IN INSTITUTIONS

Some institutions, particularly in their administrative functions, became embroiled in a seemingly endless round of internal psychosocial problems that did not make the environment conducive to problem solving. The move to computerizing manually oriented functions, whether in the library or other parts of an institution, was found to be extremely threatening to established departmental structures. It was consistently reported that the political and emotional aspects of system conversion, both in the library and elsewhere, were much more aggravating than the technical aspects. The problem simply showed up first outside the library because applications of computers occurred there earlier. Departments were sometimes unwilling to give up data for computer manipulation for fear that computerization would take jobs away. This phenomenon is not unknown in librarianship where some professionals take an extremely proprietary attitude toward bibliographic data. Now pressures from governments, legislatures, and the academic community at large are gradually establishing the concept that some categories of data are corporate, and do not belong to a specific individual or department, or even to an institution, but should be shared through networking or other mechanisms. But the rapidity of microsocial change and its upsetting emotional consequences caught some library leaders unawares. A considerable reeducational process for both management and labor is required to smooth the transition to the new view.

MOTIVATION PROBLEMS

It is difficult to elicit sound comment concerning motivation (or lack thereof) as a deterrent to progress in library automation. It is an emotional subject and neither the librarians nor the programmers come out "clean."

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[1]The technical person need not be a librarian. Northwestern University represents a significant instance where a faculty member in Computer Sciences and Electrical Engineering undertook the development effort.

The prima donna computer programmer, much in evidence in the early days of computer center development, is very much on the wane these days. Like the spoiled child, the prima donna programmer could only exist where personal interests were permitted to take precedence over social goals—or perhaps where institutional goals for the computer facility had not been clearly articulated or had not yet come into focus. Some prima donnas, partly out of ignorance, partly through a stereotyped image of library activities, were inclined to disdainfully dismiss library applications as "trivial," and demand "really challenging" assignments.

But the librarians had their prima donnas, too. Some had learned enough programming to be a little dangerous and they then felt like peers who could tell the computer center not only what to do but how to do it. At first, few members of the library staff were willing to learn how to articulate their specifications and requirements to the management of a computer facility. Most librarians expected some kind of miraculous magic, akin to a wave of the hand, to bring a computer system to reality. Very few understood the heuristic nature of development.

So there were barriers of status, depth of knowledge, and language—any one of which would have sufficed to kill the development of the good motivation essential to breaking new ground. In the wrong combination they could present an overwhelming conspiracy, for their mutual interaction could only produce polarization and intransigence.

THE LIBRARY AND THE COMPUTER FACILITY

The Role of Similarities and Differences

For a long time the library has been the "heart of the university." Until the advent of the computer, little could challenge the supremacy of the library as the principal resource of an educational institution. Even the faculty could be put into second place, since it was difficult to attract high quality faculty without good library resources, and the faculty were to a greater degree transient, for the library was considered "permanent," an investment for all time. The computer represents a new and challenging force in the arena where shrinking resources are allocated among competing academic users. Both the library and the computer facility have experienced exceedingly rapid growth in the recent past, concurrent with an expanded demand for services that can easily outstrip available resources. Among some of the larger academic libraries, the staff of the computer center may be half or greater than half that of the library.

Important differences between the two services have recently come into focus. First, most of the services and benefits of the library are intangible. Because of this it has always been difficult to measure the cost benefit of the library as an institution, and it is well known that counts of the number of people entering the door or the number of circulations are far from true measures of the library's functional success. The computer, on the other hand, is a relentless accounting engine; computer facilities can produce endless statistics on the number of jobs run, lines printed, terminal hours provided to users, turnaround time, cards punched, etc. The computer's output is extremely tangible and can be more directly and easily related to academic achievement than can library use.

A second major difference lies in apparently different financial roles within the institution. In most organizations, the library is run as an overhead expense, without any attempt to charge back to users or departments proportional costs of utilization. Like air, the library resource is there for anyone to use as much or as little as he pleases; the library gets a "free ride," but the computer center is expected to pay its own way. This dichotomy is often explicitly designated as the "library-bookstore" duo model. Furthermore, since the library does not generate much in the way of research grants and contracts, it is looked upon as a consumer rather than a producer of financial resources. In fact, those who support computing in preference to books point to the fact that overhead income generated by computer-related research grants and contracts is shared with the library which may have done little to contribute toward the acquisition of such income! In some institutions the situation has become critical indeed because of the recent substantial reductions in federal support. Much political infighting has been necessary to maintain current levels of computer activity, and not all such efforts have been successful. Some institutions have been forced to cut back on computing power, merge facilities, or combine resources with other institutions.

Several years ago when the National Science Foundation imposed an expenditure ceiling on grants, associated overhead income was correspondingly reduced. One computer center director was reported to have suggested that the effect of this overhead cut could be nullified by a simple, internal reallocation of funds, say by taking the needed amount from the budget of another agency on campus of less significance to researchers and scientists, such as the library. This attitude is clear evidence that the library has lost its sacred cow status as a "good thing" on the campus. It too must justify itself.

Close examination of the library and the computer facility gives clear evidence that both deal with the same commodity: information. Within the recent past several computer facilities have changed their designations to "information processing" facilities or centers. Several institutions, notably the University of Pittsburgh and Columbia University, have coalesced the library and the computer center organizationally or have both units reporting to a vice-president for information services. The recognition and furtherance of this natural linkage may do much to reduce the potentially destructive competition that can characterize the relationship between the two units.

There are remarkable growth parallels between the two facilities—the library acquiring and processing more and more books in response to expanded publication patterns, more users, and the growth of new disciplines and interdisciplinary research, while the computation facility moves rapidly from one generation of software and hardware to the next. The expansion of both organizations produces seemingly equal capital-intensive and labor-intensive pressures: library processing staff doubles and triples, while the newly acquired books demand more in the way of housing, whether of the traditional library type or warehouse space; the computer center moves toward more sophisticated hardware, especially terminals and communications, which need to be supported by greater numbers of still more highly qualified systems programmers, communication experts, and user services staff. Both services have a marketing problem, but the computation facility, being relatively more dynamic and more interactive (because of terminal services), can be *more sensitive and responsive*, financially and technically, to its clientele than can the library. Only now with the emphasis upon computerized bibliographic networking has the library as an institution begun to approach the marketing strategies and the effective user feedback already well developed in computation facilities.

Service Capacity, Resource Utilization, and Sharing

Differences both in service capacity and resource utilization represent a key political issue affecting the future of both libraries and computer facilities. In major universities, the budget for the computer facility is now not far from the library budget in size, and in a few institutions it exceeds the library budget. With the diminution of external grants and contracts, the two organizations compete for the same hard dollars. This economic competition can either drive the two facilities apart, dividing the campus, or cause them to coalesce—as has been the case at Columbia and Pittsburgh.

Despite its high operating costs, from the viewpoint of resource utilization, the well-managed computer facility can almost always point to an excellent record.[§] No matter how well managed, the research library can never make this claim in the context of its current materials and processing expenditures, much of which by definition are aimed at filling future needs. The library and its patrons cannot "use" all the resources at their command; the library could not even *service* all the patrons should they demand the use of "all" the resources. In contrast, the computer facility (particularly large online systems with interactive capabilities) can be very efficiently utilized even when demand is heavy. Thus, to the "objective" eye, it would appear that in the computer facility both the institution and the individual patron get more value for their dollar than they do in the library, which in comparison resembles a bottomless financial pit. One may counter that apples and oranges are being compared, but the institution that pays their bills nevertheless *makes* the comparison.

[§]In fact, if a computer resource is not much used and isn't "carrying its weight," it can be disposed of, by sale if purchased, or by cancellation if leased.

Flexibility, Inflexibility, and the Future

Besides better resource utilization, the computer facility offers the patron far greater flexibility of resource *use* than can the library. There is no way a large collection of books on the Celtic language or the military history of the Austro-Hungarian Empire can help a professor of structural engineering, a student of marine biology, or a researcher in modern urban problems. Even the books these people actually need and use cannot easily assist others, as relevant data in them is not indexed or readily available for computer manipulation.

The point is that, unlike the library, the computer is a highly elastic universal tool, one that each user can temporarily shape to his own need, replicate the shape later, or if he wishes change the shape at will. The traditional library has no such flexibility; its main bibliographic retrieval device—the card catalog—is especially noted for its high maintenance cost, its limited ability to respond to complex queries, and a general fixity of organization and structure that is ever at variance with changing patron expectations and interests. (If computers can be flexible, why can't the library?)

There is much in the library that is not used because it is inaccessible—locked up in an inflexible retrieval tool or unavailable because the state-of-the-art (both in bibliography and computer science) or staffing does not yet permit far deeper access via "librarian-negotiators" and patrons at terminals interacting with large and deeply indexed databases. As long as major portions of the library budget and staff are devoted to housekeeping and internal technical processing, the library will look less good, less "cost-beneficial" to the academic community than does the computer facility. But there is growing recognition that both institutions deal with information processing which covers a wide spectrum of time. True, the storage formats differ, but this may be a temporary phenomenon. As progress is made on improved, less expensive conversion of data from analog to digital form and vice versa, the day may arrive when the library and the computer facility are indistinguishable.

Will the Library Become an Information Utility?

Computer utilities are an important developing trend and it is sometimes suggested that library services could be delivered within the utility model. Utilities and libraries as they exist today have very different characteristics.

A utility can be defined as a system providing a relatively undifferentiated but tangible service to a mass consumer group and with use charges in accordance with a pricing structure designed for load leveling (i.e., optimization of resource utilization). Typically, a utility both wholesales and retails its services. Within this definition, a conventional library cannot be construed as a utility; its services are generally intangible and very highly differentiated—indeed, chiefly unique, for rarely is one book "just as good as another"; its clientele is not the general public but a highly select group which itself contains highly unequal concentrations of users; and almost no libraries impose user charges in the interest of cost recovery; practically speaking, there is only one United States wholesaler (of bibliographic data)—the Library of Congress.

This situation is changing in several respects. First, the establishment of practical, computerized bibliographic networks has introduced among participating institutions cost sharing schemes closely resembling the load leveling or rate averaging algorithms prevalent among utilities.‖ These new ideas have been readily accepted by libraries and could even become the basis for balancing more equitably the costs of interlibrary loan traffic.

Second, specialized "information centers" have evolved in certain fields, partially as a consequence of lack of responsiveness (or slow turnaround) by conventional library services, and "for profit" commercial services have been set up. Examples of the latter include the European S'il Vous Plait and its American counterpart, F.I.N.D. (Often such commercial services do not hire librarians as they are considered too tradition bound.)

A third force which is rather inchoate at the moment may soon take on a recognizable shape: facilities management. Under such a scheme, the complete management responsi-

‖ An example of rate averaging is the practice of the Ohio College Library Center to lump total telecommunication cost and prorate it into the membership fee, in effect creating a distance independent tarriff. (This arrangement does not hold outside of Ohio.)

bility for all or part of a function is contracted to an outside vendor. For instance, it is conceivable that some libraries in the near future may have no in-house staff for technical processing. Services would be purchased totally from a vendor or obtained from *his* resident staff, much as computer centers buy specialized expertise through the "resident s.e." (systems engineer). The gradual buildup of computerized bibliographic services offers an excellent opportunity for commercial ventures into turnkey bibliographic operations for libraries. This would bring the libraries one step closer to the utility concept, as they buy a complete package from a wholesaler who probably services many customers.

The traditional library service concepts we know today may undergo drastic changes in financing and in methods of delivery. Beyond the commercialized or contractual arrangement for technical processing, which is only one component of the total information flow, lie unknown territory and little explored concepts: use charges for library services (the bookstore model), the "for profit" library, the complete information delivery system integrated with computers, communication satellites, and cable TV.

If the computer-based library is to become an information utility, a major accommodation will be needed in the financing arrangements, perhaps in the form of user charges—for no utility can survive without regulated demand. An unlimited, uncontrolled demand for any product or service is untenable, for without regulation (i.e., pricing), demand rapidly outruns supply. In the traditional library, where theoretically every user has the "right" to unlimited demand, this never happens for several reasons: (1) not all potential patrons elect to use the resource; (2) the users must usually go to the library to access the bibliographic apparatus and obtain the materials held by the library; (3) every item in a library collection does not have an equal probability of use; and (4) there is a finite rate at which human beings can "use the resource," i.e., people can read just so fast. None of these self-limiting factors applies to say, electric power, radio and TV broadcasting, telecommunication services, or similar utilities.

The library picture could become quite different if these limitations were removed or mitigated. Suppose the patron could access the bibliographic apparatus through his home computer terminal attached to his TV in the "wired city." Further suppose that he could receive selected, short items (where time of delivery is important to him) directly at his TV set, or longer items having less time value as microforms or hard copy delivered by mail or private delivery systems. Given such possibilities, the collecting policies of individual "libraries" (if they continue to be called by that name) might well change drastically so that nationally, collections might become much more standardized or "homogenized" increasing the likelihood that individual holdings *will* have more nearly equal use probabilities. This would imply the need for one or more national and/or regional centers for servicing the less used materials, along with appropriate delivery systems and pricing schedules.

CONCLUSION

Work on library automation has proceeded during a highly developmental period in the history of computing. In this sense, librarianship has suffered no worse than any other computer application, nearly all of which have gone through traumas of design, installation, redesign, reprogramming, etc. The main distinction is that in many of these other applications—government, military, industrial, or commercial—there have been far greater resources available to the task and vastly greater experience with the development process. Despite the obstacles, progress in computerized bibliographic work has been far more significant and has achieved far more than many librarians—especially those unaccustomed to the development cycle—can appreciate. The snowballing growth of practical consortia and networks along with the successful installation and operation of several online bibliographic systems has already changed the face of librarianship in a very short time. Like the breaking of the sonic barrier, once the initial difficulty is overcome, further progress is easier.

The computer has successfully achieved what librarians have until recently only paid lip service to: cooperation and wide sharing of an expensive and large resource. Though the linear growth model in libraries has been dead for some time, the recognition of this fact has not yet penetrated the entire profession. If libraries are to survive as viable institutions throughout this century and into the next, their leaders must solve the financial, space, and human communication problems inherent in growth. Local autonomy, local self-sufficiency, and the "freedom" to avoid, evade, and even undermine national standards now show up as expensive and dangerous luxuries—potentially self-destructive. Only through the computer will true library cooperation be possible. Only the development of regional and national bibliographic networks, with the assistance of substantial federal funding, can really "save" the library. The computer is actually the library's life insurance and blood plasma. A failure to respond to the challenge of the computer could be fatal, for it is increasingly apparent that patrons growing up in the computer era will not patiently interact with library systems geared to nineteenth-century methods. Nothing in the educational system exists to force people to use a given resource; people use the resources that are effective, responsive, and economical. If the computer is a better performer than the library, patrons will go to the computer. This will particularly be the case as computer services become broader in coverage, simpler to use, and unit prices continue to decline. Despite the serious and irritating problems associated with learning to use the computer, librarians must continue aggressively to support computer applications; indeed, library leaders can impart no more important message than this to *their* community leaders.

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APPENDIX A

List of Institutions Visited

University of Alberta
University of British Columbia
University of Chicago
Cleveland Public Library
The College Bibliocentre, Ontario
University of Colorado
Columbia University
Cornell University
Harvard University
University of Illinois
Indiana University
Massachusetts Institute of Technology
University of Michigan
New York Public Library
Northwestern University
Ohio College Library Center
University of Pennsylvania
Pennsylvania State University
University of Pittsburgh
Purdue University
Simon Fraser University
Syracuse University
University of Toronto
Yale University

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Proceedings of the 1977 ISAD Institute on a National Bibliographic Network

Introduction

S. Michael Malinconico

These papers represent the proceedings of the February 1977 ISAD institute on the topic of a national bibliographic network.

In the late 1960s the application of data processing technology to library functions was for the most part an amateur, hesitant effort. It was viewed as an interesting experiment that at some time in the undefined future might perhaps bear fruit. As late as 1971 the major issue was Ellsworth Mason's skepticism that automation could prove viable in a library context. Ironically enough, at the same time, two developments were coming to fruition that would ensure the success of the rites of passage from promising puberty to virile adulthood for library automation. These were, of course, the successful initiation of the MARC distribution service from the Library of Congress and the inauguration of shared cataloging services by the Ohio College Library Center (OCLC).

It need only be recalled how hesitant and full of doubt were the steps being taken in the late 1960s in applying computer technology to appreciate the boldness of the steps taken by Fred Kilgour and the OCLC. They developed not just another automated system but one based on the most sophisticated form of that technology—an online, interactive, teleprocessing system initially serving some fifty Ohio libraries. In the intervening five years, OCLC has expanded from fifty libraries to some 1,200 and now supports approximately 1,600 terminals. The unquestioned success of OCLC has dramatically served to extinguish any doubt regarding the economic viability of automated library systems. If it has crystallized any doubts, these are with respect to the viability of systems conceived on any substantially smaller scale. The nontechnically related doubts still linger. Several observers have expressed concern over the direction developments such as OCLC are taking as related to bibliographic control in the United States.

But this is not meant to be a panegyric for, nor a damnation of, the accomplishments of the OCLC. It is only meant to illustrate the rate of development that we have witnessed in this most recent decade and to note that further developments can be expected to be more rapid and that perhaps their consequences will be less discernible, or benign. As further perspective: these papers represent the third ISAD institute on networks and networking. As an indication of how far we have come we might recall that the first such institute, held in 1974, concerned itself with: the benefits to be derived from joining into a consortium established to promote cooperative activity; the responsibilities imposed on individual consortium participants (in short, the sociology of consortia); and the methodology for selecting an appropriate cooperative consortium to join. The emphasis at the time, as reflected in the subtitle of the institute, was "Alternatives in Bibliographic Networking." The second institute, held one year later, in 1975, concerned itself with "Networks—the Present and Potential." This institute sought to identify and describe the technological components and organizational structure of automated networks. By 1976 bibliographic networking was a reality, no longer a portent for the future.

By 1977 the efficacy of extended, computerized library networking has been firmly established. The questions before us now relate to the nature of a national network, which we are told is rapidly emerging, and the place of individual libraries within it. In a sense we are no longer exploring the potential of a "global bibliographic village" created by a telecommunication network, the benefits to be derived therefrom, and the responsibilities exacted upon the villagers. The questions are no longer those of the benefits and obligations of citizenship. Rather, the questions now relate to the rights of citizenship, or, in other words, what should national bibliographic network policy be?

In the last several years ISAD has sought to present institutes that would address two major professional needs: first, to serve as a means of providing continuing education regarding the rapidly evolving ambience being shaped by the application of technology to librarianship; and second, considered equally important by the program planning committee, to fulfill a need for public *fora* in which the consequences of the application of technology can be openly discussed while decisions and policy are still malleable.

We shall attempt to explore national bibliographic network policy from several significant perspectives. It is hoped that the variety of viewpoints will provide a sufficiently stereoscopic view that at least a beginning will be made toward informed dialogue.

Network Brew: Hints from a Misty Crystal Ball

Joseph A. Rosenthal

A LOOK BACKWARD

This paper is basically an attempt to perform witchcraft. That is, we are trying to address the future, to prognosticate, and to advise on our directions and movements in this wonderland of information, bibliographic records, and libraries. I would like, however, to begin with a short look backward. About a dozen years ago a book was published which caused a considerable stir among the groups in which we move, even though it was authored by a person whose prior professional training and experience were largely outside the field. The book was *Libraries of the Future*, by J. C. R. Licklider.[1] I suspect that many of us who read it a decade ago reacted with that now somewhat quaint expression "far out," and perhaps speculated that the author was not unfamiliar with a few of the more potent mind-expanding drugs.

Today the book is no longer a shocker. A good deal of its terminology and many of its concepts have become comprehensible to a wide cross section of people working in information science and librarianship. A look backward at some of Licklider's concepts and divinations might serve as a rough measuring stick against which you may judge the omens and portents of the future as we see it today.

Licklider used the term "procognitive systems" in some senses at least as equivalent to what we call networks. He identified elements of information processing which would play important roles in shaping these procognitive systems of the future. These elements included such now-familiar building blocks as random access memory, parallel processing, cathode ray displays with light pens, and timesharing computer systems with remote user stations.

His discussion of specific problems and techniques, with respect to both hardware and software, seems in retrospect to be less significant than his conceptualization of the structure of procognitive systems and his presentation of the conditions and requirements for achieving them. Of particular note is the awareness throughout *Libraries of the Future* of the totality of factors involved in the development of these systems and of their interrelatedness. In his view, the nurturing of these complex structures depends on (a) the future course of technology—for which the outlook is good—and (b) our social values, philosophy, and programs, where the prospects are considerably more uncertain. He writes:

. . . information processing systems lack the sex symbolizing and attention-compelling attributes of rockets . . . . procognitive systems will have to prove their value in dollars before they will find widespread demand.[2]

In the same vein, Licklider goes on to say that the potentially contributory disciplines—the library sciences, the computer sciences, the systems sciences, and the behavioral and social sciences—are on the whole not effectively conjoined. A series of developments will be necessary, he postulates, for the realization of the envisaged systems. These include (1) the overcoming of disciplinary barriers, (2) the development of the concept of relevance networks, (3) the availability of fast processing and advanced memory systems, (4) advanced displays and controls for man-computer interaction, (5) the development of procedure-oriented, field-oriented, and user-oriented languages, (6) advancement in the understanding of machine processing of natural language, and (7) the implementation of multiple-access computer systems. At another point he casts a brief look at the human engineering factors in man-machine interaction, and concludes that these had received scant attention relative to their importance in procognitive system development. Ten years later it is not difficult to reach the same conclusion.

From this necessarily brief and wildly selective summary of a quite stimulating work, we can come to some meaningful observations about the course of bibliographic networking. Licklider's forecasts in general hold up well after a decade. Reasonably sophisticated access, at a price, to databases extensive in size and decidedly useful by any standard is commonplace. The utilization of intelligent terminals, complete with a battery of peripheral devices in the way of printers, cursors, and other bells and whistles, is by no means unusual. Financial and technological limitations on machine storage capacity have become less threatening, and remarkable advances have come to pass in facilitating the transmittal of information through telecommunication channels. (It should be noted, however, that one of the knottiest problem areas on the current networking scene is the fashioning of protocols for adequate and precise identification of the data to be transmitted over these same channels.)

Moving into areas of networking somewhat more beset with difficulty, we pass along to considerations of overall system design and social and behavioral aspects. A good deal of work remains to be done in systematizing links among various segments of information, such as optimum transferability of data from hard copy to microform to digital form. We have only begun to work toward convenient interface and linkage of information represented by full text, by abstracts, by index terms, by a bibliographic record (as on a catalog card), and by data descriptive of a library or archival collection. Some tricky problems lie ahead with regard to confidential information and the privacy of personal and institutional data in a cooperative milieu. In working with two emerging library consortia, I have had abundant opportunity to observe the varieties of attitudinal response to cooperative objectives and the strains of coping with additional workload demands as library staff members begin to be faced with network tasks.

Let us imagine a consortial scene. We find ourselves as flies on the wall of a station wagon or bus or train after a day's meeting of several representatives from each of a number of libraries participating in a fledgling network. Half a dozen staff members from Library A are wending their way home after a long, solid day's work. (Some of you who have gotten your feet wet in cooperative programs can probably recite the dialogue by heart, or add variations on the theme.)

"Do you think that group in Zilchville will ever get its act together?"

"Not a chance; they're so loaded with money they'll never really be interested in cooperation."

"Say, Ms. X [Director of Library B] really has a tough time managing *her* staff. Those kooks are a bunch of prima donnas."

"Yeah, what a contrast to Y [Director of Library C]. He's got his staff so terrified they only speak when he waves the baton."

"Right—just wait till *they* get unionized!"

"Did you notice how the Head of Special Collections at Library D went to sleep for most of the afternoon, once we'd agreed that rare books wouldn't have to be included in the database for two years?"

"Where do they get off, making us check NUC before we submit a TWX request?"

"They sure have a lot of nerve; I've seen the serial record file at C, and you wouldn't *believe* the garbage that's in there!"

I would concur, then, with Licklider in his prediction that the major obstacles to be overcome in the development of information systems lie in fusing the necessary contributions from a wide array of disciplines and in the psychological, social, political, and economic hurdles to be encountered in an era of rapid change. In the remainder of this paper we shall explore a few more of these hurdles.

NETWORK TOPOLOGY, OR RAMPANT SEMANTICS

"The national network." "The national library network." "The national bibliographic network." What neat phrases! They have been too often used as a palliative, as easy answers to tough questions. They should serve as the jumping-off point for consideration of bibliographic policy issues.

Some questions arise from the very nature of the terms. *The* national network: should we think and plan in terms of *one* national network? What we have now, and for better or worse, for the indefinite future, is a host of networks, consortia, and cooperative programs with varied objectives, different bases for membership, wide ranges in the pitch and intensity of cooperative activity, and a motley pattern of governance and funding. The quilt may not be entirely crazy, but it is far from resembling the symmetrical double wedding ring pattern my grandmother and her sewing circle used to construct.

The *national* network: do we stop at the U.S. borders? A fair amount of network planning has already embraced components within Canada, and, in fact, some of the more imaginative thought and decisive action in networking evolution has occurred north of the Great Lakes. What relationship should planning and cooperation on the North American continent have to worldwide bibliographic services? An up-to-date report from the LC perspective comes from Lucia Rather.[3] Within the United States, what influence should the semiartificial boundaries of state lines play in a "national" system? State governments acting as funding channels have already helped shape our bibliographic configuration, with salutary effect in some cases and questionable results in others. With due regard for the meteoric achievements of OCLC, the lack of effective governance participation by non-Ohio institutions now verges on the absurd. It remains to be seen whether a single state can develop and maintain a bibliographic network that serves both as a data utility and as the focal point for achieving the ultimate objectives of library and information services within the state. The Washington Library Network has embraced these two major roles; its progress should be most interesting.

The national *library* network: will the system be based (and should it be) on connections among libraries? OCLC, after its initial development in Ohio, has followed a policy of distributing data principally through arrangements negotiated with networks or groups of libraries rather than with individual institutions, and the Library of Congress about a year ago enunciated a similar guideline with respect to access to LC's online data services. In other words, will network centers and data utilities interact at a system level which will replace, for the most part, more direct patterns of interinstitutional contact?

As the last in this series of semantic queries, we might question the precise title "The National *Bibliographic* Network." Although the phrase is useful for analytic and conceptual purposes, it concentrates on means rather than ends and should be considered in an ever-present context of our intended objective, to bring information to people.

The conceptual balloon of a monolithic, all-encompassing, *total* national bibliographic network is not difficult to deflate. We may consider it briefly from two perspectives: (a) is it likely to happen? and (b) should it happen? The answer to each question, I believe, is no.

American society honors by symbol and shibboleth the ideals of political freedom, of economic laissez-faire, and of individual choice and diversity. Realities, to be sure, differ significantly from these ideals. As ideals which affect us, however, they are not likely to be abandoned with haste, and we may assume their potency for the immediate future.

One implication of their prevalence is the resultant diversity of institutions and other forces or vectors in most segments of society; the bibliothecal community is no exception. I do not need to expound the varied panorama of libraries, which are the dominant organizational form for providing information, on the

American scene, but we might mention some of the other forms and influences which abound: indexing and abstracting services, together with the vendors of data compiled by such services (Lockheed, SDC, and Bibliographic Research Service); publishers and publishers' associations, which are beginning to realize their stake in how bibliographic data are assembled, transmitted, and used, and which have a fair amount of that mystical ingredient called "clout"; equipment manufacturers and vendors, whose decisions on research, development, and marketing impose rather fundamental constraints on bibliographic network capabilities; commercial services of one kind or another which have developed to satisfy unfilled needs in the library and information field, such as private research agencies, book and serial jobbers, and consultant services.

To conjecture the actual and potential relationships of this myriad of organizations and services and to realize the vested and entrenched interests associated with them, are tantamount to the conclusion that a relatively rigid, encompassing, and stable bibliographic network on the North American continent is unlikely.

Although this concept of a national, or North American, bibliographic network is sometimes useful for political or fiscal purposes, we should recognize it as a semantic construct which tends to distort reality in at least two significant ways. In the first place, the term implies a solidity and a monolithic quality which will not be present in the foreseeable future and which is arguably not even a worthwhile objective. Secondly, the phrase may lead us to conclude that someone up there is fashioning a system which will soon overcome the many obstacles and problems we now face.

The developing cooperative library and information systems on this continent might be conceived as a multidimensional chess game in which the pieces have varying capabilities for planning and action in and on several planes of bibliothecal operations, all of which will evolve and be modified at varying rates of speed over the course of time.

What might be termed "superficial confusion" seems to be a likely characteristic of our bibliographic future. The phrase is not meant to be pejorative. The diverse and dynamic nature of our situation carries great advantages. It gives us the opportunity to experiment and to change; it provides to some extent the capacity to tailor the superstructure of information control to match particular, local circumstances, building on the potential of feedback and response between the information community and those who use its products and services. In a similar vein, this state of "superficial confusion" more easily accommodates change, in particular the sort of change which has little or nothing in its origin to do with libraries or information dissemination—for example, economic recession, expansion, or inflation.

The utilization of technology is serving as a catalyst in drawing the various segments of the information field together as never before. In the process, we need to examine and to appraise our diversity in order to retain and to support its valuable features, while looking critically at those which are ill-suited to maximizing our resources. For example, the precise identification of a corporate body called the National Research Council as an agency functioning in Washington, Delhi, Canberra, or Ottawa has become more significant than in times past. On the other hand, I suspect that most of us are willing, after due consideration, to forego the benefits which may have accrued from the appearance of subject headings in red capitals on our catalog cards.

STANDARDS AND THEIR KIN

A word or two, then, about standards, recognizing that the topic will be addressed more definitively later in these proceedings.[4] A good deal of loose thought and sloppy action is swept under the carpet labelled "standards," and here again there is need for some close scrutiny. The question of how the library and information community can achieve adherence to and conformity with promulgated standards is an interesting topic, but one that usually generates little light.

Standards relevant to bibliographic networking range along a continuum from what might more properly be called guidelines to extremely precise definitions of, for example, machine-readable records. Perhaps the most overlooked fact about standards is the degree to which they do *not* remain constant. Think of those which affect your work: the rules for cataloging library materials; the MARC formats; filing rules; reduction ratios and formats for microforms; romanization tables; the International Standard Bibliographic Description; and a host of others.

One of our notable areas of nonsuccess is the extent to which we have not recognized the pace and the inevitability of change, especially with regard to bibliographic standards, and the creaking mechanisms we have devised for coping. Are we doomed to the throes of catalog code revision every ten to twenty years, supplemented by quarterly jolts announced by LC's *Cataloging Service*? Is this the best possible way in which to fashion and maintain rules for bibliographic description and entry which will enable people to reach information they need and want? Probably not.

I am a member of an ALA group working on revision of rules for filing. A fair amount of the group's time and attention is being devoted to (1) coordination with the catalog code revision effort and (2) attempts to attain consistency with similar work on filing rules going on in England. Whatever the outcome in substantive terms, the process is ill-designed to achieve the stated ends. What we have is a heterogeneous group of eight people, all of whom have primary job responsibilities in other endeavors, who assemble for periods of from two hours to two days semiannually (in conjunction with ALA conferences), who communicate erratically in the intervals by mail and telephone, and who juggle considerations of bibliographic organization, machine constraints and capabilities, anticipated behavior of people perusing displays of bibliographic data, and the care and feeding of our present card catalogs.

There are even now alternatives. One such is the structure of committees operating under the American National Standards Institute, which seeks to achieve a general objective of quinquennial review of standards once they have been promulgated. ANSI and its committees are relatively well funded, and the procedures for extensive review of draft standards, while less than perfect, at least embody a serious attempt to query potential users. The MARBI Committee of ALA is a group with considerable built-in continuity, and by dint of intensive work at each ALA conference, is able to function at least moderately effectively in the development and upkeep of the MARC formats. *Library of Congress Subject Headings* illustrates another style of adaptation to change. Responsibility here is centered in one library, which adds and modifies terminology on the basis of additions to its collections. Occasionally LC will seek advice in a formal way from another library or from an individual known to be an expert in a particular area. Users, generally librarians in the field, have been known to influence the substance and even the principles of *LCSH* through protest or milder forms of representation. The procedure for accommodating change, other than that established within the Library of Congress, is almost totally unstructured. Yet the tremendous increase in reliance on this standard in recent decades has vested it with an importance far beyond its value for one collection (even though that collection is central to American library service).

Although there is no magic formula to offer as a means for maintaining and adapting bibliographic standards in our era of change, the tasks associated with this work deserve a substantial infusion of time, money, and attention. If this does not happen, the confusion I have so merrily advocated will be more than superficial.

Before leaving this fascinating topic, we should recognize that guidelines, standards, or criteria for excellence are lacking, or at best embryonic, for several important operations involved in library networking. Except for certain gross (in both a quantitative *and* pejorative sense) statistical measures, we have no generally accepted means of describing and comparing library collections and have only begun to formulate common ground rules for the expression of collection policies. Although there is a great deal of current interest in the subject, much remains to be done in the way of categorizing reference and research queries. And that effort is in a way only a preliminary step toward measuring user satisfaction with respect to such factors as (1) ease and convenience in the use of libraries and the obtaining of information, (2) adequacy—quantity, accuracy, intelligibility—of the information provided, and (3) speed of response time.

HARD, COLD CASH (WITH A LOOK AT NCLIS AND OTHER STRANGE CREATURES IN THE BIBLIOGRAPHIC JUNGLE)

The subject of money is usually approached with circumlocution by practitioners of witchcraft. Bills change hands discreetly, and earnings are rarely reported to the IRS. Price, Waterhouse, if you think about it, was never called in to perform an audit on the balance sheet of the Oracle at Delphi. Library networking, at this stage of development, bears more than a few resemblances to the art of necromancy. Incantations and spells—in the form of grant proposals, "old buddy" contacts, site visits, and invitational retreats—are proffered to the funding deities: the Council on Library Resources and the major private foundations, the National Science Foundation, the National Endowment for the Humanities, and other government agencies at various levels. Detailed accounting of expenditures is made, if at all, only to the source of funds, and public access to the ledgers is limited (at best) to a few lines of figures in an annual report.

More significantly, very little can be deduced from our present information concerning the relationship of networking costs to the benefits provided. As the value of information increases in our ever more complex society, and as the provision of information captures a larger share of available financial resources, the imperatives to account for and to justify expenditures will likewise increase.

We already face the difficulty in justifying the cost of our future information system relative to other competing societal needs such as the provision of health and public safety services and the maintenance of a formal educational system. The difficulty may be eased by an increased ability to identify the costs of providing library and information services. In part this will occur because the sources of funds will demand more precise accountability; the demand will be able to be satisfied because more of us in the information field will be trained to gather and to report cost data and because the machine (bless its little heart) will be able to provide such data with relative ease.

Let us examine some institutional responsibilities regarding money and power in the age of bibliographic networking. The major foundations, both public and private, should continue to support research and development activities. Some agency—and it would appear at this juncture that the National Commission on Libraries and Information Science (NCLIS) is the best bet—should assume the role of monitoring R&D fund allocations as a whole from two points of view, which are not now given sufficient attention. NCLIS, if indeed it is to carry out this role, should assess what research and experimentation is desirable in the field and should stimulate its inception and assist in endeavors to round up financial support. In a related fashion, NCLIS should serve as a monitoring and evaluative body which critically assesses what is and what is *not* happening in the context of achieving national goals. The result should be a conscious posture of stimulating needed development, or recommending change or cessation for badly functioning or unwarranted activities.

In order to be capable of this role, NCLIS needs to develop as a clearinghouse of information on plans, state of the art, and implementation of network-related operations. In this capacity it could serve as a central source for guidance and advice on such matters as (1) what technology might work best in a given situation, (2) what the likely sources of funds are for a particular project, and (3) whether a particular project or experiment can benefit from previous experience or currently operating systems which are similar.

NCLIS might well act in an advocacy role to counterbalance the now prevailing tendency in R&D disbursements: "Them that has, gets." For example, one of the topics which currently interests me a great deal is the projected closing of the catalogs of the Library of Congress, the adoption and implementation of *AACR2*, and the end of superimposition. The major research and large academic libraries in North America have been the arena for a fair amount of reflection on, grappling with, and even planning for the impact of these anticipated developments. There is little evidence, aside from occasional low moans and gnashing of teeth, of research or investigation of such impact on small public libraries, on school libraries, or on community college libraries. The closing of the LC catalogs and the related changes now seem to be slated for the end of the present decade, by which time it seems unlikely that all of the smaller school and public libraries will be included in regional or local networks capable of accommodating these rather major bibliographical changes. Are such libraries, from the point of view of national network planners, simply to be left dangling in the wind?

Attention to problems such as this one is now given by a number of agencies in addition to NCLIS: the Library of Congress, the

National Library of Canada, the Council on Library Resources, and (with lesser efficacy) the American Library Association, the Association of Research Libraries, and trade associations. As a result there is a good deal of overlap, duplicative effort, lack of communication, erroneous communication, and more than a desirable level of confusion—to the point where it can no longer be characterized as "superficial." Furthermore, the functions of critical assessment and guidance within a framework of agreed-upon objectives are imperfectly performed.

Some clarification of roles, at least, is desirable here. If NCLIS or any other agency is to undertake effectively the functions outlined in this paper, it will require the services of an advisory body larger than the present commissioners, who should be considered as an inner council responsible for policy determination. The commission diligently sought the advice and opinion of many members of the library and information community in the development of its 1975 report. It needs to formalize in a continuing way relationships with people, either as individuals or as representatives of organizations, who can be called upon for preliminary reaction to policy proposals and for ongoing expression of grassroots needs.

These relationships should not be confined to occasional retreats along the lines of the Airlie House Conference or to periodic meetings such as the semiannual ARL seances, although these occasions may well be useful. Advisors to NCLIS could operate as referees on specific proposals or could be queried by mail and telephone in order to elicit articulations of problem areas and unmet needs.

Some potential candidates might be found within the structure of organized bodies: the Council of the American Library Association; the governing body of the Information Industry Association; the members of ARL; the Council of the American Society for Information Science. If some or all of these were to be utilized as advisors in fashioning and maintaining our bibliographic system, I would recommend an additional leavening from less organized segments of the information community in order to balance the "Establishment" orientation of the above named groups.

The financial aspects of library networking pose some major problems. It will not be a simple task to devise budgeting/costing/accounting systems that will (a) channel funds productively, (b) attribute costs equitably, and (c) function so as to impose minimal data collection and reporting burdens on the participants.

In a mixed economic system where private, quasi-public, and public agencies are all active, sometimes in multiple roles as producers, jobbers, or vendors, and users of information sources and adjunct services, pricing decisions tend to be made very much on an ad hoc basis. Some policy guidelines with regard to pricing might be considered.

Governmental policy, at all levels, should be based on the principle that information is to be made widely available, as opposed to the controlling principle of cost return. As an extension of this policy, if governmental subsidization or privilege is granted to a private firm to enable it to develop a service or resource, there should be a legal obligation to extend this resource or service widely, with appropriate constraints on pricing. It should be acknowledged that private firms, while capable of making valuable contributions to the totality of information services, are risk-based enterprises. They may fail, and, as a general rule, operations within the private sector should not be supported by public funds merely to perpetuate an existing firm.

THE PRIVATE SECTOR; OR, ADAM SMITH RISES AGAIN

We have heard increasing concern expressed in recent years about the role of the private sector in the information field. A good deal of this concern, of course, comes from those associated with the private sector and often comes close to constituting a plea for governmental protection against the rigors of the (supposedly) free market. I would heartily agree that commercial organizations, both as manufacturers and as service enterprises, can be highly beneficial in helping achieve the objectives associated with improved library operations and information delivery. Private firms act in part to supplement foundation and government funds in that they provide risk capital, in many cases attempting to fill lacunae in the existing bibliographic web. We have known some outstanding successes, from the H. W. Wilson Company on down to some of the newer indexing and abstracting organizations. We need to understand clearly the implications of private sector participation in bibliographic networking. Private firms may falter or even fail, and their services or products as a consequence may change or may no longer be available. It is impossible to avoid dependency to a greater or lesser degree on commercially available products and services; it may be extremely advisable to conceive some alternatives for emergencies. Two fairly major fiscal earthquakes have occurred in the past few years, to wit, the Richard Abel Company and BIBNET; and the hardware and software situation with regard to Sigma computers has been of some concern to those associated with the Ohio College Library Center. The frequency of this sort of event should induce the realization that we are more likely than not to be affected by this type of change. As our libraries and network centers and bibliographic data utilities become more interdependent, the consequences will tend to become more significant.

A BAS GENTILITY

The results of R&D allocations should be scrutinized with greater care than is now the case and should be disseminated more widely. One of the quite legitimate functions of funded experiments is that of failure: the opportunity to test provocative concepts and, sometimes, to fail in contexts where failure is not disaster. This concept is probably understood, at least in an abstract way, by those responsible for funding decisions. What seems to be less clear is the imperative to learn from instances of nonsuccess. As far as I can observe, most of the specific mistakes that have occurred in library networking history are the subjects for brilliant analysis and dissection—in the corridors and restaurants and bars at library institutes and conferences. With quite limited knowledge of the continental scene, I am aware of several cooperative schemes that have progressed to various stages of realization and either (a) self-destructed with as few shock waves as possible, (b) retreated to considerably more modest goals than were announced with trumpets and flourishes at the onset, or (c) regrouped with changed intentions, organization, and (perhaps most importantly) changed personnel.

To take one example close to home, the history of the attempts during the past fifteen years to fashion the libraries of the nine campuses of the University of California into a system would make a fascinating and instructive study. Although our technological situation today is vastly different from that of the sixties, the fundamental mistakes that were made during this period—and there were mistakes—should not be attributed to imperfect knowledge of technological capabilities. The basic errors lay in the organizational structure for decision-making, which was ill-adapted to receive and interpret pertinent information; in the widely varying and incomplete formulations of systemwide goals and objectives; in the assumption of unity of purpose when in fact this was not the case; and in the lack of organizational capacity at all levels to adjust to rapid changes in the economic, political, and technological scenes. The familiar Santayana precept on history finds concrete application in this and a few other recent networking experiences; past experiences require documentation and historical analysis if we are to profit from them.

GET OUT THERE AND PUSH

The above comments have been intended as cautionary remarks and exhortations, not as a catalog of horrors complete with eye of newt and toe of frog. The present reality and the prospect of cooperative library and information activities must be enormously stimulating to anyone whose career is associated with this field. With this in mind I would like to close with a final set of admonitions. One further effect of the phrase "the national bibliographic network" which I have not previously mentioned is that of distorting perspective. Too often it seems that "the system" is overpoweringly enormous and frighteningly complex, that a corps of unnamed and unknown network planners in Washington, Ottawa, Columbus, Chicago, and selected other strategic sites are fiendishly at work deciding our bibliographic future, just as the gnomes of Zurich have been accused of determining our economic fate. Nonsense! The cast of characters (and there are a few characters!) is comprised principally of librarians you all know and love. Moreover, at this stage especially, influence and infiltration by those of us in the boondocks is not only a possibility but a positive obligation. The success or failure of cooperative activities lies in the long run with the people who actually deliver information services to users, just as a democratic society depends upon participation of the citizenry. The people who are active in one segment or another of bibliographic networking need the advice, the opinions, and the expertise of their colleagues who work with bibliographic tools and systems in order to deliver information. The future belongs to you.

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Automation and the Library Administrator

Eleanor Montague

The development of automated systems in libraries is traced through three broad phases: developmental, operational, and integrative. Management reactions to these phases, as well as typical problems and failures, are characterized. Questions and challenges for management to address in the future are explored.

INTRODUCTION

"If you have the urge to automate, sit down and calmly wait for it to pass!" was a common piece of advice to library administrators in the mid-1960s. The news of large money expenditures, problems, and pitfalls spread even when system developers and administrators went to great lengths not to divulge such problems or mistakes. At the same time, computer specialists likening libraries to screw and nut inventory problems promised that our concerns were trivial; that library processing would occupy only seconds of computer processing time. Administrators were promised "instant computerization" of library functions as a remedy for problems of spiraling labor costs, increasingly complex procedures, growing manual files, and other ills.

While no library administrator involved with early automation efforts will claim it was easy, thanks to advances in technology, networking, and turnkey systems, examples of successful applications of computer technology to library processing and services abound. The computer has become a fast new tool, both in the backroom and in the front lines of patron service; it has brought greater flexibility, speed, and the potential for expanded cooperation and service. The computer has been a significant agent of change in libraries and we can be assured that future developments will bring even more dramatic changes and challenges.

Early soothsayers predicted an instant organizational, management, and service revolution to go along with the instant computerization—a new order of things. While there has been change, it has been evolutionary rather than revolutionary, and we have a long way to go. In looking at the impact of automation on administration, it is also important to remember that automation has not been the sole agent of change in libraries recently. Pressures for sound management practices and the need to manage for innovation as well as for the status quo have increased during the 1970s, including demands for greater accountability, pressures from the changing economic and social scene, inflation, staff demands for a greater role in the management and decision-making process, networking capabilities and national developments, competing demands for limited resources, and a leveling or constriction of budgets.

The purpose of this paper is, first, to look at the changing characteristics of the development of automation in libraries over time; second, to examine the reaction of management to these developments; and third, to list the management challenges for the future. For the purposes of discussion, the development of automation in libraries is divided into three phases:

1. *The Developmental Phase*—The period through the early seventies, characterized by system experimentation, development, and entrepreneurship in a limited number of institutions around the country.

2. *The Operational Phase*—The period beginning in the seventies through the current time, characterized by system sharing and electronic networks, vendor supplied systems, competition, and broad library participation.

3. *The Integrative Phase*—The period emerging now and going into the future, characterized by the integration of systems across functional lines, the definition and implementation of national networking capabilities, greater cooperation, a more substantial impact on processing and service capabilities, greater information industry involvement, and continuing technological innovation.

THE DEVELOPMENTAL PHASE

In planning for automation, library administrators counted on a number of effects: speedier and simplified processing procedures, greater sharing of bibliographic information, improved access to collections, and reduced staffing. In general, the practical goals for automation were (1) to do what was currently being done better, faster, or more effectively, and (2) to provide services and products that were infeasible or impossible with the manual system. In addition, many hoped that this would be a period of research into the applicability of computers to help libraries achieve their missions, unfettered by many of the constraints imposed by manual systems.

The period was characterized by generous foundation and government funding for several large system development projects in individual libraries throughout the country, numerous small automation projects in individual libraries, little interaction or coordination between development projects, and substantial schedule slippages.

The concept of total system design was alive in the literature, but, with only a few exceptions where systems were indeed designed with the totality in mind, applications were typically restricted to one or a few functions. The prime candidates were serial processing and lists, circulation, acquisitions, and book fund accounting (and occasionally cataloging), depending on pressures being felt in the institution, the interests of library management, the interests of funding sources, available expertise, and the computer facilities or services available.

Just as we lauded the potential situation in which a book would be cataloged just once in the country, the management hope for system development during the period was that a system developed once at one institution could be transferred to another institution. This management dream was thwarted on a number of counts. Hardware and software operating systems differed from place to place. Library application programs were integrated into computer systems in various ways. But more importantly, libraries did not agree on a standardized way of doing things. An output format found quite acceptable at one institution would be found woefully lacking by the staff at another institution; a data element deemed essential by institution X would be scoffed at by institution Y, and so on. At each library, the application of automation even to similar functions appeared different and incompatible.

There were two significant national developments during the period: the MARC Pilot Project and the initiation of the regular MARC subscription service. These developments established for the library community an exhaustively complete, standardized bibliographic record content and format definition for the communication of bibliographic information that could still be utilized by the individual institution to fit local processing requirements and priorities.

Several challenges faced management in planning for this new tool. First, the technology itself was evolving rapidly. A 1967 White House report on computers in higher education begins with the statement that "after growing wildly for several years, the field of computing now appears to be approaching its infancy."[1] Management inclined to pursue automation was faced with making decisions without the benefits of personal expertise or prior experience in the midst of rapid hardware and software changes and technological developments. Expert computer advice was available but suffered from both ignorance and underestimation of library requirements and the same rapid technological changes.

Second, there were few librarians trained in the new technology. Therefore, the application of computer technology required the integration of expertise from three different groups of people: librarians, programmers, and computer experts. Finding no immediate common ground of terminology, priorities, or concerns, the seeds of miscommunication, misdirection, and misunderstanding flourished. Salary scales, work habits, work hours, and views of the work to be done varied widely between library and computer personnel, with library managers expected to play referee and interpreter.

Organizationally, a common management decision was to create a systems office, populated by systems analysts and programmers given the responsibility of designing, testing, and implementing the computer application in the library. On the positive side during the developmental period, this brought the people charged with automation together in one place in the organization. On the negative side, the isolation occasionally fed the suspicion of the staff, caused miscommunication, and often led to a situation in which the systems staff ignored the real requirements and priorities of the library. The concentration of responsibility in a systems office frequently robbed the line manager of the opportunity to understand the automated application in the context of the total operation of the unit or department. In addition, the majority of the time, library management did not possess the expertise to properly direct or evaluate the system development effort. Unfortunately, the result was often an autonomous systems staff.

Third, change is ideally predicated on a long-range plan, a thorough knowledge of the present system in totality—including procedures, files, historical precedent, and resource allocations, and a method for evaluating the change. Regrettably, there were numerous management failures during this period: (1) failure to clearly articulate the goals and priorities of the organization; (2) failure to fully understand the current system that was to be modified by automation; (3) failure to analyze costs of the manual system prior to automation as a benchmark against which to compare the costs after automation; (4) failure to develop evaluation techniques to measure the efficiency or effectiveness of the automated systems; and (5) failure to establish an ongoing methodology for monitoring costs.

Fourth, resource allocation (always difficult at best) became a real challenge. Most early automation efforts resulted in no staff savings, requiring that automation development and operating costs come from other sources, including local institutions, the government, foundations, or reallocations from other areas in the budget. The challenge to the library administrator was not only to explain to funders and higher administrators the potential benefits of automation, but also to educate them as to how a library works. The real costs of computer processing in library applications were virtually unknown by library administrators making decisions to automate. Budget estimates repeatedly evaporated in a sea of red ink as libraries learned more and more about the job to be done and as computer experts learned that library requirements were different from industrial inventory applications. Additionally, influxes of grant money and "free" (contributed) computer time from local computer facilities distorted the real potential impact on the operating budget.

The myth was still very much alive that automation would save money. As this myth turned to smoke toward the end of the period, the management argument turned to increased services rather than cost savings. To some, the argument of dealing with spiraling costs for the future (slowing the rate of rise of costs), rather than cost savings in the present, became an attractive alternative way of justifying automation in libraries.

Fifth, management attempts to utilize information from other libraries engaged in automation efforts usually proved impossible because of different system designs and requirements, different data elements and databases, different computer center charging algorithms, hidden charges, internal money transfers, differing products, and so on. The automated bibliographic wheel was reinvented at each library; meaningful comparisons were nearly impossible.

Sixth, more than ever before, the dedication of management to communication (up and down) was essential, and never were the cases of abysmal failure more prevalent. Out of ignorance and fear of the unknown, typical resistance to change, and skepticism about the benefits of the computer and the interests of the systems analyst and designer in their real requirements, the staff waited to see what the result would be. Where communication was open and frequent, where the operational staff was consulted, and where training was constant and thorough, the chances for a successful implementation increased dramatically. Where these actions on the part of management did not take place and staff resistance built up, change was made more difficult, if not sabotaged altogether.

In summary, it was a period of trial and error, experimentation, and learning. By and large, the new technology touched few libraries and, in these, the change touched only small segments of the total library operation. Where it did touch, there was frequently not a revolutionary change. As a matter of fact, in many cases, the automated systems were merely superimposed on existing manual systems with little change or true integration.

The local focus on development allowed the system designers to tailor the system design to the local environment, without changing local idiosyncrasies or procedures, even when these were inefficient. On the other hand, a frequent cause for frustration in the library was the computer experts' dismissal of our requirements with the observation that "the computer can't do that." Often, library management never asked, "Why not?"

Also as a result of local development, capabilities were programmed around the country to take MARC records and massage them to fit local conventions. Decisions to deviate from the MARC content and format were the rule rather than the exception, causing problems with interinstitutional information or system sharing. The siren call of cheap, very fast computer manipulation of information caused libraries to believe that the perfectionism attempted in the manual system could be finally achieved, without additional cost. For example, failure to understand the real costs of automation led the library community to specify every conceivable piece of information in the MARC format without asking what the price tag would be; we are still paying the price of that completeness in our systems today.

A backward look into the times reveals an agonizing lack of leadership and planning on the part of library management. Managers trying to cope with change and many unknowns abdicated, in my view, their responsibility to give a sense of direction to the internal organization or to exert control over the external agents of change. The technological tail wagged the library and bibliographic dog. The staff tail, wedded to historical procedures and practices, wagged the development dog. Managers struggling with the new technology failed to follow the basic steps of systems analysis and development or the rational decision-making process in which change is made in the context of goals and priorities and the long-term view. Facing the prospect of staff resistance to change, the temptation to program the manual system was unbearable for many managers. The failure to comprehend the potential impact of automation on traditional procedures and services and the resulting failure to take full advantage of the new tool is evident in our systems of today.

THE OPERATIONAL PHASE

The benefits of automation hoped for in the 1960s were still needed in the 1970s. It was clear that the challenges of continually escalating labor costs in the manual environment could not be met merely by cutting staff; while efficiencies were undoubtedly possible in the majority of manual systems, gains in efficiency alone could not hope to meet the challenges faced by libraries. The social and economic pressures building during this time, the end of the era of unprecedented growth in libraries, the need to compete more aggressively for resources, and a society accustomed to technological advances, brought the necessity to automate into clearer focus for most library administrators.

It was during this phase that libraries witnessed the development of successful networks, the sharing of computer systems, proven online applications, turnkey library systems, vendor-supplied automated capabilities, minicomputer applications, the promise of microcomputer applications, and greater competition among systems. The earlier management prospect of having to replicate systems developed at one institution in another was largely replaced by the capability to share hardware, software, and databases. With the availability of choices and advances in the technology, it was possible to differentiate those library applications best handled cooperatively with large databases, such as cataloging, from those high-transaction-volume, specifically local applications, such as circulation, which could be handled in-house by standalone systems.

As a result, libraries of all types and sizes that were unable to invest the horrendous financial and human resources necessary to undertake system development efforts could now utilize this new tool. For library management, the risks were now less, there was more flexibility, there were choices, there was an ever-growing community of libraries utilizing similar or the same systems, the mystique surrounding computer systems was reduced, and the general acceptance of the capabilities of automation was increasing throughout the ranks of the profession. Accordingly, and in line with other pressures, the challenges involved in the management of automated systems shifted from development to implementation, integration, and greater staff involvement.

• *Technical Knowledge*. The developments in automated library applications have become such that the technical knowledge required for intelligent decision making is well within the capabilities of virtually every library manager. Rather than having to rely solely on outside experts, we have in libraries of all sizes and types a growing number of managers and staff able and willing to specify needs, evaluate alternatives, and make decisions. As a result, in many libraries there has been a shift of responsibility for system definition and implementation from a systems department or outside experts to those line managers ultimately responsible for the integration and operation of the new system. Larger libraries engaged in local system development still often utilize systems departments of experts, but the clear and welcome pattern of greater involvement for the line manager and staff seems to be an established one.

Except for a certain level of expertise and understanding required to evaluate computer capabilities specifically, the management planning and decision-making processes involving automation have proven to be identical to those necessary for other change factors requiring rational decisions—the accountability for managing the change so that it matches the needs, priorities, and goals of the organization is the same and clearly resides ultimately with the library administrator.

• *Decision-Making Process*. The successful introduction of any change involves the development of a consistent, logical process and framework for short- and long-term planning and decision making. The essential first step in this process is the preparation of a clear statement of goals, objectives, and priorities for the organization as a whole, including specific goals and expectations for the area to be impacted by the change. This plan should be formulated only after (1) wide consultation in the internal environment; (2) wide consultation in, and education of, the external environment; (3) a thorough analysis of the current environment, including bottlenecks, constraints, limitations, and inadequacies; (4) a clear understanding of current resource allocation decisions and current costs; and (5) a carefully prepared statement of the anticipated impact of automation on the organization.

Based on the analysis, it is possible for library administration to identify appropriate steps and choices. Assuming the decision is to apply new technology, the next step is to prepare a comprehensive statement of requirements, expectations, and priorities for the automated application, conducted with an air of imagination and creativity so as to fully utilize the automated capabilities, with an air of questioning tradition-bound procedures, and with a goal to supply capabilities for the library and its users impossible in the manual system.

The third step in the management process is the evaluation of all available systems against the stated criteria. Once the choice is made, the organization must construct a detailed implementation plan, a timetable for implementation, and a statement of formal organizational structure in which to make fullest use of the factors of change. Meaningful staff input to the process is essential, as are truly effective training programs and a two-way communication environment. Finally, this whole management decision-making process must take the whole organization into account, not just the segment of the organization involved in the change.

Unfortunately, examples of management failures to follow this logical process persisted in the 1970s. One of the most important steps—to define an ongoing, efficient mechanism for feedback, evaluation, and improvement—is one of the most neglected. So often, the tendency is to think that the system of today will remain unchanged over time, yet we know that technology and our utilization of it will certainly evolve and change. For this evolution to be effectively guided, it is essential to monitor the system, provide a feedback channel, evaluate the system's performance against changing requirements, and factor improvements into the ongoing system.

• *Buy or Make.* The decision to make or to buy an automated system is still a very real one for libraries. The management process to build, or have built, a system is similar to buying into a network or a turnkey system, but additional specifications must be prepared for system and vendor performance, hardware, system and user test procedures, error correction, system maintenance, implementation, evaluation and future improvements, and penalties for vendor nonperformance.

• *Competitive Bidding.* Many library managers face the requirement for competitive bidding in the choice of systems. Where it is desirable or mandatory, the preparation of a request for proposal (RFP) or request for quotation (RFQ) is an important management responsibility. Since these requests constitute specifications for what is needed, their preparation requires extreme care in order to ensure that all requirements are fully and unambiguously stated, according to the statement of the organization's plan, goals, and analysis of needs. In both substance and process, management has to evaluate the bids so as to comply with legal requirements. The evaluation process consists of a number of steps, starting with the determination of each bidder's qualifications, the extent of the bidder's compliance with the request, an analysis of costs, and the applicability of the suggested system design or configuration to the existing organization and staff. While a numerical scoring process to evaluate a bidder's promises to meet requirements is a useful tool, decisions of this magnitude cannot be decided purely on the basis of numerical scores or lowest cost. Management must factor judgment and nonquantifiable considerations of significant issues into the decision-making process. For those libraries wishing to use a numerical scoring system as one component of the evaluation process, there are numerous computer programs and consulting firms available to aid the decision maker.

• *Management Techniques.* The opportunity for library management to make rational decisions based on a logical process has always been present, but during this period there has been a proliferation of articles and conferences on how to apply decision-making and evaluation techniques from other disciplines in managing change in the library, including operations research, cost-benefit analysis, management by objectives, theory X and theory Y personnel management, socioeconomic factors of motivation, and many others. In addition, a number of self-analysis techniques have appeared within the last several years, designed to provide a systematic internal review of a library's organizational and management structure and functions. MRAP (Management Review and Analysis Program) is an example for the large institution; less exhaustive versions and variations exist for the smaller library.[2]

The challenge for management is to apply the technique that best fits the situation; to choose a technique that fits the resources available; and to choose the simplest technique, or a collage of techniques, that will get the job done. Forgetting the chaotic consequences of the failure to use any recognized management techniques for planning, we have many examples of the other extreme, namely "overkill." The national network could probably be funded if we had a dollar for every elaborate study, every committee report, or every pound of statistical data compiled as an aid to a management decision that went unused or provided no real assistance in the process. Almost as much care is required in the choice and process of analysis and evaluation as in the decision itself. Occasionally, half a day of intelligent, directed analysis is a perfect substitute for five or six day's work, if the manager knows what he or she wants and needs and takes the time to define it. Library managers must make some fundamental decisions about the allocation of their time. It is not sufficient to manage for the status quo or the short-term future. Yet, we all know that these concerns can fully occupy every waking hour. What is required is a decision to allocate time for the long-range planning that is essential in order to influence the process of change and not merely react to it.

• *Communication and Staff Involvement.* The introduction of change, to be effective, requires a management dedication to (1) involve the staff in the definition of requirements and the implementation of the system and (2) provide training so that they fully understand the system, its role in the mission of the library, and their role in making it run. Experience and common sense indicate that a properly trained and motivated staff can provide imaginative and dynamic ideas for change and the utilization of new resources that rival those of most outside experts. Staff members today are looking for job satisfaction and a share in the objectives of the organization, based on mutual trust and confidence with library management. It is management's responsibility to provide opportunities in which this kind of staff participation and involvement can grow and flourish.

• *Impact of Automation.* The utilization and impact of automation has varied significantly among libraries. Some have increased staff, some have decreased staff, some have stayed the same; some have realized the goal of processing more material with the same staffing level, some have not. The difference is dependent on a number of factors, including conditions before automation; staffing levels before automation; the attitudes, interests, and philosophy of library management; and the extent to which the staff has been prepared or encouraged to deal positively with the change.

A major technological reason behind these differences has been the flexibility of the automated systems. Almost without exception, automated systems and networks have allowed each participating library utmost flexibility in the use of the system, allowing a library to perpetuate local idiosyncrasies and procedures if it wishes. Given this degree of flexibility, it has been utterly possible to use the automated system as inefficiently and ineffectively and with as little knowledge of what is going on as with the manual system.

In summary, in contrast to the earlier period of development involving a small number of libraries, during the seventies there has been a widespread application of computer systems in libraries of all types and sizes, thanks to advances in online technology, communications, and networking. As a result, the emphasis for management has shifted from entrepreneurship and systems development, design, and experimentation, to system specification and choice, implementation, functional integration, measurement and evaluation, and greater interlibrary cooperation and sharing.

The new technology has created a challenge for management that has taxed planning and decision-making skills; however, the technology has not produced a revolution either in the way libraries go about their business or, to much of an extent, in the ways in which patrons are served. We have not simplified the procedures for or interaction with the bibliographic apparatus; instead, the automated systems are as complex as our previous manual systems. In general, staff savings have not been realized as a result of automation, nor have libraries really tested the hypothesis that the same staff could process more materials due to automation, since the era of unprecedented growth came to an end as the operational phase began. The rule rather than the exception is still to view automated capabilities as one-to-one replacements for manual systems—as an opportunity not only to perpetuate local variations but frequently to consider more of them, given the speed and apparent ease afforded by the computer. By specifying multiple, exhaustive MARC formats and applying them to retrospective as well as current records, we have failed to examine cost as a function of benefit for the retrieval of library materials. Years ago when systems were first designed, we failed to ask whether the abundance of data we specified was required and whether we could afford it. Rather than using the computer tool to create new ways of doing things, we applied it to our historical practices with little creativity. It is still too early to tell what price we have paid for those decisions.

As we find more functions in the library that can be efficiently and effectively automated, including some front-line services to patrons, our challenge is to integrate these parts creatively into one compatible whole which is greater than the sum of the parts. As a group, however, I maintain that we have rested too comfortably on past accomplishments; we have had insufficient influence on network managers or designers concerning the priorities or schedules of future developments; and we have been so happy to see the successful application of online networking to the cataloging function, for example, that we have failed to plan sufficiently for (1) other applications, such as acquisitions or book fund accounting, (2) bibliographic control of collections other than monographs and serials, (3) the ripple effects coming from our current systems, (4) future technological developments, (5) the integration of applications, or (6) the potential impact of these developments on the role of the library in a changing society.

THE INTEGRATIVE PHASE—CHALLENGES FOR THE FUTURE

It is reasonable to assume that technological advancements and pressures for sound management and accountability from the changing economic and social scene will continue, and may well affect more aspects of our business or raise more questions of our relevancy in society than developments to date. In all probability, the changing situation will put the traditional library into greater competition for resources and with other segments of the economy for the control and delivery of information. In the future, library administrators will have to deal with the ripple effects arising as a result of current systems, networks, and national planning, and plan for the future with full recognition of past accomplishments and failures. The limited growth expectations for book, materials, and building project budgets, plus developments in national network planning, will result in greater reliance on information about holdings of other libraries as recorded in the bibliographic databases available online throughout the country. The opportunity for more systematic acquisitions decisions based on knowledge of other collections, and the multilateral agreements for cooperation and resource sharing that will follow, will have an impact on internal procedures and priorities. A major impact involves the collection development function, where decisions must be made about in-house holdings versus materials of potentially lesser use that can be gotten through a cooperative arrangement. In turn, this instant access capability will affect (1) patron service goals, (2) views on ever-expanding collections and collection-development policies, (3) views on centralized, shared storage facilities for lesser-used materials, and (4) space needs and plans for new library buildings.

These effects will result in an impact on our interlibrary loan functions, which will have to accommodate the increased traffic of both borrowing and lending transactions. The load-leveling effect of multiple locations shown in bibliographic databases may offset the burden currently borne by a few large collections, but the extent of that impact is not yet known. In all probability, current interlibrary loan staffing patterns will not be sufficient to handle the increased volume likely to build as online systems are used in collection development and acquisitions decisions. This will necessitate a shift of resources to the interlibrary loan function, since speed and accuracy will be required to make the system of resource sharing work.

Another major ripple effect is the strain on large collections heavily used by other libraries, where the priorities of handling local needs must be juggled with the needs of other libraries wishing to borrow books. When these problems are solved, libraries will still be faced with improving both the communication of interlibrary loan requests and the physical transportation of the materials. Unless we can deliver the material in a timely fashion, the speed of access to location information in online systems is for naught.

An inevitable outcome of the efforts to date is the replacement of the three-by-five-inch card catalog in the local library with an online catalog, either centrally maintained on shared equipment or maintained locally on a stand-alone system. Unless we are fooled into accepting merely a machine equivalent of our unwieldy, increasingly difficult current card files, the online catalog with its multiple access points and capabilities for Boolean search operators will revolutionize the use of the catalog as a bibliographic tool, our reference service, and our interaction with the patron. As we try to learn from the past, it is distressing to note that the online catalog (frequently viewed as a one-to-one replacement of the manual file but utilizing a different medium) is more often heralded as a way to reduce filing costs in the manual card files than as a refreshing, dynamic new tool for access to the collections, with the potential of being integrated with other capabilities to form a total library system.

Challenging questions of resource allocation remain. Capital and operating costs of automation must be offset by staff savings, budget increases, reallocations from other areas in the budget, a charge for services, or a combination of these. For example, if libraries are to support the costs of patron access to online catalogs once the card catalog is closed, there must be a shift in resource allocation from manual filing and maintenance to the costs of building, maintaining, and operating the online catalog. If the shift does not result in savings, libraries will have to face reallocations from other parts of the budget, charge fees, or argue for a budget increase. The fee-for-service controversy already sparked by the issue of charging for computer literature searching may well be just the beginning as we face the online catalog, full-text retrieval capabilities on demand through a computer system, and additional capabilities that may come about in the future.

With enhancements in online systems and the emergence of vendor-supplied systems, we can look forward to significant changes in our way of acquiring material. Some libraries are already electronically ordering material from vendors and there is no reason to believe that this capability will escape general library use. Advances in direct communication with the vendor, plus the online catalog with authority control and electronic interlibrary loan switching and accounting and an interface with circulation systems, will have a substantial impact on library operations. As these developments unfold, it is essential that library management plan for a true integration of automated capabilities across functions, ask hard questions about the long-term cost-benefit tradeoff of decisions, question historical sacred cows, establish effective communication links with staff, and take a more aggressive role in shaping capabilities, schedules, and priorities in future network and national planning developments.

In summary, we have assumed that libraries are a societal good beyond question and have immersed ourselves in detailed questions of bibliographic access and control without regard to possible shifting trends and priorities in society. In an era of tax revolution (as witnessed in California by the passage of the Jarvis proposition), libraries cannot assume automatic public support. Library administration must assume an outspoken and dynamic leadership role in the definition and development of future capabilities utilizing the computer and must do so with imagination, questioning, and real attention to priorities. Management must provide direction in selling funders and taxpayers on the role of libraries in society and the importance of the new technology in this task. And most importantly, we must understand the real requirements of the user—one of our most critical reasons for existence.

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Thus Spake the OPAC User

Karen Markey

In 1981, the Council on Library Resources (CLR) provided the funding to enable five organizations to conduct a study of library users and online public access catalogs (OPACs). The five organizations were J. Matthews & Associates (JMA), Library of Congress (LC), Online Computer Library Center, Inc. (OCLC), The Research Libraries Group, Inc. (RLG), and the University of California's Division of Library Automation (UC/DLA). These five organizations coordinated their activities in the development, pretesting, and administration of questionnaires used to survey library patrons at twenty-nine libraries in the United States.[1]

CLR also sponsored three (OCLC, UC/DLA, and RLG) of the five organizations to study online catalogs using other methods in addition to the questionnaire/survey method. OCLC[2] and UC/DLA[3] employed transaction log analysis to study OPAC use at seven libraries. RLG's study of OPACs included individual and group interviews with library staff at three academic research libraries.[4] The OCLC project team conducted focused-group interviews with library patron OPAC users and nonusers and library public and technical services staff at six libraries.[5]

This discussion presents the findings of the focused-group interviews conducted by OCLC. Each of the six libraries offered online searching of its collection through an OPAC. The libraries and the names of their OPACs (in parentheses) are: Dallas Public (LSCAN), Iowa City Public (CLSI/PAC), Library of Congress (MUMS and SCORPIO), Mankato State University (MSUS/PALS), Ohio State University (LCS), and Syracuse University (SULIRS). At each interview site, focused-group interview participants were recruited either from "captured" groups, e. g., university classes and mandatory instructional workshops, or through a general plea for volunteer participation. Group participants at universities were undergraduate users, undergraduate nonusers, graduate users, graduate nonusers, faculty users, faculty nonusers, reference staff, and technical services staff. Group participants at public libraries and federal libraries were young adult users, young adult nonusers, adult users, adult nonusers, older adult users, older adult nonusers, reference staff, and technical services staff.

Focused-group interviews provide qualitative information on library patrons' and staff's needs and perceptions of online public access catalogs. This method has been employed in related research to obtain library patrons' expectations, needs, and criteria for success when searching libraries' subject catalogs.[6] Complete descriptions of the focused-group interview method and analysis procedures are given in Merton, Fiske, and Kendall's manual on the method.[7]

A focused-group interview requires a group of six to twelve individuals who are led through an open, in-depth discussion by a group moderator. The moderator follows a series of open-ended questions, focusing the conversation on pertinent subject areas in a nondirective fashion. The moderator is free, however, to pursue interesting topics that emerge in the discussion. Group members challenge, interact, and stimulate one another, and provide researchers with insights, spontaneous thoughts, and language that infrequently occur in personal interviews. One of the greatest strengths of the focused-group interview method is the qualitative nature of participants' remarks. Library patrons and staff can express their needs and perceptions of online catalogs *in their own words*. Quantitative data collection methods used in the CLR-sponsored online catalog studies, such as surveys and transaction log analyses, provided few opportunities for library patrons and staff to express in their own words their needs and perceptions of online catalogs.

Our analysis of participants' remarks yielded six generalizations about staffs' and patrons' needs and perceptions of online public access catalogs:

1. Users of the online catalog like this new form of the library catalog.
2. There are positive aspects of the traditional catalog that library patrons and staff would like implemented as features of online catalogs.
3. OPAC users have problems finding the right subject heading to enter into the OPAC.
4. Library patrons and staff envisioned features to improve subject access to OPACs.
5. Library patrons and staff want access to much more than books in the OPAC.
6. Library patrons and staff want the OPAC to provide new services.

In the following discussion, each generalization is accompanied by focused-group interview participants' remarks that capture the flavor of the generalization and illustrate it from the perspective of library patrons and staff.

USERS OF THE ONLINE CATALOG LIKE THIS NEW FORM OF THE LIBRARY CATALOG

Searching the OPAC Is Fun

• Computer gives one enjoyment looking for a book—not boring anymore. (Sources: Dallas Public, urban branch library, college student users)

• You can be lazy with the computer catalog. It's more fun. Rather use computer than flip through cards. (Dallas Public, middle school student users)

• It [searching the OPAC] is more fun than the card catalog. (Iowa City Public, sixth-grade student users, junior high school student users; Mankato State, undergraduate student users)

Searching the OPAC Saves Time

• Instant gratification. Just punch [your topic] in. (Syracuse, graduate student users)

• I can always use the computer, whereas someone often had my card drawer. (Ohio State, undergraduate student nonusers)

• You know whether a book is on the shelf; computer saves time. (Iowa City Public, university library school student users)

• I don't have to walk a long way to [card catalog] drawers. (Library of Congress, General Reading Room reference staff)

The OPAC Provides New Services

• I don't copy anything down; I just get a printout. (Mankato State, media education faculty users)

• Computer tells me where and what floor books are on. I can find a book in any campus library without going there. (Syracuse, undergraduate student users, faculty users)

• Online catalog tells me whether a book is in or out of the library. I like having all the Ohio State libraries at my fingertips; it used to be that branch libraries only listed their own books. (Ohio State, undergraduate student users)

The OPAC Provides New Features

• I like the FIND command [i.e., key-word search]; especially when I don't know the right author or title or subject heading. (Library of Congress, Science Reading Room users)

• I like author/title search; I find what I want quickly. (Ohio State, graduate student users)

• It's so easy to limit. In the card catalog, when there were 100 cards under a subject, you had to look through all of them. (Mankato State, undergraduate student users)

• I like CN [call number] search. I usually find books on a subject, e.g., Mexico, then put in the most frequent call number I see to get more books. (Syracuse, faculty users)

THE TRADITIONAL LIBRARY CATALOG HAS POSITIVE ASPECTS THAT SHOULD BE IN THE ONLINE CATALOG

Subject Access in the Traditional Catalog

• The card catalog gives me cross-references. (Syracuse, graduate student users; Ohio State, formal instruction staff; Iowa City Public, university library school users, adult OPAC users)

• In the card catalog, I had more control over the sequences of subject headings; I could jump down four drawers and understand the logical sequence of headings. (Syracuse, reference staff)

Browsability of the Traditional Catalog

• The whole alphabet was in front of patrons in the card catalog. Sometimes they just stumbled on what they wanted. (Iowa City Public, reference staff)

• Looking up a book in the card catalog is a process that is a visual overview of what is available in the library. It offers a scan of material through which I find things that would never have occurred to me. It is stimulating that way. (Iowa City Public, adult users)

• Serendipity is hard to do on the computer. To browse, I must tell the computer catalog to browse; with cards, I just stick my finger in. (Library of Congress, General Reading Room reference staff)

• I still search for a book the ways I've always done it. I would locate the area it was in, and I'm a shelf browser. I like to browse the shelves. That's the fun of the library to me. (Dallas Public, volunteer trainers)

Physical Aspects of the Traditional Catalog

• You can take a card catalog drawer and sit with it. I have more freedom to work with it. (Iowa City Public, older adult users)

• In the card catalog you could misspell something but just flip cards until you found it. Now patrons are put in the position of having to supply correct information. (Dallas Public, branch reference staff)

• It is so easy to flip [backwards and forwards] through cards, it takes a long time to do the same thing on the computer catalog. (Library of Congress, special collections users, General Reading Room reference staff)

USERS HAD PROBLEMS FINDING THE RIGHT SUBJECT HEADING

Patrons Feel Their Search Terms Are Too Specific or General

• The more specific my topic is, the less likely I am to find the term listed in the computer. So I use a broad topic. (Ohio State, undergraduate student users)

• I either put in a subject that's too broad or one that's so specific that the library has nothing on it. I don't know how to organize my choice of subjects. (Syracuse, faculty users)

• I did a paper on birth order and I needed words more specific to birth order. I just never found the right term. (Mankato State, undergraduate student users)

Patrons Input Many Subject Terms into the OPAC

• I'll try [to find my topic in the computer catalog] 15 to 20 times. (Dallas Public, middle school student users)

• *Reader's Guide* suggests other topics, the computer catalog doesn't. I get tired after thinking of five ways to say the same thing. (Syracuse, undergraduate student users)

• Patrons waste a lot of time trying subject after subject. (Syracuse, reference staff)

Patrons Consult Library Staff about Vocabulary for Subject Searches

• When I can't find my term, I panic. I go to the information desk and have them look what my topic is under. (Iowa City Public, junior high school student users)

• When I can't find the subject, I ask the librarian to see if I spelled it right. (Dallas Public, middle-school student users)

• I help patrons find subjects, especially uncommon words [i.e., words that do not have a lot of postings]. (Syracuse, reference staff)

LCSH in Printed Format Is Not Adequate to Serve Patrons' Needs

• The Children's Collection uses better terms [than LCSH], and patrons are indignant when they think we only have children's books on their topics. We could use some cross-referencing from Children to Adult LCSH. (Iowa City Public, reference staff)

• Students are intimidated by LC subdivisions, e.g., Drug Abuse—Congresses, Drug Abuse—Bibliography. They don't know what they mean. (Ohio State, catalog information desk staff)

• It's disappointing when the subject is listed in LCSH, but there are no books in our libraries on that subject. (Ohio State, undergraduate student users)

• I don't use LCSH because it seems faster to just keeping typing terms in. And LCSH is not close to the terminals. The *x*'s in LCSH are confusing—you have to think about what they mean. (Mankato State, graduate student users)

• I don't want to fetch the LCSH volumes. I want them right on the computer. (Syracuse, graduate student users)

• Put LCSH online like MeSH. (Library of Congress, Science Reading Room users)

USERS ENVISIONED FEATURES TO IMPROVE SUBJECT ACCESS TO OPACs

Cross-Reference Capability for OPACs

• Cross-references [are needed] so I don't have to know the darn way the librarian called it. (Library of Congress, General Reading Room users)

• I would like to type in what subject I'm looking for and the computer would type back to me, try this term or that. (Mankato State, undergraduate student users)

• "See" and "see also" references should tell me all terms I should or could use. (Syracuse, undergraduate student users)

• We need cross-references. People look under "American History" and find nothing. I would like a crisscross subject index to link popular subjects to the actual LCSH. (Dallas Public, branch reference staff)

Related Term Lists for OPACs

• An online subject list is needed that leads the user to more specific topics. If he's interested in "France—History," a list of specific topics would lead him to what he's really after, "France—Revolutionary Period." (Syracuse, reference staff)

• Students need something to refine their topics. If only the computer would break down a topic like American Revolution into little topics, e.g., Stamp Act, Naval Battles, etc. (Syracuse, library support staff users)

• I want LCSH online; for example, the computer would produce lists of other terms for airplanes. (Ohio State, undergraduate student users)

Augmented Subject Access to Books

• I want to see the indexes of books so I can see whether I want the book. I could narrow down my search like I do when I look at the book in the stacks. (Mankato State, undergraduate student users)

• I want a description of the book jacket text material (in the OPAC). (Syracuse, undergraduate student users)

• We need individual essays in festschriften analyzed, as they sometimes were in the card catalog. (Syracuse, faculty users)

• Catalogers should increase the number of subject headings they assign to a book, like ERIC, where they give as many as twenty index terms to a book. (Library of Congress, General Reading Room users)

• There should be supplemental subject cataloging added to titles, like children's literature, which contains a two-sentence summary. Why not other literature? (Library of Congress, shelf holder users)

• Some music albums might contain thirty-five to forty individual compositions that should be identified individually in the OPAC by title, composer, performance, instruments, edition, date of performance, etc., to be providing any useful information to serious students. (Ohio State, faculty nonusers)

• The computer could read the introduction [of a book] to you. (Dallas Public, teenage library club users)

Shelflist Searching Capability

• A shelf number search could be like reading the shelf. It would link terms with shelf numbers, e.g., DG = History. I would like a handlist like this, or the reverse, e.g., History = DG. (Library of Congress, Science Reading Room users)

• [We need to access the] shelf list online. Then I can call up a class number, see what books are there, and determine whether the book I'm cataloging will fit there. (Mankato State, technical services staff)

USERS WANT TO ACCESS OTHER MATERIALS IN THE OPAC

Reference Materials

• We need periodical literature in the computer. I want *Reader's Guide* right now. (Dallas Public, volunteer trainers)

• I want individual journal titles online, e.g., *Chemical Abstracts, Reader's Guide, Humanities Index, PMLA*. A lot of information in chemistry is only in journals. (Ohio State, graduate student users)

• Articles in the *Encyclopedia Britannica*. (Iowa City Public, reference staff)

• Patrons think periodical articles are in the computer. You spend ten minutes performing a patron's search for a book called *Fertilizing Chickens* by Cunningham. Then the patron tells you it was in a journal. And patrons seem really shocked that you don't have access to articles in the computer. (Ohio State, Telephone Information Center library staff)

• I'd like newspaper indexes, like the *New York Times Index*, in the OPAC. (Syracuse, undergraduate student users)

• I'd like indexes in the computer. I was looking for articles on nutrition. *Psychological Abstracts* would have helped. (Mankato State, undergraduate student users)

Library Materials Besides Books

• I'd like the library's older books, government documents, periodicals, theses, and films added to the OPAC. (Syracuse, faculty users)

• Everything in the library should be in the computer, e.g., comic books, paperbacks, movies, etc. (Iowa City Public, sixth-grade OPAC users)

• Add all of the library's resources, regardless of type of material—books, pamphlets, records, tapes, community resource file, vertical files. The OPAC should be a resource center, not a card catalog. (Iowa City Public, adult OPAC users)

Nonbibliographic Information

Library patrons and staff at public and university libraries had plenty of suggestions concerning the inclusion of community and campus information in the online catalog. Here are their suggestions:

Community information: job ads, current city events, public concerts, local continuing education courses, university courses, subway routes, city maps, employment services, movies, plays, restaurant reviews, doctors' specialties, government and social agencies, city directories, information about local associations and service groups, dates of festivals, genealogical information.

Campus information: library hours, library displays and exhibits, campus phone numbers, local restaurants, upcoming television shows, university research in progress and investigator names, current local plays, public concerts, campus events, academic calendar.

Patrons' ideas about enhancing the contents of the online public access catalog were virtually limitless and very imaginative. Below are some of their more imaginative ideas:

• Whole sets of encyclopedias and almanacs.

• How to fill out a job application.

• Computer could tell about taking different drugs, describe them, what shapes they are, how many to take, harmful effects, etc.

• What kind of career I should take up.

• I'd like to search the knowledge of the world. You first read what is here at the library. Graduate students could also get what is available through the state's interlibrary loan network but faculty would access everything in the world.

USERS WANT NEW OPAC-RELATED SERVICES

Access to the Online Catalog at Locations Besides the Library

• At home. (Syracuse, faculty users, reference staff; Mankato State, graduate student users, faculty users, reference staff; Iowa City Public, sixth-grade school users, junior high school users, high school users, university library school users, adult users, reference and technical services staff; Dallas Public, volunteer trainers, reference staff)

• At university offices or classroom buildings. (Syracuse, faculty users, reference staff; Mankato State, faculty users, graduate student users, undergraduate student users, media education faculty users, reference staff)

• In dormitories. (Mankato State, graduate student users; Syracuse, undergraduate student users)

• At the supermarket. (Iowa City Public, reference staff)

• Everywhere, like drive-in beverage stores. (Dallas Public, middle school users)

Miscellaneous OPAC-Related Services

• I'd like to put an automatic hold on the book instead of bothering the librarian to do it. (Dallas Public, middle school users)

• I'd like a chair at the terminal and a printer, especially for searches with a lot of output. (Syracuse, undergraduate student users)

• Librarians could profile faculty members' interests, input the profiles into the OPAC, and send them printouts on occasion. (Mankato State, faculty users)

• I would like the computer to talk to me. Show me lengthy results on a screen, and give me tickets with the book numbers. (Iowa City Public, sixth-grade school users)

Document Delivery

• Delivery of books to my home, especially in winter. (Mankato State, undergraduate student users)

• I want to order books, and have them delivered at home; that would save me gas. (Dallas Public, urban branch users)

• I want to walk to a type of telephone booth, punch in my topic, and the machine gives me the actual book or whatever it is. (Iowa City Public, adult users)

• I could use the computer anywhere in town, and it would deliver a book to my home. (Iowa City Public, sixth-grade school users)

• The computer will have a vacuum like the bank and deliver the book to you. (Dallas Public, middle school users)

CONCLUSION

These remarks about online public access catalogs revealed that patrons and staff like this new form of the library catalog. They had problems with subject access, but envisioned ways to improve it. Many of their remarks about new OPAC-related services and accessing library materials besides books in the OPAC were very imaginative, reflecting the high expectations our library patrons and staff have about this new form of the library catalog. Their remarks describe some of the characteristics of a third generation of online public access catalogs defined by Hildreth[8] in a discussion of milestones in online catalog development. As we approach this third generation of online catalogs, we must heed our online catalog users' suggestions for system enhancements and improvements to ensure that continued development of OPACs is accompanied by user acceptance.

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Electrons, Electronic Publishing, and Electronic Display

Edwin B. Brownrigg and Clifford A. Lynch

This article provides a perspective on electronic publishing by distinguishing between what we call "Newtonian" publishing and what we call "quantum-mechanical" publishing. This distinction revolves around the means by which information is distributed. We conclude that much of what is currently called electronic publishing is actually classical Gutenberg-style publishing carried out by modern methods and that, from our perspective, electronic publishing has been a reality for many years. Computers and recent advances in telecommunications, however, have greatly increased the capabilities of electronic publishing and have also given rise to the possibility of creating new types of publishable artifacts, some of which we describe. The article ends with an examination of some of the recent copyright-law issues and their relationship to quantum-mechanical publishing; in particular, this section explores the distinction between the replication and the display of a copyrightable work.

THE PROBLEM OF ELECTRONIC PUBLICATION

Suddenly people are speaking of the "advent of the electronic publishing age." Yet publishing has existed since the time of Gutenberg and, for nearly a century now, information has been disseminated electronically. One can argue that electronic publishing was established, at least in America, in East Pittsburgh in 1919-1920 with Frank Conrad's music broadcasts at radio station KDKA (previously station 8XK).[1]

In this paper we will explore the meaning of electronic publishing. We will argue that much of what today is called electronic publishing is firmly rooted in the printing press tradition, albeit updated to use electronic paper. Our thesis is that electronic publication is a delivery medium: publication is an action, a process, rather than an artifact. From the verb "to publish" comes the noun "publication," which means simply anything that is published. Calling something a publication says little about the nature of the thing, except that it can be reproduced or displayed at a distance. An electronic publication, in the strict sense, is anything that is published through electronic means; it says almost nothing about the nature of the work—the content of the media.

Our first task must be to distinguish the new electronic delivery mechanisms from the classical, Gutenberg, delivery mechanisms. We will then review some of the works that can be delivered through these two kinds of media. We will discuss not only updated forms of old printed works reworked for electronic delivery, but also new classes of works based on electronic technologies. The latter are not, from our point of view, merely electronic publications, but rather new kinds of works that can be delivered only over the channels of electronic publication. They are artifacts that exploit the capabilities of the electronic channel in essential ways. Finally, we will explore some of the ramifications of electronic publication for intellectual property rights and the copyright laws used to protect such rights.

MEDIA AND PUBLISHING

Since Gutenburg, publishing has primarily involved hard copy media, of which paper has been the most popular. Traditionally, each step of the publishing process—authoring, submission, referencing, editing, typesetting, printing, disseminating, storing, and delivering—has used paper.

How do paper and electronic media differ? To label the distinction, one might say that hard copy publishing is "Newtonian," and electronic publishing is "quantum-mechanical."

The difference between the two becomes apparent if we construct a simple thought experiment about document delivery over a relatively large distance. It is not relevant whether the publication was created or stored electronically. What is relevant is the method of delivery.

In this experiment we wish to deliver a published journal article to a space station in orbit 800 kilometers above the earth.The article could be stored either as hard copy (on paper) or digitally (on magnetic or optical media). Either form could be delivered from earth to the space station using the Newtonian or the quantum-mechanical method.

With the Newtonian method, either the hard copy or the digital medium could be put in a pouch and sent via rocket. The minimal energy required to deliver the document is directly proportional to one-half the square of escape velocity (48,000,000 centimeters per second) from earth's gravity, or about 24,000,000,000,000 ergs. In reality, we should multiply that relatively large number by one hundred to account for the inherent inefficiencies of the rocket.

With the quantum-mechanical method, the information content, without the storage medium, would be sent via radio wave from earth to the space station (and perhaps re-stored there; we shall return to the question of re-storage later). If the original storage media had been paper, the content would be digitized and modulated onto the radio carrier wave. If the original storage media had been magnetic or optical, the digitizing step of the process would be by-passed. If we assume that the radio transmitter on earth is 25 watts, the energy required to send the document would be on the order of 250,000,000 ergs. We should also multiply this relatively small number by one hundred to account for powering the radio receiver on the spaceship.

Thus quantum-mechanical delivery requires five orders of magnitude less energy than does Newtonian delivery. Moreover, quantum-mechanical delivery proceeds at roughly the speed of light and therefore outpaces the orbital mechanics of Newtownian delivery by several orders of magnitude. In either case the cost of building the delivery device (the rocket or the radio sets) has been left out of the calculation. Each cost represents capital investment, which varies according to other factors. However, radios are obviously far less expensive to build and operate than rocket ships.

Although Newton experimented with optics (for example, the diffraction of light through a prism), he did not treat light waves (photons) in his seventeenth-century physics. It was not until the late nineteenth century that Heinrick Hertz, James Clerk Maxwell, and others began to explore the possibility that light and radio waves were the same thing. Then in the twentieth century scientists began to understand the quantum-mechanical nature of radio waves (photons) and how they are created, modulated, transmitted, and detected. This understanding set the stage for the birth of electronic publishing. It is interesting to note that all attempts to understand electromagnetic effects within the confines of Newtonian physics revolved around the problem of "action at a distance." To resolve this difficulty, scientists developed various models of electronic aether—the luminiferous medium.[2] While the details of the physics have been greatly refined, the underlying idea of the early architects of the aether theories is still a valuable guide to understanding the possibilities quantum-mechanical media offer publishing.

Light and radio waves are photons. Indeed, the photon is classified as a stable, long-range field particle with a mass of zero, no charge, and a spin of one. The electron, on the other hand, is classified as a stable lepton of the fermion variety, with the lightest mass of particles that have mass, with either a positive or negative charge, and with a spin of one-half. But the two particles work together in the universe as enantiomorphs.

Alternating currents of electrons are the source of one of the most vital entities of the whole of physics—namely, the electromagnetic wave. Whenever an electric charge undergoes acceleration, an electromagnetic wave is produced. Metal aerials carrying oscillating electric currents radiate radio waves at the same frequency as the oscillating electric currents. All electromagnetic waves travel in a vacuum at the same phenomenally high speed (3,000,000,000,000 centimeters per second). All such waves can induce a nonuniform motion of electric charge. Thus, oscillating electrons induce photons, which in turn induce oscillating electrons at some distance. This phenomenon, plus the ability of electromagnetic waves to propagate faster than anything else through nothing at all, makes them invaluable in communication. Waves are the mechanism of quantum-mechanical publishing. The control of electromagnetic waves, rather than the computer, made electronic publishing possible.

Computers and modern telecommunication technologies, however, have greatly enlarged the possibilities for electronic publishing. Prior to the introduction of these technologies, electronic publishing was primarily an ephemeral, uncontrolled process. Few people could request radio or television programs. Equally few could record these programs for later reuse; tape recorders and particularly video recorders are relatively new developments as consumer electronic devices.

In the late 1960s and 1970s computers and advanced telecommunications introduced several new opportunities. First, and most importantly, they opened up the possibility for point-to-point, two-way, electronic publishing—users could request and receive works through electronic publication on demand. Moreover, it became practical to store a copy of a work rather than just to see or hear it as it "passed by." This was the real start of publication on demand.

WORKS DELIVERED THROUGH ELECTRONIC MEDIA

Having described the medium of electronic publishing, we now examine the works that can pass across this medium.

The first works were radio broadcasts of audio signals. The printed word can be readily translated into speech and thus to radio; the full range of printed media can be easily translated into television images. Thus, by the time color television came into widespread use in the 1960s, electronic publishing could deliver all of the Gutenberg-era works—the printed word, pictures, photographs, and films—but there were few new, inherently non-Gutenberg works available.

It is difficult to characterize a totally non-Gutenberg work. In virtually all cases it is possible to deliver a work through Newtonian means (such as shipping a disk) and then translate it back to electronic form at the end of its journey (by putting the disk into a disk drive attached to a computer). A totally non-Gutenberg work would have to be changing constantly (so that any copy delivered through Newtonian means would be out of date), have "real-time" value, and/or involve "real-time" interaction between multiple participants. Multiuser, computer-mediated games would be examples of such works. Other examples might be community interactive videotext systems and LANDSAT images telemetered in real time.

There is a much larger and more easily identifiable class of work that can be delivered through either quantum-mechanical or Newtonian media but that requires the use of a computer. Today many such works are termed electronic publications. Computer databases, for example, use the electronic publishing channel and represent non-Gutenberg works. (Although they do not represent the same sort of intellectual property as do books, computer databases do represent major economic assets.) Videotext systems—networks of complex, interactive color screens, sometimes with animation—also make intrinsic use of the electronic channel.

A particularly interesting form of a non-Gutenberg work is what could be described as the interactive computer book. For example, a program called SARGON will play chess with the user on the Apple Macintosh. It will also teach chess; it will play a large number of classic chess openings, give hints about moves, work out various chess problems, and let the user switch sides. Playing chess games with computers is not new; it has been done for over two decades and at times has been viewed as a sort of philosopher's stone in the quest to develop artificial intelligence. SARGON is in many ways an analog of the old-fashioned, learn-to-play-chess book, but it offers much more. Another interesting example is the series of books on dynamics written by Abraham and Shaw;[3] these books are accompanied by a series of matching computer graphics programs that illustrate the material in the books. In both of these cases a paper book is still needed with the computer program, but there is no inherent difficulty in making the book readable as part of the computer program.

In spite of the possibilities, we constantly seem to be trying to return to the comfortable, familiar world of Newtonian delivery media by using physically distributed storage media, such as mass-produced optical disks of databases, CD-ROMs, PROMs containing computer games, and the like. In such cases an information storage device and information content, rather than information content alone, is sent from place to place through channels such as the U.S. Postal Service (the ultimate Newtonian distribution method).

ELECTRONIC PUBLISHING AND THE PRINTED WORD

Using electronic delivery media for the printed word offers a great many advantages; it eliminates the need for transient storage and opens the possibility of obtaining material only when it is requested. It also raises the specter of economic and contractual chaos as libraries—the historical repositories of the printed word—become distribution points or switching stations in a quantum-mechanical world.[4]

Consider the advantages of electronically distributed journals, where individual articles can be obtained from some central repository (managed by the author or publisher) on demand. The case for converting library journal collections to such a basis has already been studied.[5]

The argument is that few people read every article in a given issue of a given journal. In addition, on the average, approximately 35 percent of subscriptions to journals are library subscriptions; however, for journals with very limited circulation the percentage of library subscriptions is much, much higher. The library also pays to process the journal volumes and to provide shelf space for the journal on an ongoing basis. Moreover, small-circulation journals cost more than large-circulation journals. The end result is that articles in journals that are never or rarely read are enormously expensive. Thus electronic media serve not only as a breeding ground and delivery mechanism for new types of works but also offer tremendous advantages as a channel for the delivery of older works.

INTELLECTUAL PROPERTY: THE DARK SIDE OF ELECTRONIC PUBLISHING

Let us return to our imaginary space station orbiting above the earth. A work has been transmitted to this station by radio. The space station inhabitants might display the work as it is received in much the same way one listens to the radio or watches television. They might store the signal for delayed review, or they might save the information in permanent storage, or perhaps even modify it and retransmit it elsewhere.

Regardless of how a work is used, there is a clear economic need to protect the author's rights to the work. This is a foundation of copyright law. Under the 1976 Copyright Act (17 USCA), an author obtains rights over reproduction, derivative works, distribution, performance, and display. With quantum-mechanical delivery, however, we enter an ambiguous world of fine distinctions between the display of a work and its reproduction.

Arthur R. Miller and Michael H. Davis have summarized the new law in their book, *Intellectual Property: Patents, Trademark and Copyright in a Nutshell*:

> The owner of a copyright . . . might publicly display the work by showing . . . [it] to others or by making . . . [it] available to the public at one location and be immunized in doing so by section 109(b). But, in order to protect the author of copyrighted works from having their products unfairly exploited by developing communications technology, Congress has granted the copyright owner the exclusive right to display the copyright in a way that would make it available in either multiple images or to persons outside the actual physical location of the copyright. Thus, multiple showings of copyrighted images through computer screens, or transmissions to multiple computer terminals would constitute a public display right and that is not immunized by the more narrow privilege granted by section 109(b) limited strictly to "no more than one image at a time, to viewers present at the place where the copy is located."[6]

One of the greater ambiguities in copyright law is the "fair use" doctrine. The issue commonly arises over photocopying in libraries. Fair use involves balancing public interests against the rights of the creators, with the deciding factors being the nature, extent, and purpose of the use.

A discussion of the complexities of this part of the law is beyond the scope of this work, but suffice it to say that fair use of display will probably ultimately parallel fair use of photocopying. Unfortunately, the exact scope of such permissible copying is not defined in the statute, and since electronic copying is so much faster than manual photocopying, the problem will only be exacerbated in the future.

Section 108 of the 1976 Copyright Act authorized libraries to make copies of certain works, implicitly recognized the right of others to make photocopies in libraries having photocopy machines, and immunized libraries from any copyright liability if certain notices are posted.

The subject of photocopying provoked much discussion in Congress during debates on the new act. However, an "Agreement on Guidelines for Classroom Copying in Not-For-Profit Educational Institutions," which is characterized by emphasis on brevity and spontaneity, was reached. While the guidelines emphasized that fair use should not substitute for the purchase of materials that are otherwise available, it is doubtful whether current law will adequately protect the creators of works that will be accessed electronically; brevity and spontaneity have entirely different meanings in this situation.

De Sola Pool, in his book, *Technologies of Freedom*, presents a pessimistic view of the future of copyrighting in a world of electronic publishing:

> The recognition of a copyright and the practice of paying royalties emerged with the printing press. With the arrival of electronic reproduction these practices become unworkable. Electronic publishing is analogous not so much to the print shop of the Eighteenth Century as to word-of-mouth communication, to which copyright was never applied.[7]

MANAGING INTELLECTUAL PROPERTY IN A QUANTUM-MECHANICAL WORLD

We have seen that the current trends in electronic document delivery through telecommunications networks have considerable precedent in earlier broadcast "publication" of works. We have further seen some of the difficulties in adapting current mechanisms of copyright law to this complex new world of quantum-mechanical media. In concluding, we must put the entire question of intellectual property into perspective.

Ultimately, intellectual property legislation—patent, copyright, or trade secret—is simply a tool for dealing with an economic and social problem. As a matter of policy, it is desirable to promote the production of novel creative works. To promote such production, a mechanism must be established to compensate the authors for creating these works; the compensation should be linked to the "value" of the work as established by the marketplace.

Perhaps the management of copyright over display should be patterned after the management of certain performance rights rather than after the management of reproduction rights to printed material.

For the performance of musical compositions, the United States Congress in 1897 passed legislation that included public performance rights within the copyright statute. For many years ASCAP (the American Society of Composers, Authors, and Publishers), BMI (Broadcast Music, Inc.), and Sesac have been carrying out the essential clearing functions without which there would be endless searches and bargaining for performance rights, involving the owners of both established and obscure songs. Without these central licensing agencies, each radio station would require copyright clearance experts and would undergo programming delays while contacting the owners for each performance. Just as it became necessary to have general clearance agencies for performance rights to large amounts of musical material in order to facilitate the orderly supply of music to radio broadcast stations, it could be necessary to have such clearance agencies for display rights to large amounts of documents in order to facilitate the orderly supply of copyrighted material to database servers or libraries.

The way clearing agencies for display rights of copyrighted material would function could be patterned after the way clearing agencies for performance rights of copyrighted material function. Authors and publishers could submit their copyrighted material to the catalog of a clearing agency, which would collect royalties on their behalf according to the following scheme. First, the clearing agency would collect an assessed fee from database servers, libraries, and other agencies in the document delivery business. This fee would be based reasonably on some statistic, such as a small percent of gross receipts in the case of the database server, or ARL statistics in the case of the library. Next, the clearing agency would statistically monitor the electronic delivery of particular copyrighted material from individual businesses and institutions involved in document delivery. Certainly, with all transactions being carried out via computer, an abundance of statistical information on which to base payments should be available, although providing sufficient auditability to satisfy all interested parties is an extremely difficult problem. (Perhaps we can see at least a glimmer of a potential solution in various emerging technologies, such as write-once optical media and various authentication protocols, which are being developed using public-key cryptosystems as a basis.[8])

Privacy is another issue. One of the great perils of electronic document delivery is that the identity of a document user is too easily recorded. The ability to defuse the privacy problem by paying royalties on a very broad statistical basis is very attractive. It could be done by using the number of times a document was accessed for display from a server without regard for the identities of the requesters. Finally, royalty payments to the copyright holders by the clearing agency could be based on a proportion of the amount of use of a particular copyright owner's material as against the total current use of the entire catalog of the clearing agency.

It is interesting to view the current Copyright Clearance Center (CCC) in the historical perspective of organizations such as ASCAP and BMI. There is a clear trend in the direction we are describing. The CCC began primarily as a passive accounting mechanism, but recently has begun to negotiate broad-based usage agreements with major corporations such as General Electric and Warner-Lambert.[9]

Whether such clearing agencies would become involved in granting advances of money to publishers and writers would depend on policy and practice. Nonetheless, the display of works through quantum-mechanical media does seem to have strong precedence in the history of performance of copyrighted material, and currently there is a legal and practical vacuum that must be filled. The distinctions between display, performance, and replication may ultimately prove to be of little use with electronic media and the new kinds of works that inhabit these media.

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Public-Access Computer Systems: The Next Generation of Library Automation Systems

Charles W. Bailey, Jr.

Historically, library automation has focused attention on the automation of internal library processes, such as cataloging; however, a new generation of library automation systems intended for direct use by library patrons is emerging. These public-access computer systems are categorized and described. The types of public-access computer systems are: (1) catalog information systems, (2) electronic information systems, (3) information presentation systems, (4) instructional systems, (5) consultation systems, (6) information service and delivery systems, (7) conferencing systems, (8) integrative systems, and (9) end-user computing facilities. To be effective, these computer-based systems must be integrated with the traditional collections and services of libraries.

Increasingly, libraries are making computer systems available for public use. Online catalogs, end-user searching services for remote databases, CD-ROM reference databases, and local reference databases on mainframes and minicomputers are examples of public-access computer systems. A public-access computer system is defined, simply, as any library computer system that a patron can use directly.

Prior to the advent of public-access computer systems, library automation had focused primarily on improving the effectiveness and efficiency of internal library functions: acquisitions, cataloging, circulation, interlibrary loan, office automation, and serials control. The benefits of automating these functions were significant, but not always visible, to library users. Now, libraries are providing users with a powerful array of computerized systems, and the long-standing effort to automate library functions is, at last, becoming unmistakably apparent to users.

This paper will survey current and projected public-access computer systems.

OVERVIEW OF PUBLIC-ACCESS COMPUTER SYSTEMS

Public-access computer systems are still emerging, but it is possible to draw a preliminary map of the territory that they will cover.

Public-access computer systems are based on computer and telecommunications technologies, which are evolving at a very rapid rate. Several major trends are shaping the current computing environment.[1] Historically, computer and telecommunications technologies have been characterized by dramatic increases in functionality and price/performance over time and by equally significant decreases in the size of system components. Different types of information (e.g., text, audio, and graphics) are increasingly becoming digitized. High-density storage devices, such as optical disks, are emerging that can store massive amounts of information at low cost. Evolving network technologies permit computers to communicate with each other, although data exchange across heterogeneous networks is still problematic. Artificial intelligence (AI) software is maturing, and a growing number of AI products and systems are becoming available.[2]

Public-access computer systems utilize specific computers, operating system and applications software, storage technologies, input/output devices, and data communications systems to provide services to users. The unique mix of technologies employed by a public-access computer system determines its capabilities. It is beyond the scope of this paper to consider fully the diverse technological infrastructures that could be used to implement each different type of public-access computer system. Nonetheless, there are certain technical capabilities of public-access computer systems that are worth highlighting briefly.

Depending on underlying software and hardware configurations, these systems can provide users with: (1) rapid dissemination of new information; (2) powerful searching tools for quickly retrieving needed information; (3) sophisticated information manipulation and analysis tools (e.g., statistical and textual analysis software) to assist the user in creating intellectual works from retrieved information; (4) the ability to download information to the user's computer for further manipulation and analysis; (5) simultaneous access to system resources by multiple users; (6) remote access to needed information and services from offices, homes, and other locations; and (7) round-the-clock availability of system resources.

Given these capabilities in the context of the overall information technology environment, the library can be envisioned as evolving into an online information utility that provides users with access to local public-access computer systems and acts as a gateway to remote systems. To be effective, this new function will need to be integrated with traditional library materials and services. A number of thoughtful authors have probed different aspects of such a transformation. Works by Battin,[3] Dowlin,[4] Downes,[5] Drake,[6] Horny,[7] Lancaster,[8] and Murr and Williams[9] investigated key issues related to this subject. Parsons foresightedly speculated about possible "online public access systems."[10]

Overall, it is important to recognize that impressive technological advances do not necessarily imply that successful, operational systems will emerge in libraries that make use of these technologies. Public-access computer systems efforts by libraries and vendors will be bound by fiscal, organizational, and legal constraints that will help shape the course of their development.

Equally important will be user demand for these systems. Convenient access and adequate user support will be necessary to nurture the use of public-access computer systems. Users are likely to continue to be cost-sensitive, and, if they are being charged, they will ration their use of public-access computer systems. Issues related to fees for service, equitable access, and library subsidies will become increasingly important as public-access computer systems become an increasingly visible and critical part of library services. When considering scenarios about technology-driven changes in library collections and services, it is important to remember that the library plays an important social role as a provider of no-cost or low-cost information to those who cannot afford to obtain this information directly from publishers and other information vendors.

Public-access computer systems offer exciting prospects for libraries and their users. Librarians should neither be discouraged by the obstacles that must be overcome in order to make them a reality nor expect that their libraries will be transformed overnight into the elusive "electronic library." As was the case in past automation efforts, progress will be made in a steady, evolutionary fashion. A variety of pioneering projects, most of which will be done with relatively modest resources, are likely to explore the benefits and problems associated with new types of public-access computer systems before they are adopted on a widespread basis by libraries.

As libraries continue to develop public-access computer systems and provide them to their users, they are likely to concentrate their efforts in the following broad areas.

CATALOG INFORMATION SYSTEMS

These systems give library users direct access to bibliographic, authority, summary and detailed holdings, and item-status information (or to subsets of these types of information) about materials in library collections. These systems typically offer users powerful retrieval capabilities, such as keyword and

Booleansearching. A single-institution online catalog represents a typical contemporary catalog information system.

The long-term goal in the catalog information systems area will be to make information about remote library collections as accessible to the user as information about the local library collection.[11] This trend can be seen in the efforts of library consortia either to establish online union catalogs that reflect their joint holdings or to link the separate institutional online catalogs of their member libraries. On a broader level, libraries will increasingly provide public access to the regional, national, and international databases of bibliographic utilities, such as WLN, RLIN, and OCLC. As libraries provide users with instant access to information about remote library collections, issues related to libraries' ability to support increased resource sharing and to ensure rapid delivery of requested materials will become more critical.

An example of a local catalog information system is the UCLA library's ORION system, which is written in PL/I and runs on a mainframe computer.[12] ORION, which is under authority control, offers users a diversity of searching techniques with which to retrieve bibliographic, authority, and holdings data, including exact phrase, keyword, Boolean, call number, and control number searching (e.g., ISBN), as well as search limitation by different criteria (e.g., location, date, and language).

Hildreth describes a variety of enhancements to online catalogs that could be incorporated in the next generation of these systems, including user interfaces that provide more feedback and prompting, system reformulation of search keys to correct user-input errors, search techniques derived from information retrieval research (e.g., relevance feedback, stemming, and term weighting), and expanded bibliographic records that contain information from the tables of contents and indexes of books.[13] These types of system enhancements are applicable to all types of catalog information systems.

ELECTRONIC INFORMATION SYSTEMS

These systems provide users with access to a growing variety of reference and source materials in digital form. Sophisticated searching techniques are commonly available in electronic information systems, and analysis tools may be incorporated as well.

Representative types of electronic information include: (1) indexes and abstracts; (2) full-text reference works, such as directories and encyclopedias; (3) full-text journals; (4) full-text newswires; (5) full-text books that are not reference works; (6) numeric databases, such as census data; (7) digitized audiovisual materials, such as graphic images; and (8) hypermedia, which organize other types of electronic information materials into a network of frames.

Electronic information materials may be derived from printed or audiovisual materials, or they may exist solely in digital form.[14] As electronic information continues to evolve, new information formats, which draw upon the unique capabilities of computer technology and have no equivalents in prior technologies, will emerge.

In the foreseeable future, electronic information systems are likely to complement, rather than dramatically displace, traditional materials in libraries, such as books. The development of electronic information systems by publishers is likely to be driven primarily by marketplace forces rather than strictly by technological capabilities. The provision of electronic information systems by libraries will be strongly influenced by economic factors and intellectual property rights issues, reflecting high costs relative to those of traditional materials and attempts by copyright holders to restrict use of electronic information materials.

The question of ownership is likely to be especially problematic, since neither licensing nor accessing a database gives the library any permanent claim on it. Maintaining parallel print and electronic collections is an expensive solution to part of this problem; however, it does not address the issue of ensuring permanent access to information that is available solely in electronic form. These databases may be discontinued by vendors for economic or other reasons. Without a national program that, at minimum, targets preservation of databases that exist solely in electronic form, we are in danger of losing an increasingly important part of our intellectual heritage. A potential model for such a preservation effort is the Knowledge Warehouse, a pilot project in England that is exploring legal, commercial, and technological issues related to the preservation of electronic information, including electronic working copies created as part of the print publication process.[15,16]

An example of an electronic information system is Carnegie Mellon University's Library Information System, which utilizes the STAIRS retrieval software running on a mainframe computer.[17] The mainframe computer is linked to the campus local area network. The Library Information System includes databases such as *Academic American Encyclopedia, Computer Database*, Houghton Mifflin's *American Heritage Dictionary, Magazine Index, Management Contents, National Newspaper Index*, and *Trade and Industry Index*. The system enables users to search these databases using keyword, Boolean, proximity, and search limitation (e.g., date limitation) techniques.

INFORMATION PRESENTATION SYSTEMS

These systems provide users with a structured sequence of screens that describe library-related topics, which users can review at their own pace. Typically, an information presentation system will be menu-driven, with the user moving up and down a hierarchy of screens; however, with the advent of hypermedia, systems are being created that use a network of interconnected information frames.

A representative information presentation system is the Information Machine at the University of Houston libraries written in QuickBASIC and running on a microcomputer.[18] The Information Machine provides users with menu-driven access to explanations of library research strategies, materials, systems, facilities (complete with library maps), services, open hours, policies, and other orientation information.

INSTRUCTIONAL SYSTEMS

These systems interactively teach users about library-related topics, analyzing user responses and varying the information presented in accordance with them. Current instructional systems, commonly referred to as computer-assisted instruction systems, use drill-and-practice, tutorial, simulation, and game techniques to teach needed material.[19]

Prototype intelligent computer-assisted instruction (CAI) systems, which are based on expert system technology, have been developed, and researchers are examining how these systems can be grounded in learning and instructional design theory.[20] These systems may provide much greater tailoring of instruction to individual learner differences than is currently possible in conventional CAI programs.

An illustrative instructional system is a CAI program at the University of Delaware library, which employs the PLATO software as its authoring language and runs on a mainframe computer.[21] A microcomputer version was also developed which includes four lessons that treat the card catalog and LCSH, periodical indexes, newspaper indexes, and government documents indexes.

CONSULTATION SYSTEMS

These systems advise users, much as a professional librarian would, about library-related topics. Consultation systems are typically based on expert system and related artificial intelligence technologies. They are knowledge-based systems that embody the special expertise of library staff in using the library's collections, systems, and services.

Expert systems have three primary components: a knowledge base that contains facts, rules, and other representations of human knowledge related to a particular topic; an inference engine, which solves problems by manipulating information in the knowledge base in a way that mimics human reasoning; and a user interface, which permits system interaction with the user and explains system findings.[22]

A representative consultation system is the University of London's PLEXUS system, a prototype expert system that is written in Turbo Pascal and runs on a microcomputer.[23] This system, which is intended for public library use, is designed to identify relevant sources of information (e. g., individuals, books, and institutions) that can assist a user with a specific gardening problem. After building a profile of the user, PLEXUS allows the user to enter free-text questions about gardening, and it employs knowledge about the user, gardening, and gardening resources to identify appropriate resources to answer those questions.

INFORMATION SERVICE AND DELIVERY SYSTEMS

These systems allow users to request library services (e. g., mediated online search) and document delivery (e.g., local delivery or interlibrary loan of an item). This latter objective may be achieved through delivery of a physical item or the transmission of digitized information derived from a physical item.

As users employ more powerful tools for quickly identifying needed local and remote library materials in printed form, they will want equally convenient and speedy access to the information itself. Unless adequate attention is paid to information delivery, enhanced access to bibliographic and electronic information systems may create a "library with glass walls" instead of a "library without walls"—needed information can be quickly identified but not readily obtained.[24]

An example of this type of system is the Electronic Access to Reference Service system at the Health Sciences Library of the University of Maryland at Baltimore. The system is written in MIIS and runs on a minicomputer.[25] This menu-driven system allows users to search the online catalog, request a mediated online search, ask a reference question, submit an interlibrary loan request, request that an article be photocopied and delivered, submit book purchase requests, read electronic mail from library staff about service requests, and read library news notices.

CONFERENCING SYSTEMS

These systems give users a way of exchanging points of view on different topics in a public or private forum.[26] Unlike electronic mail systems, which provide one-to-one or one-to-many message services, computer conferences allow users to read ongoing dialogues by many participants on specific issues and to contribute to those dialogues. Computer conferences can be available to all or restricted to particular participants. A computer conferencing system can support a number of simultaneous conferences on different topics.

For academic and other research libraries, computer conferencing provides a new way of disseminating scholarly knowledge, potentially on a national or international basis, if appropriate network and internetwork links exist. Given their mutable nature, computer conferences offer interesting challenges in the areas of access and preservation.

An example of a library-sponsored computer conference is a private conference for librarians affiliated with the university library system, independent campus libraries, and the library school at the University of Michigan.[27] This system, which is one of many conferences supported by the University's CONFER conferencing software, enables librarians to electronically discuss a variety of issues of mutual concern and to make announcements of general interest.

INTEGRATIVE SYSTEMS

These systems provide users with convenient access to diverse local and remote public-access computer systems, new services based on these systems, and simplified techniques for utilizing these systems. Other types of public-access computer systems will be unified into a cohesive information network environment by integrative systems.

As the number of public-access computer systems offered by a library increases, there will be a need to reduce the complexity of administration and use of these systems. Integrative systems will be developed to meet a variety of objectives, including: (1) permitting the use of a standard library workstation with a multiplicity of local and remote systems; (2) establishing a coherent networking strategy to provide access to these systems; (3) providing users with an interface that organizes the use of these systems; (4) assisting users in identifying appropriate systems to meet their needs; (5) teaching users how to utilize these systems; (6) linking heterogeneous systems to provide enhanced services to users (e.g., connecting an indexing database with an online catalog to identify locally held journals); (7) providing tools for further analysis and manipulation of information from different systems; and (8) furnishing a uniform user interface that masks underlying system differences in command syntax, retrieval capability, controlled vocabulary, and record structure as much as possible.

An example of an integrative system is the DoD Gateway Information System, which is being developed by the Defense Technical Information Center.[28] This prototype system offers the user: (1) a directory of available online databases, which can be searched by subject; (2) a variety of communication services, including electronic mail, online conversations with other users, and automated log-on to online systems; (3) a knowledge-based, common command language system for accessing heterogeneous online databases; and (4) postsearch processing tools that can perform tasks such as converting records to a common format, eliminating duplicate records, sorting records by different keys, and analyzing search results.

END-USER COMPUTING FACILITIES

Microcomputer workstations housed in the library can provide users with access to a diversity of software tools, including business software (e.g., database management, spreadsheet, and other programs), programming languages and utilities, and scholarly productivity software (e.g., specialized foreign or scientific word processing, citation management, desktop publishing, and other programs). These workstations can be linked together in a local area network in order to share hardware and software resources. Given appropriate data communication linkages, these workstations can also access software packages, databases, and services on institutional or remote computers, including public-access computer systems provided by the library.

The linkage of increasingly powerful microcomputer workstations to public-access computer systems may bring into existence the long-awaited "scholar's workstation," an integrated computing environment for producing intellectual works. This may be achieved through a careful blending of resources: access to catalog and electronic information; a coordinated set of software tools to create, analyze, and manipulate information; and hardware to accomplish information transfer, production, and output.

Hess's detailed survey of seven microcomputer facilities located in academic libraries provides a good overview of contemporary efforts in higher education.[29]

CONCLUSION

Public-access computer systems represent the next step in the evolution of libraries. They provide an opportunity to synergetically blend printed and computerized information resources to create new, more effective library services. The library as we know it is not "dead," but it will be transformed.

Traditional library collections and services as well as existing library automation systems will provide a firm foundation for building public-access computer systems. In the near future, the library is unlikely to abandon print and metamorphose completely into a sophisticated system for providing electronic information and computer-based services. However, public-access computer systems will play an increasingly important role in libraries, and they will change the nature of the library in fundamental ways. Although the library as a physical entity will not disappear in the foreseeable future, the need for the user to walk through its doors will diminish over time, and increasingly its resources and services will be available in remote locations around the clock. Except in a small number of well-funded, innovative libraries, this change is likely to be incremental rather than swift and dramatic.

If the last generation of library automation systems is any guide, public-access computer systems could have a lengthy development cycle, gradually evolving from single-function to integrated systems. With careful planning, we can lay the foundation for eventual integration as we establish public-access computer systems.

An important step is to implement a high-capacity, librarywide local area network to permit access to a multiplicity of public-access computer systems from individual microcomputer workstations. With this essential infrastructure in place, local public-access computer systems can be added as network servers in a modular fashion and appropriate linkages to external public-access computer systems can be established as required. Gateway or bridge connections to institutional local area networks, dial-access ports, and other appropriate linkages can provide needed access to public-access computer systems for remote users.

Equally important is being cognizant, when developing or purchasing public-access computer systems, of the need eventually to integrate them. Standardization efforts in the computer, library, and publishing communities will play a key role in ensuring that systems can be effectively integrated, and libraries should be sensitive to whether their proposed public-access computer systems comply with applicable existing and emerging standards, such as the Common Command Language for Online Interactive Information Retrieval,[30] the Information Retrieval Service Definition and Protocol Specification for Library Applications,[31] and the Open Systems Interconnection standards.[32]

The challenge ahead is to balance our ongoing, increasingly expensive commitments to traditional information resources and services with the significant investment of human and fiscal resources required to make public-access computer systems a reality. Library automation systems aimed at computerizing internal library functions were costly; however, they did not alter the nature of the library's collections. Electronic information systems change library collections, providing better access to information at higher costs. These electronic information costs will constitute a significant and growing proportion of the total cost of providing public-access computer systems. Unlike equipment or software costs, which are primarily front-end costs, electronic information license or access fees will not drop significantly after the first year of use; rather, they are permanent costs subject to fee increases.

Libraries and library automation vendors have an overall record of success in creating complex, sophisticated library automation systems. Public-access computer systems offer exciting new challenges which libraries and vendors will overcome to create a new generation of library automation systems that will provide library users with improved access to information resources and library services.

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Expanding the Online Catalog

William Gray Potter

At one time, a library's catalog was designed to index every intellectual work in the collection—not just books, but also articles in periodicals held by the library, pamphlets, maps, government publications, the whole range of materials acquired by a library.[1] By 1900 all but a few highly specialized libraries found this was an impossible task, and today most catalogs provide access only to the books and the set titles of serials. Readers interested in the other types of materials are compelled to consult indexes that are separate from the catalog such as printed indexes, CD-ROM databases, or commercial online services. While these tools are usually of high quality, they are scattered throughout a library. The reader has lost the unifying function of the catalog, the ability to locate any item from a single source.

Tyckoson estimates that most library catalogs, be they on cards or online, index only 2 percent of the works in a collection.[2] The remaining 98 percent of the works include journal articles, government publications, individual essays in collections, maps, pamphlets, etc. Many libraries have specialized collections with their own catalog or index distinct from the main catalog.

Technology offers a possible solution to return libraries to the ideal of yesterday by providing access to a greater variety of material through the online catalog. Some libraries have loaded indexes to journal articles along with their main catalog. Others have loaded indexes to specialized collections and to government publications.

Beyond a library's local collection lies a wealth of information held by other libraries or collected by affiliated academic and government departments. While this information may be of tremendous value to readers, access to it is difficult and murky at best. Again, online catalogs have been used to improve this situation.

The articles that follow in this issue of *Information Technology and Libraries* describe the experiences of several libraries who have used technology to provide greater access to the materials available in their collections and, in some cases, to information outside their libraries. In most cases, the work described here has been performed in conjunction with an online catalog so that the reader is provided with a single source, a common interface, a unified environment in which to retrieve information.

These articles represent the experience of the following institutions: the Georgia Institute of Technology, Carnegie Mellon, Dartmouth, Vanderbilt, the University of Pennsylvania, the California Institute of Technology, Arizona State University, and the Colorado Alliance of Research Libraries (CARL). Figure 1 provides an overview of the various databases available at these institutions. There is also a general essay by Charles Bailey that suggests some future directions. It should be stressed that this set of articles is not meant to be exhaustive. There are other libraries and organizations working in this area, including the Division of Library Automation of the University of California, Clemson University, the University of Delaware, the University of Southern California, and Lehigh, among others.

The purpose of this essay is to identify some of the major trends or themes reflected by the articles that follow. There are three trends that will be discussed: the unification of local collections, providing access to outside resources, and the incorporation of reference works and full text.

THE UNIFICATION OF LOCAL COLLECTIONS

There is a wealth of material in all libraries that is more difficult to find than the books that are usually reflected in catalogs—journal articles, technical reports, essays in collections, songs in collections, government publications, etc. Somewhere in most libraries there are specialized indexes that provide access to this other material, but barriers of cost and effort stand between them and most readers. Online systems now in place in many libraries offer the possibility of providing more unified access to collections.

The indexing power of some online catalogs can unlock works that are buried in the main catalog. For example, the MARC record for many collections of essays contains a contents note that lists the author and title of each essay. The same is true for collections of short stories. Some libraries index this contents note in their online catalog and thus release these individual essays or stories for searching. The CARL software, also used by Arizona State University (ASU), does this, as does the BRS software used by Dartmouth for searching its main catalog. So, even without adding additional databases, some online catalogs can increase access to local collections.

The most common first step of the libraries represented here has been to load periodical indexes alongside the online catalog. The set of databases provided by Information Access Corporation (IAC) has been mounted by Georgia Tech and Carnegie Mellon. Recent years of MEDLINE have been loaded by Vanderbilt, Penn, and Dartmouth. Some of the H.W. Wilson indexes have been loaded by Georgia Tech, ASU, and Vanderbilt. Penn has loaded ABI/INFORM. Cal Tech has mounted a subset of SciSearch that reflects its holdings. Georgia Tech has included INSPEC. CARL has created a database called UnCover that consists of the table of contents of up to 10,000 journals received by the member libraries of CARL and that is available to other libraries as well.

In most cases, these databases are presented along with the main catalog so that, from a single terminal, a reader is given the choice of searching the main catalog or searching one of these other databases. Even those libraries that do not offer this menu approach, such as Penn, have attempted to keep the search interface for these databases as consistent as possible with that of the main catalog. The intention is to provide as much information as possible from a single source and within a common environment.

Beyond access to articles in journals, some libraries have created their own indexes to specialized collections or to works that are not covered in the general catalog. Usually, these indexes already exist in some other format and are transferred to the online system. Georgia Tech has included a catalog of its collection of architectural slides. Penn has loaded an index to its student newspaper and an index to a special collection of television scripts. ASU has loaded an index to its map collection and to its solar energy collection and plans to include records reflecting the holdings of its Government Documents Collection. It has also created an index to individual songs that are published in collections.

There is a trend, then, to providing users with a common environment from which to learn an increasing amount about what is contained in the whole of a library's collection. This common environment centers, for now, around the online catalog. While we are a long way from providing convenient and unified access to the entire collection, the work represented here is certainly an improvement.

ACCESS TO OUTSIDE RESOURCES

Even if a library could index 100 percent of its collection in a unified system, there are still vast resources that exist outside the library. Collections of other libraries and files created by affiliated agencies can be valuable resources if access is provided.

Libraries that have loaded periodical indexes have, in most cases, already provided access to materials outside their collection. While Cal Tech and Dartmouth tailored these databases to reflect only their holdings, the other libraries have loaded them completely, including citations to titles that they do not own. Thus, readers are, albeit indirectly, being referred to other libraries where the title is owned. CARL, in its UnCover database, does inform the reader which of the member libraries actually own which titles. At other libraries, readers are referred to interlibrary loan.

More active access to other collections is

	Periodical Indexes	Reference Works/Full Text	Local Collections	Other
Georgia Tech Hardware = IBM Software = BRS	Magazine Index Newspaper Index Management Contents Computer Index Trade & Industry Reports Applied Science and Technology Index	Grolier Encyclopedia Commerce Business Daily	Architectural Slides	Georgia State University Catalog
Carnegie Mellon Hardware = IBM Software = Stairs	Magazine Index Newspaper Index Management Contents Computer Index Trade & Industry Reports	Grolier Encyclopedia American Heritage Dict.	Architectural Illustrations	Reference Bibliographies
Vanderbilt Hardware = IBM Software = NOTIS/BRS	MEDLINE General Sciences Index* Humanities Index* Social Sciences Index*			
Penn Hardware = IBM Software = BRS	MEDLINE ABI/INFORM		Penn publications Television scripts	
Dartmouth Hardware = DEC Software = BRS	MEDLINE	Grolier Encyclopedia	Theatrical programs and information Popular sheet music	
Cal Tech Hardware = IBM Software = BRS	ISI Sci Search			

Magazine Index, Newspaper Index, Management Contents, Computer Index, and Trade & Industry Reports are products of Information Access Corporation
Applied Science and Technology Index, Business Periodicals Index, Education Index, General Sciences Index, Humanities Index, and Social Sciences Index are published by H. W. Wilson

Figure 1. Databases Available in Selected Local Online Library Systems.

provided by some libraries. CARL allows readers to search the catalogs of any of its member libraries. Georgia Tech has loaded the catalog of Georgia State University into its online system. While not discussed in this set of articles, there are many other systems that provide this type of access, notably the LCS network in Illinois, MELVYL among the University of California campuses, and, of course, OCLC and RLIN.

There is some indication that for interlibrary programs to work effectively, we must tear down the barriers between the reader and the information sought. In the Illinois

	Periodical Indexes	Reference Works/Full Text	Local Collections	Other
ASU Hardware = Tandem Software = CARL	Applied Science and Technology Index Business Periodicals Index General Sciences Index Humanities Index Education Index Social Sciences Index UnCover Article Access	Grolier Encyclopedia Songs in Collections	Maps Solar Energy	Career Services
CARL Hardware = Tandem Software = CARL Shared by fifteen member libraries	UnCover Article Acess	Grolier Encyclopedia Roget's Thesaurus* American Heritage Dict.* Denver Business Journal*	Government Pubs	MetroDenver Facts InfoColorado

*in process of loading March 1989
Magazine Index, Newspaper Index, Management Contents, Computer Index, and Trade & Industry Reports are products of Information Access Corporation
Applied Science and Technology Index, Business Periodicals Index, Education Index, General Sciences Index, Humanities Index, and Social Sciences Index are published by H. W. Wilson

Figure 1. Databases Available in Selected Local Online Library Systems (continued).

LCS system, it was possible for years for a patron at one library to directly request a book from one of the other twenty or so participating libraries. However, a long, complicated command was required. When a user interface program, based on a microcomputer, was introduced, this long command was shortened to a simple question: "Do you want to borrow this book?" If the reader responded "Yes," a paging slip was generated at the holding library, and the book was pulled and sent to the reader's home library. The result was that use of interlibrary borrowing through LCS tripled.[3] Bibliographic access alone is not enough. Delivery systems are needed as well.

There is also a growing recognition that there are databases being built in affiliated agencies, such as academic departments, that could be incorporated with the library's online system. Dartmouth sees its library system as a node in the Dartmouth College Information System (DCIS), a campuswide network with a variety of information resources based on a variety of computers. The three components of DCIS are a powerful user workstation, a high-speed communications network, and various host systems that contain information resources. The library's system is just one of the hosts on DCIS. The aim at Dartmouth is to develop an interface program that will search any of the hosts, using a common protocol, and display the results in a common format. Thus, users could use the same workstation to search the library's catalog or to search a file of Dante commentaries maintained by the Romance Languages Department or even a list of student employment opportunities, all using common formats for searching and displaying information. Carnegie Mellon is working toward a similar arrangement with its campus network.

The collection of any library contains only a small subset of the universe of knowledge. Connections between the system that indexes that collection and systems that index other knowledge sets are needed if we are to best serve our readers. The online systems represented here show that these connections are being made.

REFERENCE WORKS AND FULL TEXT

Another feature that is developing as libraries expand their online catalogs is the inclusion of ready-reference works. The *Grolier Academic American Encyclopedia* has been incorporated into the systems of Georgia Tech, Carnegie Mellon, Dartmouth, CARL, and ASU. Carnegie Mellon has also loaded the *American Heritage Dictionary*. CARL is also loading this dictionary as well as Roget's *Thesaurus*.

These reference works provide support for users of the catalog because they put background information on topics at the readers' fingertips. For example, someone searching for books about fractal geometry might be helped by the brief article on the topic contained in an encyclopedia. Further, a dictionary might be useful to ensure that fractal is spelled correctly.

Beyond providing such support for searching, the reference tools can stand alone as sources of information. Indeed, several libraries report that the encyclopedia is the most popular database they have loaded. One user at Carnegie Mellon referred to it as "the greatest thing since the invention of bedsheets."[4]

Georgia Tech has also incorporated the full text of *Commerce Business Daily* into its Online Information System. They keep six months of this service online and, as the name implies, update it daily. Faculty can establish profiles so that they can be notified when a relevant article appears.

These full-text services mark a radical departure for online library systems. All the other services provided as part of these systems merely point the reader to where information can be located. The full text of reference works and of journal articles, however, actually delivers the information. The services in place today should serve as an important first step to the eventual provision of a wide range of full texts of reference works, journal articles, and possibly complete books.

ADDITIONAL OBSERVATIONS

There is a slight identity crisis reflected in these articles. The terms used to describe the online systems discussed in these articles include Online Catalog (ASU and Dartmouth), Library Information System (Carnegie Mellon), and Online Information System (Georgia Tech). Some may see the word "catalog" as being too restrictive, others may prefer it because it still connotes the primary function of these systems. Georgia Tech and ASU see these systems as a step in the evolution of "electronic libraries." Perhaps that is the name these systems are moving toward.

There are many databases available to load into an online library system, and the selection process for each library is very interesting. Most select databases that satisfy the greatest, most general need. Some look at which databases were used the most in searches of commercial search services. Everyone strives for a balance of service and economy.

All of the libraries report tremendous success with these expanded services. Their reception by faculty and students mirrors the general acceptance of online catalogs. However, more than one library reports that successful implementation of these services may bring a spiraling demand for even more services. Readers reacted to the first online catalogs with a request for access to journal articles. They apparently react to the appearance of periodical indexes with requests for even more, usually for additional indexes or for the full text of the article. Apparently, the more libraries do with these systems, the more readers will demand that we do.

Further, success breeds demand on traditional library services. Georgia Tech reports an increase in the use of its periodical collection (measured by pick-ups) of 54 percent from fall 1987 to fall 1988. Other libraries have seen similar increases in use. Carnegie Mellon has noted an increase in traffic at the reference desk. Apparently, we are developing systems that are doing exactly what we want them to do, which is to increase use of the library.

CONCLUSION

There is a common theme among these papers that the services provided by expanding the online catalog (or online library information system) are part of a larger set of services.

There are appropriate tools for different levels of expertise and needs. While several libraries have loaded indexes to periodical articles, no library has been able to abandon online searching of commercial databases, and each library is continuing to purchase CD-ROM-based indexes. Emily Fayen, writing about Penn, points out that they have found that they actually need MEDLINE in all three forms—online as part of their local system, on CD-ROM, and through commercial services. The local system only contains up to three years of data but is free to readers. The commercial, remote version of MEDLINE meets the need of the serious researcher who needs to cover the entire file and needs the assistance of an experienced searcher. The CD-ROM version is an excellent teaching tool.

Penn's experience with three tiers of access suggests a pattern for other libraries. There are some databases, usually the more general ones or the ones that match an institution's strengths, that should be incorporated into the local online system. The wide use these databases receive will justify the expense. Other databases may be used less often but frequently enough to justify their purchase on CD-ROM. Still other databases will be used infrequently and may be so difficult to use that mediated searching of an online commercial database is justified.

There is a fourth tier that should be addressed, and that is printed indexes. Some indexes are simply not available in machine-readable form. Others cover only the past few years in an online or CD-ROM version. There are also readers who do not want to go near a computer. So, printed indexes should be with us for some time to come.

The next steps for expanding online library systems lie along three complementary paths. The first is simply more of the same—more indexes to more sets of collections and more reference works. The second is the inclusion of the full text of more articles and, possibly, books. For those libraries that have mounted indexes to journal articles as part of their online system, the next logical step is to provide the full text of these articles. While this is technically possible today, the economics of it are cumbersome. Storage costs are significant, but, more importantly, agreements with publishers need to be developed. The third path involves providing greater connectivity from online library systems to other systems, including other library systems, commercial services, bibliographic utilities, local networks, CD-ROM servers, and other information providers in the community.

The progress of automated library systems as reported in this issue of *Information Technology and Libraries* is very promising. We have come a long way in a short time and, by doing so, are returning to ideas we had to abandon years before, ideas of unified and universal access to information. Much of the local collection may still be unavailable, discovering the holdings of other libraries may still be difficult, and the timely delivery of documents may still be unrealized. However, we are moving closer, and the closer we get, the better libraries will become.

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The Shared Cataloging System of the Ohio College Library Center

Frederick G. Kilgour, Philip L. Long,
Alan L. Landgraf, and John A. Wyckoff

Development and implementation of an off-line catalog card production system and an online shared cataloging system are described. In off-line production, average cost per card for 529,893 catalog cards in finished form and alphabetized for filing was 6.57 cents. An account is given of system design and equipment selection for the online system. File organization and programs are described, and the online cataloging system is discussed. The system is easy to use, efficient, reliable, and cost beneficial.

The Ohio College Library Center (OCLC) is a not-for-profit corporation chartered by the State of Ohio on July 6, 1967. Ohio colleges and universities may become members of the center; forty-nine institutions are participating in 1971/72. The center may also work with other regional centers that may "become a part of any national electronic network for bibliographic communication."

The objectives of OCLC are to increase the availability to individual students and faculty of resources in Ohio's academic libraries, and at the same time to decrease the rate of rise of library costs per student.

The OCLC system complies with national and international standards and has been designed to operate as a node in a future national network as well as to attain the more immediate target of providing computer support to Ohio academic libraries. The system is based on a central computer with a large, random-access, secondary memory, and cathode ray tube terminals which are connected to the central computer by a network of telephone circuits. The large secondary memory contains a file of bibliographic records and indexes to the bibliographic record file. Access to this central file from the remote terminals located in member libraries requires fewer than five seconds.

OCLC will eventually have five online subsystems: (1) shared cataloging; (2) serials control; (3) technical processing; (4) remote catalog access and circulation control; and (5) access by subject and title. This paper concentrates on cataloging; the other subsystems are not operational at the present time.

Figure 1 presents the general file design of the system. The shared cataloging system has been the first online subsystem to be activated, and the files and indexes it employs are depicted in figure 1 by the heavy black lines and arrows. As can be seen in the figure, much of the system required for shared cataloging is common with the other four subsystems.

The three main goals of shared cataloging are: (1) catalog cards printed to meet varying requirements of members; (2) an online union catalog; and (3) a communications system for requesting interlibrary loans. In addition, the bibliographic and location information in the system can be used for other purposes such as book selection and purchasing.

The only description of an online cataloging system that had appeared in the literature

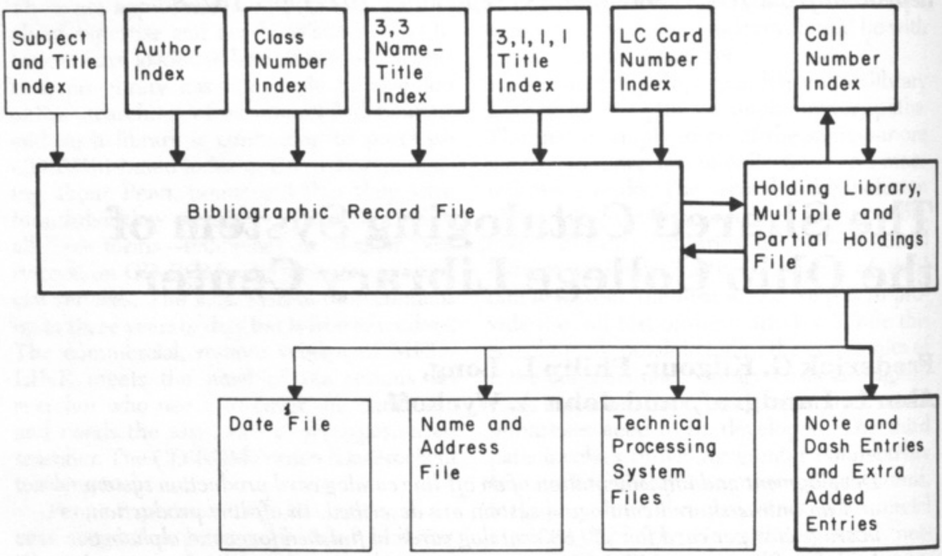

Figure 1. General File Design; Shared Cataloging Subsystem in Heavy Lines.

during the development of the OCLC system is that of the Shawnee Mission (Kansas) Public Schools.[1] The Shawnee Mission cataloging system produces uniform cards from a fixed-length, nonMARC record. The OCLC system uses a variable-length MARC record and has great flexibility for production of cards in various formats. There are a number of reports describing off-line catalog card production systems, including systems at the Georgia Institute of Technology,[2] the New England Library Information Network (NELINET),[3] and the University of Chicago.[4] The flexibility of the OCLC system distinguishes it from these three systems as well.

CATALOG CARD PRODUCTION—OFF-LINE

An off-line catalog card production system based on a file of MARC II records was activated a year before the online system.[5] OCLC supplied member libraries with request cards (punch cards prepunched with symbols for each holding library within an institution). For each title for which catalog cards were needed, members transcribed Library of Congress (LC) card numbers onto a request card. Members sent batches of cards to OCLC at least once a week. At OCLC, the LC card numbers were keypunched into the cards and new requests were combined with unfilled requests to be searched against the MARC II file. By the spring of 1971, over 70 percent of titles requested were found the first time they were searched.

The selected MARC II records were then submitted to a formatting program that produced print images on magnetic tape for all cards required by a member library. The number of cards to be printed was determined by the number of tracings on the catalog record and the number of catalogs into which cards were to go, including a regional union catalog (the Cleveland Regional Union Catalog) and the National Union Catalog. Individual cards were formatted according to options originally selected by the member library. These options included: (1) presence or absence of tracings and holdings information on each of nine different types of cards; (2) three different indentions for added entries and subject headings; (3) a choice of upper-case or upper- and lower-case characters for each type of added entry and subject heading; and (4) many formats for call numbers. OCLC returned cards to members in finished form, alphabetized within packs for filing in specific local catalogs.

The primary objective of off-line operation was the production of catalog cards at a lower cost than manual methods in OCLC member libraries. Early activation of off-line catalog card production did reduce costs and gave some members an opportunity to take advantage of normal staff turnover by not filling vacated positions in anticipation of further savings after activation of the online system.

Other objectives of off-line operation were the automated simulation of online activity in member libraries and development and implementation of catalog card production in preparation for card production in an online operation. The number of catalog card variations required by members, even after members had reviewed and accepted detailed designs of card products, proved to be higher than anticipated. More than one man-year was expended after activation of the off-line system in further development and implementation to take care of the formats and card dissemination variations requested by specific libraries. The one-year advance start on catalog production made possible by using MARC II records in the off-line mode proved to be a far greater blessing than anticipated, for it would have been literally impossible to have activated online operation and catalog card production simultaneously.

A major goal of OCLC card production is elimination of uniformity required by standardized procedures. The OCLC goal is to facilitate cooperative cataloging without imposing on the cooperators. The cost to attain this goal is slight, for although there is a single expense to establish a decision point in a computer program, the cost of selection among three or thirty alternatives during program execution is infinitesimal.

Design of catalog cards and format options began four months before off-line activities. Two general meetings of the OCLC membership were held at which card formats were reviewed and agreed upon in a general sense. Next, the OCLC staff published a description of catalog card production and procedures for participation.[6] This publication was reviewed by the membership and format variations were reported for inclusion in the procedure. Members reported few variations at this time, but when implementation for individual members was undertaken, it was necessary to build many additional options into the computer programs. To assist the OCLC staff in defining options for off-line catalog products and online procedures, an Advisory Committee on Cataloging was established. This committee met several times and provided much needed guidance and counsel.

The catalog card format options that members could select were extensive. For example, although the position of the call number was fixed in the upper left-hand corner of the card, there were twenty-four basic formats for LC call numbers, and libraries using the Dewey Decimal Classification could format their call numbers as they wished. In general, the greatest number of format options are associated with call numbers, probably because there has never been a standard procedure for call number construction.

Programs

Because designing, writing, coding, and debugging of catalog card production programs can cost tens of thousands of dollars, OCLC sought existing card production programs that could run on computers at Ohio State University (OSU), which is the generous host of the Ohio College Library Center. Only two programs were located that could both produce cards in the manner required by OCLC and run on OSU computers. Card production costs were not available for one of the programs, but because analysis suggested that the design of the program would create very high card costs, this program was not selected. The other program had been written and used at the Yale University Library, and although the card production costs were high, it was known that changes could be made to increase efficiency. Thus, arrangements were made to obtain and run the Yale programs at OSU.

Members were free to choose a variety of format options and submitted on a Catalog Profile Questionnaire (see figure 2) their specifications for each catalog. Holdings information and tracings could be printed on any or all of nine types of cards: (1) shelflist; (2) main entry; (3) topical subject; (4) name as subject; (5) geographic subject; (6) personal and corporate added entries; (7) title added entry; (8) author-type series added entry; and (9) title-type series added entry. Subject headings and added entries could have top-of-card or bottom-of-card placement and could be printed in all upper-case or in upper- and lower-case characters. Any type of subject heading and added entry could begin at the left edge of the card or at the first, second, or

OHIO COLLEGE LIBRARY CENTER

Catalog Profile Questionnaire

I. To define the pack of a receiving catalog, the Member should complete the following table. Directions for completing the table are in the Instruction Manual, pp. 2-3. Leave blank rows for types of entry not to be included in this pack.

II. 1. What is the name of the holding library or collection for which this pack contains cards? Juvenile AKJ

2. What is the name of the receiving catalog into which this pack will go? Union shelflist AKRsl

3. If this receiving catalog is not in the holding library or collection, put in the following box the stamp to appear above the call number (see Instruction Manual).

Type of Entry	Holdings Information		Tracings		Subject Headings Position		Indention of Headings at Top of Cards (first line only)				Capitalization of Headings at Top of Cards.	
	Yes	No	Yes	No	Top of Card	Bottom of Card	Left edge	First indention	Second indention	Third indention	Upper case	Upper & lower case
Main Entry to be Arranged by Call Number (Shelf List)	✓		✓									
Main Entry												
Topical Subject Entry												
Name as Subject Entry												
Geographic Subject Entry												
Personal or Corporate Added Entry												
Title Added Entry												
Author-Type Series Added Entry												
Title-Type Series Added Entry												

Institution: University of Akron

Figure 2. Catalog Profile Questionnaire.

third indention. Other options are described in the *Manual for OCLC Catalog Card Production.*[5]

The data received on Catalog Profile Questionnaires were transferred to punch cards and a computer program written in SNOBOL IV embedded the information in the form of a Pack Definition Table (PDT) in one of the principal catalog production programs named CONVERT (CNVT). Each PDT defined the cards to go into the catalogs of one holding library, a holding library being a collection with its own catalog.

The first major program in the processing sequence was PREPROS, which was written in IBM 360 Basic Assembler Language (BAL) and run on an IBM 360/75. PREPROS converted records from the weekly MARC II tapes to an OCLC internal processing format, including conversion of MARC II characters from ASCII to EBCDIC code. This program also parsed LC call numbers and partially formatted them. It also checked for end-of-field and end-of-record characters and verified the length of record. Finally, it wrote the output records in LC card number sequence into huge variable format blocks of 20,644 characters. The large blocks reduced computer costs since the pricing algorithm employed on the IBM 360/75 imposed a charge for each physical read and write operation.

The magnetic tape output weekly by PREPROS was then submitted to CNVT together with the old master file of bibliographic records in LC card number order and a file of request cards that had been sorted in LC card number order. CNVT merged the records on the weekly tape with the master file and then matched the requests by LC card number. When a match was obtained, CNVT deleted some fields from the bibliographic record and formatted the call number according to the specifications of the library that had originated the request. It then wrote the modified record and associated PDTs onto an output tape in external IBM 7094 binary-coded-decimal (BCD) character code with the record format converted to that of the Yale Bibliographic System. The second principal product of CNVT was the new master tape of bibliographic records that would become the old master for the next week's run. CNVT also punched out a card bearing the LC card number for each request card for which there was a match. These punch cards were used to withdraw cards from the request card file so that they would not be submitted again. CNVT was first run on an IBM 360/50.

The tape file of modified records and PDTs was then submitted to EXPAND, a modified Yale program written in MAD and run on an IBM 7094. By combining the number of tracings and PDT requirements, EXPAND developed a card image for each catalog card required by the requesting library. It also prepared a sort tag for each image so that the image could be subsequently sorted by the library into packs and alphabetized within each pack. EXPAND essentially did the formatting of catalog cards except for the complex LC call number formatting carried out by CNVT.

The file of card images was passed to a program named Build Print Tape (BLDPT) written in BAL and run on the IBM 360/75. BLDPT first converted the external IBM 7094 BCD characters to EBCDIC. Next BLDPT sorted the images, and finally, it arranged the images on a single tape to allow printing on continuous, two-up catalog card forms—the first half of the sorted file was printed on the left-hand cards and the second half on the right.

The PRINT program was also written in BAL but run on an IBM 360/50. It was designed so that either the entire file or a segment as small as four cards could be printed; the latter feature was of greatest use in reprinting cards that for one of several reasons were not satisfactorily printed during the first run. Cards were printed six lines to an inch and the print train used was a modified version of the train designed by the University of Chicago which in turn was a modified version of the IBM TN train.

The printer attached to the IBM 360/50 was an IBM 1403 N1 printer. This printer appears to be superior to any other high-speed printer currently available, but to obtain a product of high quality, it was necessary to fine-tune the printer, to use a mylar ribbon from which the ink does not flake off, and to experiment with various mechanical settings to determine the best setting for tension on the card forms and for forms thickness. Above all, patience in large amounts was required during the initial weeks when it seemed as though a messy appearance would never be eliminated.

OCLC off-line catalog card production programs were written in assembler language and higher level languages. Use of higher level languages for character manipulation incurs unnecessarily high costs. Therefore, for a large production system like OCLC, it is absolutely required that processing programs and subroutines that manipulate all characters, character by character, be written in an assembler language to obtain efficient programs that run at low cost. Programs that do not manipulate characters, such as the OCLC program for embedding PDTs in CNVT, may well be written in a higher level language.

Materials and Equipment—Summary

Off-line catalog production was based on availability of MARC II records on magnetic tapes disseminated weekly by the Library of Congress. Without the MARC II tapes, the off-line procedure could not have operated. Each week, the new MARC II records were added to the previous cumulated master file also on magnetic tape, and previously unfilled and new requests were run against the updated file.

OSU computers employed were an IBM 360/75, an IBM 360/50, an IBM 7094, and an IBM 1620. The run procedure was complex and therefore somewhat inefficient, but this inefficiency was traded off against a predictably high expense to write a new card formatting program.

Members submitted a request for card production on a punch card on which the member had written an LC card number. Members could specify a recycling period of from one to thirty-six weeks for running their request cards against the MARC II file before unfulfilled requests would be returned. In general, request cards bore LC card numbers for that section of the MARC II file that was complete; at first, the file was inclusive for only "7" series numbers, but in early 1971 the RECON file for "69" numbers was added. Request cards often numbered several thousand a week.

Catalog card forms are the now-familiar two-up, continuous forms with tractor holes along each side for mechanical driving. The card stock is Permalife, one of the longest-lived paper stocks available. A thin slit of about one thirty-second of an inch in height converts each three-inch vertical section of card stock to 75mm. The lowest price paid in a lot of a half million cards has been $8.065 per thousand.

After having been printed, the card forms are trimmed on a modified UARCO Forms Trimmer, model number 1721-1. This trimmer makes four continuous cuts in the forms and produces cards with horizontal dimensions of 125mm. Cards are stacked in their original order as printed and are therefore in filing order. The trimmer operates at quoted speeds of 115 and 170 feet per minute or 920 and 1,360 cards per minute. Measurements of speeds of operation confirmed these ratings.

Results

The off-line catalog production system produced 529,893 catalog cards from July 1970 through August 1971 at an average cost of 6.57 cents per card. This cost includes over twenty separate cost elements plus a three-quarter cent charge for overhead. The firm of Haskins & Sells, Certified Public Accountants, reviewed the costing procedures that OCLC employs, found that all direct costs were being included, and recommended the three-quarter cent overhead charge.

The number of extension cards varies from library to library depending almost entirely on the types of cards on which libraries have elected to print tracings. However, one university library with a half-dozen department libraries and requiring tracings on only shelf-list and main entry cards averages approximately six cards per title.

Cataloging using the OCLC off-line system results in a decrease of staff requirements, and some libraries that used the system during most of the year found that they needed less staff in cataloging. Reduction of staff by taking advantage of normal staff turnover facilitated financial preparation for the OCLC online system in these libraries.

Evaluation

Despite the obvious inefficiencies generated by running production computer programs on four different computers in two different locations and despite inefficiencies in the programs themselves, computer costs to process MARC II tapes and to format catalog cards, but not to print them, was 2.27 cents per card. As will be shown later, newer and more efficient programs have halved this cost, but even at 2.27 cents per card for formatting and .33 cents per card for printing, the cost of OCLC off-line card production is less than half the cost of more traditional card production methods.[7]

Two features originally designed into the system were never implemented, somewhat diminishing the usefulness of the system for some libraries. One of the incomplete features was a technique for deleting, changing, or adding a field to a MARC record (this capability exists in the online system). Absence of this procedure meant that libraries had to accept LC cataloging without modification except to call numbers. The second missing feature was the ability to print multiple holding locations on cards (this capability also exists in the online system), although it was possible to print multiple holdings in one location. This deficiency limited the usefulness of the system for large libraries processing duplicates into two or more collections. Both of these features could have been activated, but shortage of available time prior to activation of the online system prevented their implementation.

Figure 3 shows the high quality of the catalog cards produced. Subsequent to attainment of this level of quality, there have been no complaints from members except in cases where a piece of chaff from the card forms went through the printer and caused omission of characters. OCLC continues to vary the design of its continuous forms to achieve completely chaff-free stock.

The shortest possible time in which cards could be received by the member library after submitting a request card was ten days, but it is doubtful that this response time was often achieved. The minimum average response time for the three-quarters of requests for which a MARC record was located on the first run was two weeks. Delays at a computer center or incorrect submission of a run could extend this delay to three and four weeks, and unfortunately such delays were cumulative for subsequent requests until the "weekly" runs were made sufficiently more often than weekly to catch up. If another delay occurred during a catch-up period, the response time further degraded. During the fourteen months of operation, there were two serious delays.

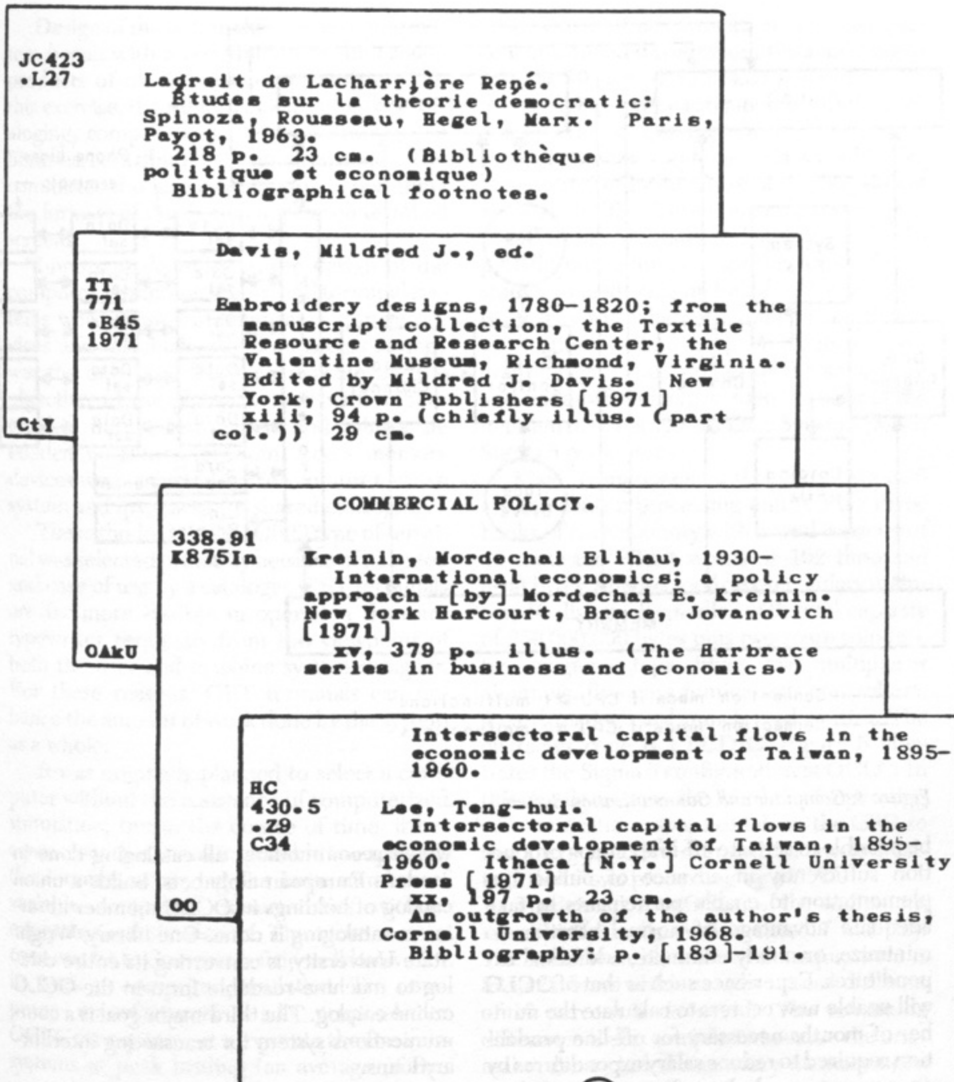
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Figure 3. Computer-Produced Catalog Cards.

The amount of normal turnover that occurred in OCLC libraries during the fourteen months and that was taken advantage of by not filling positions was too small to reduce the financial burden incurred in starting up the online system. A few libraries demonstrated that it was possible to take advantage of such attrition. However, 20 percent of the libraries did not participate in the online system and perhaps half of those who did participate were uncertain as to whether the online cataloging system would operate or would operate at a saving.

When feasibility of online shared cataloging has been substantiated and other centers begin to implement similar systems, it should

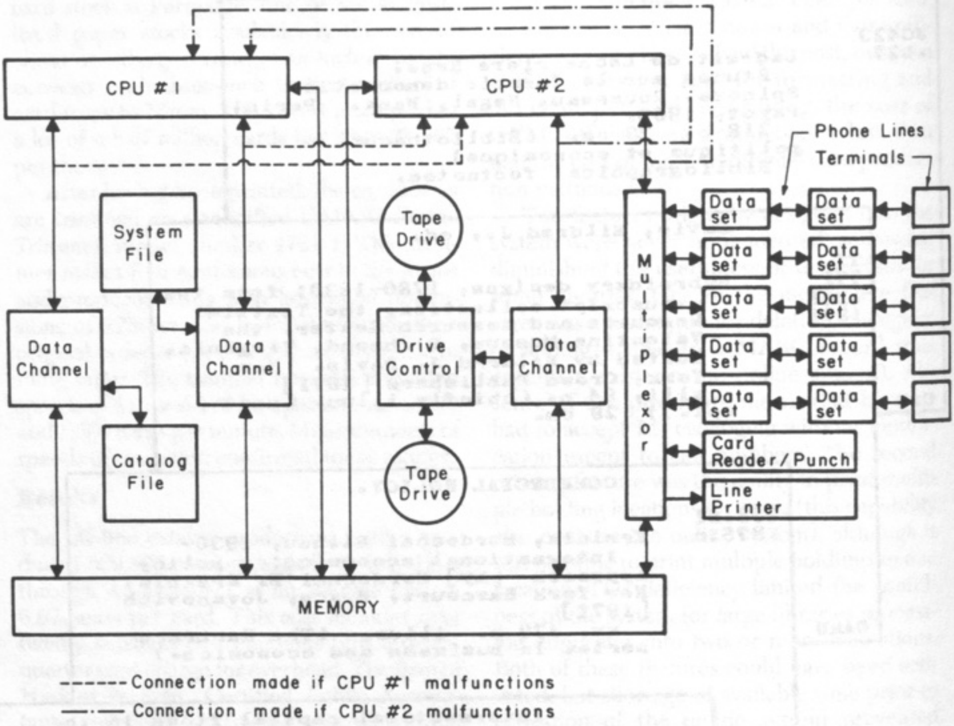

Figure 4. Computer and Communication System.

be possible to activate off-line catalog production sufficiently in advance of online implementation to enable participants to take adequate advantage of normal attrition to minimize, or nearly eliminate, additional expenditures. Experience such as that of OCLC will enable new centers to calculate the number of months necessary for off-line production required to reduce salary expenditures by an amount needed to finance the online system.

SHARED CATALOGING—ONLINE

The cataloging objectives of the online shared cataloging system are to supply a cataloger with cataloging information when and where the cataloger needs the information and to reduce the per-unit cost of cataloging. Catalog products of the system are the same as the off-line system—catalog cards in final form alphabetized for filing in specific catalogs; the online system is not limited to MARC II records but also allows cataloging input by member libraries. The shared cataloging system, which accommodates all cataloging done in modern European alphabets, builds a union catalog of holdings in OCLC member libraries as cataloging is done. One library, Wright State University, is converting its entire catalog to machine-readable form in the OCLC online catalog. The third major goal is a communications system for transacting interlibrary loans.

System Design and Equipment Selection

Figure 4 depicts the basic design of computer and communication components for the comprehensive system comprised of the five subsystems described in the introduction. The machine system for shared cataloging was designed to be a subsystem of the total system so that subsequent modules could be added with minimal disruption. Similarly, the logical design of the shared cataloging subsystem was constructed so that the modules of shared cataloging would be common to the remaining file requirements as shown in figure 1.

Design of the online shared cataloging system began with a redefinition of the catalog products of off-line catalog production.[5] In this exercise, the Advisory Committee on Cataloging, comprised of members from seven libraries, contributed valuable assistance. The committee was also most helpful in designing the formats of displays to appear on terminal screens.

Important decisions in the design of the computer, communications, and terminal systems were those involving mass storage devices and terminals. Random access storage was the only type feasible for achieving the objective of supplying a user with bibliographic information when and where he needed it. Hence, random access memory devices were selected for the comprehensive system and ipso facto for shared cataloging.

The cathode ray tube (CRT) type of terminal was selected primarily because of its speed and ease of use by a cataloger. CRT terminals are far more flexible in operation than are typewriter terminals from the viewpoint of both the user and machine system designer. For these reasons, CRT terminals can enhance the amount of work done by the system as a whole.

It was originally planned to select a computer without the assistance of computerized simulation, but in the course of time, it became clear that it was impossible to cope with the interaction among the large number of variable computer characteristics without computerized simulation. Therefore, a contract was let to Comress, a firm well known for its work in computer simulation. Ten computer manufacturers made proposals to OCLC for equipment to operate the five subsystems at peak loading (an average of five requests per second over the period of an hour).

All ten proposed computer systems failed because simulation revealed inefficiencies in their operating systems for OCLC requirements. OCLC and Comress staff then proposed a modification in operating systems, which the manufacturers accepted. The next series of trials revealed that more than half of the computers or secondary memory files would have to be utilized over 100 percent of the time to process the projected traffic. As a result of these findings, one computer manufacturer withdrew its proposal, and five others changed proposals by upgrading their systems. On the final simulation runs, the percent of simulated computer utilization ranged from 19.70 percent to 114.31 percent.

A subsequent investigation of predictable delays due to queuing in such a system showed that unacceptable delays could arise if computer utilization rose above 30 percent at peak traffic. Three manufacturers proposed computer systems that were under 30 percent utilization and, for these, a trade-off study was made that included such characteristics as cost, reliability, time to install the applications system, and simplicity of program design. The findings of the simulation and trade-off studies provided the basis of the decision to select a Xerox Data Systems (XDS) Sigma 5 computer.

Major components of the OCLC Sigma 5 are the central processing unit (CPU), three banks of core memory with a total capacity of 48 thousand 32-bit words or 192 thousand 8-bit bytes, a high-speed disk secondary memory, 10 disk-pack spindles with total capacity of 250,000,000 bytes plus two spare spindles, two magnetic tape drives, two multiplexor channels, five communications controllers, a card reader, card punch, and printer. The character code is EBCDIC. Figure 5 illustrates the Sigma 5 configuration at OCLC. In this configuration, the burden of operating communications does not fall on the CPU so that there is no requirement for "cycle stealing" that slows processing by a CPU.

The lease cost to OCLC of the equipment represented in figure 5 is $16,317 monthly. The listed monthly lease of the equipment is $21,421 from which an educational discount of 10 percent is deducted. (The remaining difference is due to a rebate because the original order included secondary memory units that XDS was to obtain from another manufacturer who proved incapable of supplying units that fulfilled specifications. Hence, XDS was forced to supply other memory units having a higher list price but has done so at a cost per bit of the units originally ordered.)

The printer furnished with the Sigma 5 does not provide the high-quality printing required for library use. At the present time, OCLC prints catalog cards on an OSU IBM 1403-N1 printer that without doubt provides the highest quality printing currently available from a line printer. However, OCLC is designing an interface between a Sigma 5 and an IBM 1403 printer; XDS is also developing

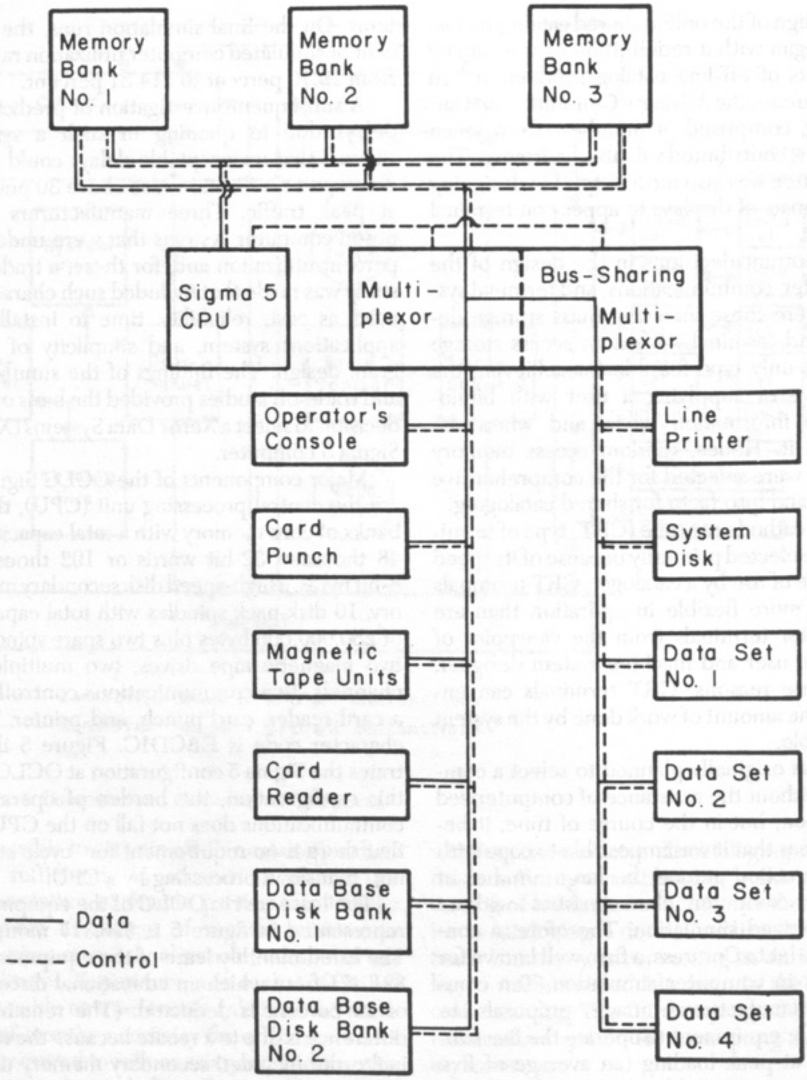

Figure 5. XDS Sigma 5 Configuration.

a new type of printer that will provide high quality output. When the Sigma 5 can produce quality printing, it will be fully qualified to be used for nodes in national networks.

As has already been stated, the CRT-type terminal was selected because of its ease of use. Moreover, the simulation study confirmed that CRT terminals would place far less burden on the central computer and therefore, for the OCLC system, would make possible selection of a less expensive computer than would be required to drive typewriter terminals. Although typewriter terminals cost less, the total cost could be higher for a system employing typewriter terminals than for one using CRTs because of greater central computer expense.

Library requirements for a CRT terminal are: (1) that the terminals have the capability of displaying upper- and lower-case characters and diacritical marks; (2) that the image on the screen be highly legible and visible; (3) that the terminal possess a large repertoire of editing capabilities; and (4) that interaction with the central computer and files be simple and swift. System requirements were: (1) that the terminal accept and generate ASCII code; (2) that it make minimal demands for message transmissions from and to the central site; (3) that it have the capability of operating with at least a score of other terminals on the same dedicated line; and (4) that its cost, including service at remote sites, be about $150 per month.

Data were collected on CRTs produced by fifteen manufacturers, and three machines were identified as being prime candidates for selection. OCLC carried out a trade-off study in which thirty-three characteristics were assessed for these three machines. One of the thirty-three (reliability) could not be judged for any of the three because none had yet reached the market. For the remaining characteristics, the Irascope LTE excelled or equaled the other two terminals for twenty-eight characteristics including all nineteen characteristics of importance to the OCLC user. Moreover, the Irascope was outstandingly superior in its ability to perform continuous insertion of characters, line wrap-around during insertion of characters, repositioning of characters so that each line ends in a complete word, and full use of its memory. However, the Irascope was the most expensive—$175 a month as compared with $153 and $166. Nevertheless, the Irascope was selected because of its obvious superiority. Pilot operation by library staffs has not produced complaints concerning visibility or operability; complaints during pilot operation have sprung from failures caused by a variety of bugs in telephone systems and a couple of bugs in the terminals that were subsequently exterminated.

The number of terminals needed by a member library for shared cataloging was calculated on the assumption that six titles could be processed per terminal-hour. It was also assumed that a library might have only one staff member to use the terminal throughout the year. It was further assumed that as much as three months of the terminal operator's time would be lost to vacations, sick leave, and breaks. At the rate of six titles per terminal-hour and with 2,000 working hours in a year, 12,000 titles would be processed annually assuming full-time use. Since only nine months was assumed to be available, it was estimated that 9,000 titles would be processed at each terminal.

In large libraries where there would be more than one staff member to operate a terminal, there would be three months of time available to do input cataloging, and since only a few libraries will be obtaining less than 75 percent of cataloging from the central system, it appears that a formula of one terminal for every 9,000 titles or fraction thereof cataloged annually would give each library sufficient terminal-hours. In actual operation, operators have been able to work at twice the assumed rate of six titles per terminal-hour so that there is reason to believe that these guidelines will provide adequate terminal capability.

File Organization

The primary data that will enter the total system are bibliographic records, and since the system is being designed to conform to standards, the National Standard for Bibliographic Interchange on Magnetic Tape has been complied with in file design.[8] In other words, the system can produce MARC records from records in the OCLC file format; more specifically, the system can regenerate MARC II records from OCLC records derived originally from MARC II records, although an OCLC record contains only 78 percent of the number of characters in the original MARC II record. Similarly, the system can generate MARC II records from original cataloging input by member libraries.

The simulation study clearly showed that bibliographic data would have to be accessed in the shortest possible time if the system were to avoid generating frustrating delays at the terminal. Imitation of library manual files or of standard computer techniques for file searching would not provide sufficient efficiency. OCLC, therefore, set about developing a file organization and an access method that would take advantage of the computation speeds of computers.

OCLC research on access methods has produced several reports[9–11] and has developed a technique for deriving truncated search keys that is efficient for retrieval of single entries from large files. These findings have been employed in the present system that contained over 600,000 catalog records in April 1973, arranged in a sequential file on disks, and indexed by a Library of Congress card-number index, author-title index, and a title index. The research program on access methods did not, however, investigate methods for storing and retrieving records.

Research on file organization included experiments directed toward development of a file organization that would minimize processing time for retrieval of entries or for the discovery that an entry is not in the file. Since the OCLC system is designed for online entry of data into the database, it was not possible to consider a physically sequential file for the index files. The indexed sequential method of file organization obviates the data-entry obstacle posed by physical sequential organization, but is inefficient in operation. Consequently, scatter storage was determined to be the best method for meeting the efficient file organization requirements of the system.

The findings of the investigation have shown that very large files of bibliographic index entries organized by a scatter-store technique in which search keys are derived from the main entry can be made to operate very efficiently for online retrieval and at the same time be sparing of machine time even in those cases where requests are for entries not in the file.[12] This research also produced two powerful mathematical tools for predicting retrieval behavior of such files, and a design technique for optimizing record blocking in such files so that, on the average, only one to two physical accesses to the file storage device are needed to retrieve the desired information.

The files displayed in figure 1 are constructed by a single file-building program designed so that additional modules can be embedded in the program. The program accepts a bibliographic record, assigns an address for it in the main sequential file, and places the record at that address. Having determined the bibliographic record address, the program next derives the author-title search key and constructs an author-title index file entry that contains the pointer to the bibliographic record. Then the program produces an LC card number index entry and a title index entry, each of which contains the same pointer to the bibliographic record.

When a bibliographic record is used for catalog card production, an entry is made in the holdings file. When the first holdings entry is made for a bibliographic record, a pointer to the holdings entry is placed in that record; the pointer to each subsequent holdings entry is placed in the previous holdings entry. An entry is made at the same time in the call number index containing a pointer to the holdings entry.

This file organization operates with efficiency and economy. The files containing the large bibliographic records and their associated holdings information are sequential, and hence, are highly economical in disk space. The technique used ensures that only a low percentage of available disk area need be reserved for growth of these large sequential files. Disk units can be added as needed. Each fixed-length record in the scatter-store files is less than 3 percent of the size of an average bibliographic record, and since 25 percent to 50 percent of these files are unoccupied, the empty disk area is small because of the small record lengths.

Sequential Files

The bibliographic record file and holdings file are sequential files, the holdings file being a logical extension of the bibliographic record file. A record is loaded into a free position made available by deletion of a record or into the position following the last record. Whenever a new version of a record updates the version already in the file, the new record is placed in the same location as the old if it will fit; otherwise, it is placed at the end of the file and pointers in the indexes are changed. There is a third, small sequential file containing unique notes for specific copies, dash entries, and extra added entries.

Each bibliographic record contains the information in a MARC II record. Each record also contains a 128-bit subrecord capable of listing up to 128 institutions that could hold the item described by the record. At the present time, only 49 of the 128 bits are used since there are 49 institutions participating in OCLC. The record also includes pointers to entries in index files, so that the database may be readily updated, and a pointer to the beginning of the list of holdings for the record. In addition, each record has a small directory for the construction of truncated author-title-date entries, which are displayed to allow a user to make a choice whenever a search key indexes two or more records.

Although each bibliographic record includes all information in a standard MARC II record, records in the bibliographic record file have been reduced to 78 percent of the size of the communication record largely by reducing redundancy in structural information. OCLC intends to compress bibliographic records further by reducing redundancy in text by employing compression techniques similar to those described in the literature.[13,14]

The holdings file contains a string of holdings records for each bibliographic record; individual records are chained with pointers. Information in each record includes identity of the holding institution and the holding library within the institution, a list of each physical item of multiple or partial holdings, the call number and pointers to the next record in the chain, and to the call number index. The last record in the chain also has a back-pointer to the associated bibliographic record. Whenever there is a unique note, dash entry, or extra added entry coupled to a holding, that holding has a pointer to a location in the third sequential file in which the note or entry resides.

Index Files

Indexes include an author-title index, a title index, and an LC card number index. Research and development are underway leading to implementation of an author and added author index and a call number index. A class number index will be developed and implemented in the future.

With the exception of the class number index, which by its nature is required to be a sequentially accessible file, the OCLC indexes are scatter storage files. The construction of and access to a scatter storage file involves the calculation of a home address for the record and the resolution of the collisions that occur when two or more records have the same home address. The calculation of a home address comprises derivation of a search key from the record to be stored or retrieved and the hashing or randomizing of the key to obtain an integer, relative record address that is converted to a storage home address. The findings of OCLC research on search keys has been reported.[9–11]

The hashing procedure employs a pseudorandom number generator of the multiplicative type:

Home Address = $\text{rem}(Kx_n/m)$

where K is the multiplier 65539, x_n is the binary numerical value of the search key, and m is the modulus which is set equal to the size of the index file; "rem" denotes that only the remainder of the division on the right-hand side is used. Philip L. Long and his associates have shown that efficiency of a scatter storage file is rapidly degraded when the loading of the file exceeds 75 percent[12]; therefore, OCLC initially loads files at 50 percent of physical capacity. Hence, the modulus is chosen to be twice the size of initial number of records to be loaded. When 75 percent occupancy is reached a new modulus is chosen and the file is regenerated.

Collisions are resolved using the quadratic residue search method proposed by A. C. Day[15] and shown to be efficient.[12] In this method, a new location is calculated when the home address is full; the first new location has the value (home address—2), the second (home address—6), the third (home address—12) and so on until an empty location is found if a record is being placed in the file, or the end of the entry chain is found if records are being retrieved. When the file size m is a prime having the form $4n + 3$, where n is an integer, the entire file may be examined by m searches.

Retrieval Techniques

The retrieval of a record or records from the OCLC database is achieved in fractions of a second when a single request is put to the file, and rarely exceeds a second when queuing delays are introduced by simultaneous operation of upwards of fifty terminals. Response time at the terminal is greater than these figures because of the low communication line data rate, but terminal response time rarely exceeds five seconds.

Figure 6 shows the map of a record in the author-title index file and the title file. In the author-title file, the search key is a 3,3 key with the first trigram being the first three characters of the author entry and the second being the first three characters of the first word of the title that is not an English article.[9] For example, "Str,Cha" is the search key for B. H. Streeter's *The Chained Library*. However, any or all of the characters in the trigrams may be all in lower case. The author-title index also indexes title-only entries, but the title index provides a more efficient access to this type of entry.

The pointer in the record map in figure 6 is the address of the bibliographic record from

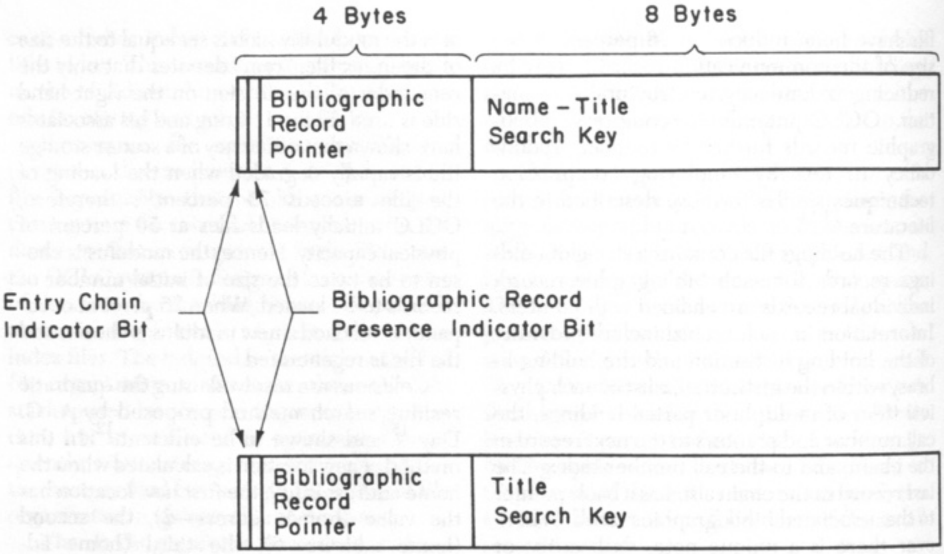

Figure 6. Author-Title and Title Index Records.

which the search key was derived. The Entry Chain Indicator Bit is set to 0 (zero) if there is another record in the entry chain and to 1 if the record is last in the chain. When this bit is 0, the search skips to the next record as calculated by Day's skip algorithm. The Bibliographic Record Presence Indicator Bit is set to 0 (zero) to indicate that the bibliographic record associated with this index entry has been deleted; it is set to 1 to indicate that the bibliographic record is present.

An author-title search of the database is initiated by transmission of a 3,3 key from a terminal. A message parser analyzes the message and identifies it as a 3,3 author-title search key by the presence of the comma and by there not being more than three characters on either side of that comma. Next, the hashing algorithm calculates the home address and the location is checked for the presence of a record. If no record is present, a message is sent to the terminal stating that there is no entry for the key submitted and suggesting other action to be taken. If a record is present and its key matches the key submitted and if the entry-chain indicator bit signifies that the record at the home address is the only record in the chain, the bibliographic record which matches the key submitted is displayed on the terminal screen.

If the entry-chain bit signifies that there are additional records in the chain, those records are located by use of the skip algorithm. If more than one record possesses the same key as that submitted, truncated author-title-date entries derived from the matching bibliographic records are displayed with consecutive numbering on the terminal screen. The user then indicates by number the entry containing information pertaining to the desired work, and the program displays the full bibliographic record.

The title-index record has the same map as the author-title record and is depicted in figure 6. The title index is also constructed and searched in the same manner as the author-title index. The title search key (3,1,1,1) consists of the first three characters of the first word of the title that is not an English article plus the initial character of each of the next three words. Commas separate the characters derived from each word. The title search key is "Cha,L,," for B. H. Streeter's *The Chained Library,* the three commas signifying that the message is a title search key. The bibliographic record pointer and the two indicator bits have the same function as in the author-title record.

Figure 7 exhibits the map for a record in the LC card number index. The three left-

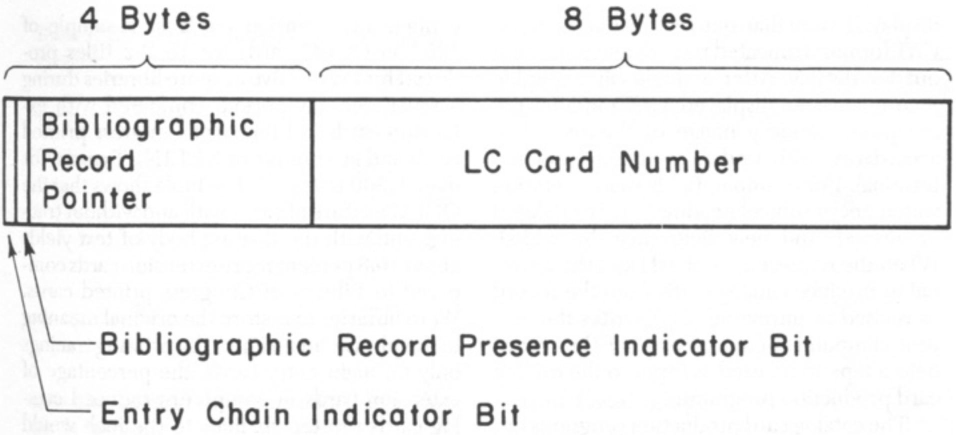

Figure 7. Library of Congress Card Number Index Record.

most bytes in the LC card number section contain an alphabetic prefix to a number where this is present, or, more usually, three blanks when there is no alphabetic prefix. Similarly the right-most byte contains a supplement number or is blank. The middle four bytes contain eight digits packed two digits to a byte after the digits to the right of the dash have been, when necessary, left-filled with zeroes to a total of six digits. The dash is then discarded. For example, LC card number 68-54216 would be 68054216 before being packed. The pointer and the two indicator bits have the same function as in the author-title index record.

An LC card number search is started with the transmission of an LC card number as the request. The parser identifies the message as an LC card number search by determining that there is a dash in the string of characters and that there are numeric characters in the two positions immediately to the left of the dash. The remainder of the search procedure duplicates that for the author-title index.

Online Programs

As is the case with all routinely used OCLC programs, the online programs are written in assembly language to achieve the utmost efficiency in processing. In addition, every effort has been made to design programs to run in the fastest possible time. In other words, one of the main goals of the OCLC online operation is lowest possible cost.

The simulation study had shown that it was necessary to modify the operating system of the XDS Sigma 5 so that the work area of the operating system would be identical with that of the applications programs. The XDS Real-time Batch Monitor, which is one of the operating systems furnished by XDS for the Sigma 5, has been extensively altered, and one of the alterations is the change to a single work area. Another major change to the operating system was building into it the capability for multiprogramming. At the present time, the online foreground of the system operates two tasks in that two polling sequences are running simultaneously, and the background runs batch jobs at the same time. This new monitor is called the Online Bibliographic Monitor (OBM).

An extension of OBM is named MOTHERHOOD (MH); MH supervises the operation of the online programs. MH also keeps track of the activities of these programs and compiles statistics of these activities. In addition, MH contains some utility programs such as the disk and terminal I/O routines.

The principal online application program is CATALOG (CAT); its functions are described in detail in the subsequent sections entitled "Cataloging with Existing Bibliographic Information" and "Input Cataloging." In general, CAT accepts requests from terminals, parses them to identify the type of request, and then takes appropriate action. If a request is for a bibliographic record, CAT identifies it as such, and if there is only one bibliographic record in the reply, CAT formats the record in one of its work area buffers and sends the formatted record to the terminal for display. If more than one record is in the reply, CAT formats truncated records and puts them out for display. After a single bibliographic record has been displayed, CAT modifies the computer memory image of the record in accordance with update requests from the terminal. For example, fields such as edition statement or subject headings may be deleted or altered, and new fields may be added. When the request is received from the terminal to produce catalog cards from the record as revised or unrevised, CAT writes the current computer memory image of the record onto a tape to be used as input to the catalog card production programs.

The catalog card production programs operate off-line, and the first processing program is CONVERT (CNVT), which formats some of the fields and call numbers. The major activity of CNVT is the latter, for libraries require a vast number of options to set up their call numbers for printing. CNVT also automatically places symbols used to indicate oversized books above, below, or within call numbers as required.

FORMAT is the second program; it receives partially formatted records from CNVT. FORMAT expands each record into the total number of card images corresponding to the total cards required by the requesting library for each particular title. FORMAT determines this total from the number of tracings and pack definition tables previously submitted by the library that define the printing of formats of cards to go into each catalog.

FORMAT, which is an extensive revision of EXPAND, contains many options not found in the old off-line catalog card production system. FORMAT can set up a contents note on any particular card, and puts tracings at the bottom of a card when tracings are requested. The author entry normally occurs on the third line, but if a subject heading or added entry is two or more lines long, FORMAT moves the author entry down on the card so that a blank line separates the added entry from the author entry. In other words, each card is formatted individually.

The major benefit of this feature, which allows the body of the catalog data to float up and down the card, is that the text on most cards can start high up on the card, thereby reducing the number of extension cards. The omission of tracings from added entry cards has a similar effect. Table 1 presents the percentage of extension cards in a sample of 126,738 OCLC cards for 18,182 titles produced for twenty-five or more libraries during a seventeen-day period, compared with extension cards in Library of Congress printed cards and in a sample of NELINET cards "for over 1,300 titles."[16] The table shows that the OCLC mixture of cards with and without tracings and with the floating body of text yields about 10.8 percent more extension cards compared to Library of Congress printed cards. Were libraries to restore the original meaning to the phrase "main entry" by printing tracings only on main entry cards, the percentage of extension cards in computer-produced catalog cards printed six lines to the inch would probably be less than for LC cards.

FORMAT also sets up a sort key for each record and a sort program sorts the card images by institution, library, catalog, and by entry or call number within each catalog pack. Another program, BUILD-PRINT-TAPE (BPT), arranges the sorted images on tape so that cards are printed in consecutive order in two columns on two-up card stock. Finally, a PRINT program prints the cards on an IBM 1403-N1 Printer attached to an IBM 360/50 computer.

Cataloging With Existing Bibliographic Information

This section describes cataloging using a bibliographic record already in the central file; the next section, entitled "Input Cataloging," describes cataloging when there is no record in the system for the item being cataloged.

The cataloger at the terminal first searches for an existing record, using the LC card number found on the verso of the title page or elsewhere. If the response is negative or if there is no card number available, the cataloger searches by title or by author and title using the 3,1,1,1 or 3,3 search keys respectively. If these searches are unproductive, the cataloger does input cataloging.

When a search does produce a record, the cataloger reviews the record to see if it correctly describes the book at hand. If it is the correct record and if the library uses Library of Congress call numbers, the cataloger transmits a request for card production by depressing two keys on the keyboard. Cataloging is then complete. If the LC call number is not used, the cataloger constructs and keys in a

Table 1. Extension Catalog Card Percentages

Number of Cards	OCLC MARC II Cards	Library of Congress Printed Cards	NELINET MARC II Cards
1	77.2	87.8	79.9
2	18.9	10.0	16.7
3	2.5	1.6	2.5
4	1.1	0.3	0.6
5	0.2	0.2	0.1
6	—	0.1	0.2

new number and then transmits the produce-cards request.

If the record does not describe the book as the cataloger wishes, the record may be edited. The cataloger may remove a field or element, such as a subject heading. Information within a field may be changed by replacing existing characters, such as changing an imprint date by overtyping, by inserting characters, or by deleting characters. Finally, a new field such as an additional subject heading may be added. When the editing process is complete, the cataloger can request that the record on the screen be reformatted according to the alterations. Having reviewed the reformatted version, the cataloger may proceed to card production.

When a cataloger has edited a record for card production, the alterations in the record are not made in the record in the bibliographic record file. Rather, the changes are made only in the version of the record that is to be used for card production. The edited version of the record is retained in an archive file after catalog card production so that cards may be produced again from the same record for the same library, should the need arise in the future.

The author index currently under development will enable a cataloger to determine the titles of works in the file by a given author. The call number index, also currently being developed, will make it possible for a cataloger to determine whether or not a call number has been used before in his library. The class number index that will be developed in the future will provide the capability of determining titles that have recently been placed under a given class number or, if none is under the number, the class number and titles on each side of the given number.

Input Cataloging

Input cataloging is undertaken when there is no bibliographic record in the file for the book at hand. To do input cataloging, the cataloger requests that a workform be displayed on the screen (see figure 8). The cataloger then proceeds to fill in the workform by keyboarding the catalog data, and transmitting the data to the computer field by field as each is completed. As shown in figure 8, a paragraph mark terminates each field; each dash is to be filled in by the cataloger for each field used. Input cataloging may be original cataloging or may use cataloging data obtained from some source other than the OCLC system.

When the catalog data has been input, revised, and correctly displayed on the terminal screen, the cataloger requests catalog card production. In the case of new cataloging, not only are cards produced, but also the new record is added to the file and indexed so that it is available within seconds to other users. If a MARC II record for the same book is subsequently added to the file, it replaces the input-cataloging record but does not disturb the holdings information.

Union Catalog

Each display of a bibliographic record contains a list of symbols for those member institutions that possess the title. In other words, the central file is also a union catalog of the holdings of OCLC member libraries, although in the early months of operation these holdings data are very incomplete. Nevertheless, they will approach completeness with the passage of time and with retrospective conversion of catalog data. Titles cataloged during the operation of the off-line system have been included in the union catalog.

```
Type:                Lang:
Form:                ISBN
Intel lvl:           Card No:
Bibl lvl: ¶
¶
▷ 1  1-- --       d ¶
▷ 2  24- --       b c ¶
▷ 3  250            ¶
▷ 4  260 -        b c ¶
▷ 5  300          b c ¶
▷ 6  4-- --       d ¶
▷ 7  5-- -          ¶
▷ 8  6-- --         ¶
▷ 9  7-- --       d ¶
▷ 10 8-- -          ¶
▷ 11 092          b ¶
▷ 12 049 --         ¶
▷ 13 590            ¶
```

Figure 8. Workform for a Dewey Library.

The union catalog function is an important function of the shared cataloging system, for it makes available to students and faculties, through the increased information available to staff members, the resources of academic institutions throughout Ohio.

Libraries also use the union catalog as a selection tool since they can dispense with expensive purchases of little-used materials residing in a neighboring library. Members also use the file to obtain bibliographic data to be used in ordering.

Assessment

With over nine hundred thousand holdings recorded in the union catalog as of April 1973, it is clear that having this type of information immediately at hand will greatly improve services to students and faculties. Enlargement of holdings recorded will enhance the union-catalog value of the system. Wright State University is in the process of converting its holdings using the OCLC system, and the Ohio State University libraries—the largest collection in the state—has already converted its shelflist in truncated form. The OSU holdings information will soon be available to OCLC members.

Members using the OCLC system report a large reduction in cataloging effort. Two libraries using LC classification report that they are cataloging at a rate in excess of ten titles per terminal hour when cataloging already exists in the system. Libraries using Dewey classification are experiencing a somewhat lower rate.

The original cost-benefit studies were done on the basis of a calculated rate of six titles per hour for those books for which there were already cataloging data in the system. The net savings will be realized when the file has reached sufficient size to enable the largest libraries to locate records for 65 percent of their cataloging and for the smallest to find 95 percent. To reach this level, members collectively would have to use existing bibliographic information to catalog 350,000 titles in the course of a year, or an average of approximately 1,460 titles for the total system per working day. It was thought that this rate would be attained by the end of the second year of operation. However, at the end of the first month of online operation, over a thousand titles per day were being cataloged.

The new catalog card production programs operating on the Sigma 5 are much more efficient than the programs used in the older off-line system. Earlier in this paper it was reported that the cost of the older programs to format catalog cards, but not to print them, was 2.27 cents per card. If costs of the Sigma 5 are calculated at commercial rates, the new programs format cards at 2.21 cents per card. However, if actual costs to OCLC are used and with the total cost being assigned to one shift, the cost of formatting each card becomes 0.86 cents. The total cost of producing catalog cards is, of course, much more than the cost to format them on a computer. Nevertheless, either the 2.21 cent or 0.86 cent rate might serve as a criterion for measuring the efficiency of computerized catalog card production.

The low terminal response-time delay for the operation of seventy terminals is a good gauge of the efficiency of the online system. In particular, the file organization is efficient, for it enables retrieval of a single entry swiftly from a file of over 600,000 records. Moreover, no serious degradation in retrieval efficiency is expected to arise as the result of the growth of file size.

The system operates from 7:00 a.m. to 7:00 p.m. on Mondays through Fridays, and at times the interval between system downtimes has exceeded a week. It is rare that the system will be down on successive days, and when a problem does occur, the system can be restored within a minute or two. Moreover, when the system goes down, only two terminals will occasionally lose data, and most of the time, there is no loss of data. Hence, it can be concluded that the hardware and software are highly reliable.

In summary, it can be said that the OCLC online shared cataloging system is easy to use, efficient, reliable, and cost beneficial.

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Index to Advertisers

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Stanford University's BALLOTS System

Project BALLOTS and the Stanford University Libraries

The library automation program at Stanford University is called BALLOTS (Bibliographic Automation of Large Library Operations using a Time-sharing System). BALLOTS is an online, interactive system that has been supporting the day-to-day acquisition and cataloging operations of the Stanford University Libraries since November 1972. This article describes the background and functional capabilities of the system and the hardware environment in which it operates. Line managers in the library who are responsible for running the BALLOTS system discuss its impact on library procedures and staff. Prospects for extending BALLOTS to network use are summarized.

BACKGROUND

In early 1967, following a period of rapid growth in library staff and in the volume of items processed, Stanford University received a grant (and a subsequent extension) from the U.S. Office of Education (USOE) to create a flexible and reliable online system for bibliographic control. The focus was on supporting library technical processing in order to reduce the clerical workload by placing the burden of repetitive tasks on a machine system; using a time-sharing computer already serving several groups of users; creating an online system with multifile and multiindex capabilities; and using video display units. The design of the system was to allow for its extension, in phases, from technical processing support to other areas of library operations and eventually to other libraries. Additionally, a long-term project goal was to reduce per-unit costs for acquisition and cataloging while allowing the library to handle more materials without a proportional increase in the size of the staff.

Under the two USOE grants, a prototype acquisition system (BALLOTS I) was designed and implemented by BALLOTS in collaboration with SPIRES (Stanford Public Information Retrieval System), a Stanford project funded by the National Science Foundation.[1] BALLOTS I was operated for a nine-month period in 1969 in the Stanford University Libraries. At the end of this period, the system was evaluated and the design of the production version begun. User response to the prototype system was excellent. Library personnel who were borrowed part-time from library departments in order to staff specialized data preparation and input units learned to operate the system in one-third the planned training time. Typewriter terminals were used because at that time no economical or suitable video display unit was found, but these terminals proved to be noisy and slow. User-initiated backup procedures were required to ensure file protection—a practice that proved inadequate. The BALLOTS I prototype system was too costly for production operations.

After the prototype evaluation, the requirements for the production system were clear: (1) reliability—minimum downtime; (2) rapid recovery time; (3) file integrity—procedures had to be designed into the software that would protect all files from user-, program-, or equipment-initiated failure; (4) cost acceptability—in the long run, the system would have to be able to handle an increasing volume of work at a cost equivalent to or less than the cost of a manual system handling comparably increasing workloads; (5) procedural integration—the system had to be integrated into the day-to-day work of the acquisition and cataloging departments rather than segregated in specialized units.

In 1972, BALLOTS applied for and received a two-year joint grant from the Council on Library Resources and the National Endowment for the Humanities to implement a series of ten cumulative technical processing "modules" or sets of capabilities.[2] This work resulted in the operational BALLOTS II production system described below.

The development cycle for each system module included the following steps: (1) determine the system requirements; (2) prepare written specifications; (3) update these specifications in response to library and programmer review; (4) program (including design, coding, checkout, and documentation); (5) perform system acceptance testing (both systems analyst and library user testing); (6) train users; and (7) begin production. Because of the extensive acceptance testing before production, parallel operations in the library were not carried on after the onset of production.

Currently, the BALLOTS staff is organizationally part of the Stanford Center for Information Processing (SCIP), reporting to the associate director for library and administrative computing. The project director and staff also have a dotted-line relationship with the Stanford University Libraries and are represented on the library's organization chart as the Automation Department.

SYSTEM OVERVIEW

BALLOTS II (hereafter referred to simply as BALLOTS) has been in continuous production at Stanford since November 1972, when the first module was implemented, providing comprehensive online technical processing services in the Stanford University Libraries.

For the Acquisition Department, the system supports the ordering, claiming, canceling, receiving, and in-process control of monograph materials arriving on regular or standing orders; the receiving and in-process control of materials received on approval or blanket plans, by exchange, or gifts; the ordering, claiming, and canceling of serials; and the procurement control of out-of-print materials. Claiming for serials includes automatic follow-up until the first piece of a new subscription is received; claiming for all other materials (including standing orders for terminal sets) includes antomatic follow-up of orders on a regular schedule until the entire order is filled or canceled.

For the Catalog Department, the system supports the in-process control, cataloging, and records maintenance of all materials (monographs, serials, terminal sets, microtexts, etc.) cataloged in the roman alphabet, including transliterated Cyrillic. The system also enables one to establish automatic, repeated standing searches against the BALLOTS MARC file; this capability will be described later.

As one result of each day's online activity in the library, the following morning the library receives all the printed documents required in processing. Se-Lin spine labels are printed at a computer typewriter terminal in the library.

The BALLOTS system uses programmable CRT (cathode ray tube) terminals in the library that are connected to an IBM 360 model 67 computer, approximately one mile away. This computer also supports the faculty and student academic and research computing. About 2,000 computing jobs, in addition to BALLOTS, are run on this computer each day. The online portion of BALLOTS utilizes approximately 3 percent of the computer capacity during normal working hours.

FILES AND INDEXES

The system supports several online files accessible through a powerful set of indexes. Currently, in addition to the BALLOTS MARC file, there are three generic types of files that may be created: (1) in-process—containing bibliographic and acquisition or in-process control information; (2) catalog data—containing bibliographic and holdings (shelving location, copy number, and call number) data; and (3) reference—containing see, see also, and explanatory references to catalog data. At this time, two libraries (the Stanford University Libraries system and the Meyer Undergraduate Library) have their own in-process, catalog data, and reference files. For a particular library, the in-process, catalog data, and reference records appear to belong to separate files. In fact, there is a single file; index qualifiers specify the library to which a record belongs and whether the bibliographic record being searched is in process, has been cataloged, or both, or if it is a reference entry that refers to another form of entry used in catalog data file records.

The characteristics and use of the MARC and other files are discussed below, followed by a discussion of each index.

MARC File

The MARC file is updated once a week with records received from the Library of Congress (LC) on magnetic tape. LC MARC tapes are converted into BALLOTS internal format and incorporated into the MARC file and its indexes. Records may be copied from the MARC file for inclusion in the in-process or catalog data file, and they may be altered in the in-process or catalog data file, but they are never changed (by the user) in the MARC file. If a revised MARC record arrives, the first record is deleted and replaced by the revised version. This automatic replacement of MARC data occurs only in the MARC file.

There are four indexes to the MARC file that may be used alone or in combination to search the file. These are:

1. personal name,
2. corporate/conference name,
3. title word, and
4. Library of Congress card number.

In-Process File (IPF)

The IPF contains bibliographic and acquisition information for items on order or in process. If a title is ordered from a record found in the MARC file, the IPF entry for that book will contain a copy of the MARC record (either unmodified from MARC or modified at time of order by the user) and the acquisition information input at time of order. If a record is not found in the MARC file for the title to be ordered, and the title is not an added copy to a book already in the system (i.e., a record for the title does not already exist in the IPF or the catalog data file), then the Acquisition Department enters the most reliable bibliographic description available for the item. When the bibliographic description of an item is input, its source is indicated for later use in cataloging.

If the book ordered is an added copy to a title already in the catalog data file, the catalog data file record is used to order the added copy. Acquisition data are added and the catalog data file record can then be retrieved as an IPF record. Every physical item ordered or in process is represented by a separate set of data elements in the IPF record for that title, so that partial receipts, partial claims, and other partial record transactions can be handled. Status information attached to each item clearly indicates the location of each item or items in the stream of technical processing activities.

When all the technical processing for a title in the IPF is completed (i.e., the items in process are cataloged or the order canceled), the IPF status of the record is deleted from the indexes to the record, the acquisition information is deleted, and only a catalog data file record remains.

The IPF has five indexes that can be used alone or in combination to search the file. Four of these indexes are the same as those for the MARC file, and function in exactly the same manner. The additional fifth index is:

5. BALLOTS record identification number.

Catalog Data File (CDF)

The CDF contains complete bibliographic descriptions and holdings information (i.e., the copy number and shelving location of each copy) for items cataloged. The IPF record becomes a CDF record at the time the book is cataloged through the automated system. The bibliographic descriptions of items cataloged may come from various sources, e.g., MARC records, LC or NUC book catalog copy, Title II cards, LC proof slips, or original cataloging efforts. All bibliographic descriptions except MARC copy are keyed into the system by the user, either at the time of acquisition or at the time of cataloging. These records are reviewed during cataloging and are upgraded or modified as necessary to conform to cataloging conventions.

The CDF has the same indexing scheme as the IPF plus two more valid indexes:

6. Library of Congress subject heading, and
7. call number.

Reference File (REF)

The REF contains all the references required to locate a title in the catalog data file. These records are of three basic types: (1) see references, (2) see also references, and (3) explanatory/history references. The REF indexes are:

1. personal name,
2. corporate/conference name,
3. title word,
4. subject heading, and
5. BALLOTS record identification number.

Standing Search Request File (SSR)

A library may, using this file, institute an automatic regular search of the MARC file for entries expected to appear in a future weekly LC MARC tape. These automatic searches of the MARC file may be repeated for any number of months specified by the user. With this file, a library has the option of delaying original cataloging until an expected MARC record arrives and is added to the MARC file.

Indexes

Each BALLOTS file is accessible through a variety of indexes (see table 1).

1. Personal name (PN) index. If values exist in a record for any personal author data elements, the personal name portions of those values (i.e., excluding dates and relators like joint author or title) are indexed in the PN index. Title portions of author/title entries are indexed in the title word index. A series statement personal name is indexed only if it is traced in the same form.

2. Corporate/conference name (CN) index. The CN index is a "word" index. In a word index, every significant word in the value of an indexed data element is indexed. Frequently occurring words, such as institute, are not indexed. Title portions of author/title entries are indexed in the title word index. A series statement corporate or conference author is indexed only if it is traced in the same form.

3. Title (T) word index. The T index is a word index like the CN index.

4. Library of Congress card (CRD) number index. The one BALLOTS data element indexed in this index is the LC card number, and only the numeric portion (excluding revision, prefix, and suffix notations) is indexed. It is indexed for MARC, IPF, and CDF records.

5. The BALLOTS identification (ID) number index. Each record in an IPF, CDF, or REF file has a unique ID number that is added to the record when the record is created. The final digit is a check digit.

6. Subject (S) index. Only topical and geographic subject headings are included in this index for records in a CDF or REF file. The subject index is not a word index; the whole subject heading is treated as a single index term.

7. Call number (CAL) index. The CAL index is valid only for records in a CDF. The only data element indexed is the holding library's call number.

SEARCHING THE BALLOTS FILES

The BALLOTS search logic can be quite simple or quite elaborate. Simply stated, the user at the terminal keys a search request composed of the basic command "find," a valid name of the index to be used, and a value or values to be located. "Find t fire" will cause the system to gather a list of the records in the file that conform to this criteria—i.e., those that have the word "fire" somewhere in a data element indexed in the title word index (T). By using Boolean operators ("and," "or," "not") and requesting searches of more than one index at a time, the user can make his search broad or specific, depending on his purpose in searching the files.

An author's name in the personal name index can be searched for in a variety of forms. For example, the following variations, or any combination of them, would be accepted as valid search terms and would locate the same record:

White, J.E.M.	(initials)
White, M.	(some initials omitted)
White, J E M	(initials without periods)
white, jon ewbank manchip	(capitalization ignored)
J.E.M. White	(surname first or last)
Manchip White, J.E.	(surname first or embedded)
White, Jo Ewb Man	(implicit truncation of forenames)
Whi#, J.E.M.	(explicit truncation of surname through use of pound sign)

The BALLOTS system makes extensive efforts to recognize different versions of a personal name because the exact form of an author's name is not always known.

A user may truncate an index value using

Table 1. BALLOTS Files and Indexes

	Index						
Files	LC Card Number	Personal Name	Corp./Conf. Name	Title Word	LC Subject Heading	Call Number	BALLTOTS Record ID Number
MARC	X	X	X	X			
Catalog Data	X	X	X	X	X	X	X
In-Process	X	X	X	X			X
Reference		X	X	X	X		X

the pound or number sign; e.g., "find CN librar# automation" will retrieve all the entries in the corporate/conference index beginning with "librar" (libraries, library, librarian, etc.) and the word automation. The words need not occur in that order since each word is indexed separately. As another example, "find CAL QD450#" will retrieve all records indexed in the call number index with a call number that begins with QD450.

A subject heading search can be made as specific or as general as desired by the user. For example, "find subject Art#" will retrieve all entries in the subject index that have "art" as the first three letters (artists, artistic, art nouveau, etc.). This, of course, is liable to result in unmanageable output, so the user could specify a further criterion—"find subject Art# 19th Century," which would retrieve all the entries in the subject index with the character string "19th Century" coming somewhere after the string "art." When the truncation symbol is used to stand for words interior to the subject heading, there is implicit truncation at the end of the subject heading.

Each index term is qualified to indicate to which logical file (MARC, IPF, CDF, or REF) and to which library the associated data belongs. The user can specify the files he intends to search, or BALLOTS will establish a default sequence of files. If the initial search of a file yields no results, the system automatically goes on to search the next file in the sequence. If a single record is found in a file, the system automatically displays it for the user. If more than one record is found that meet the search criteria, the system informs the user of the number of records matched. At this point, the user can narrow the search by specifying additional requirements in an interactive session with the system. If he derives too few or zero results as a consequence of his commands, the system will retain the last non-zero result obtained, or the user may issue the "backup" command to reinstate the most recent result stack.

The user can now give the command "display," and BALLOTS will show him the first record of the result stack (the records retrieved in the search) on the CRT terminal screen. Paging commands can be used to see each record in turn, moving forward or backward through the result stack.

The display of data in searching is organized to be as meaningful as possible for the specific task. Data can be displayed on a variety of CRT screen formats. Depending on his choice of display format, the user can browse through search results at the level of the bibliographic information or at the level of the acquisition or holdings information.

TECHNICAL PROCESSING SUPPORT

BALLOTS technical processing support is divided into nine computerized functions: ordering, receiving, non-purchase-order material receipt, claiming and canceling, cataloging, in-process material distribution, catalog records maintenance, reference input and maintenance, and standing search removal. In addition, there is a tenth function that supports Meyer Undergraduate Library reserve book processing.

The user interacts with the system in each function at the CRT terminal by means of a unique "protocol," i.e., a prescribed and ordered set of user commands and display and input formats. Each protocol has two parts or modes: searching (discussed above) and record input/update. The protocol guides the user through his work, provides him with the appropriate subset of data, and ensures that all the necessary steps in the task are completed. By using a protocol to support particular technical processing activities, the system can (1) optimize the normal sequence of actions, (2) enable the user to deal with any exceptional situations that might arise, and (3) disable all actions that are extraneous or detrimental to a given activity. The protocol sets up boundaries to orient the user. Through the use of protocols, the system makes it as evident as possible what can, cannot, should, and should not be done at a particular point in a function.

In the input/update mode, information is presented to the user on the input/update CRT screen formats. Each protocol has a set of input/update formats for bibliographic information, for holdings information (call number, shelving location, etc.), and for acquisition information. The formats are designed to present as much recognizable information and as many valid associations as possible to the user. Data are always displayed in the same order and position, and wherever possible, each data element is prefaced with a mnemonic tag. In the design of these formats, careful attention was paid to spacing and alignment to clarify visually the distinction between tags and data.

The user is prompted with the commands for the most common route through a protocol, as a default option. Each screen format contains a command field (line 3 of 24) in which the system prompts a default command that will produce the next step in the main line of that protocol. Thus, the user does not need to take any special actions to deal with the usual cases. In figure 1, the format name ("OR1"—order input) to order a copy of the title is prompted by the system in the command line. Figure 2 is a sample of the bibliographic input/update format that a user would call for in order to alter some bibliographic information.

The command prompts are independent of the particular screen format on which they appear, since the same format may be used in several different protocols. For example, the format for input of basic bibliographic information (see figure 2) may be used to produce a purchase order or to produce a set of catalog cards. In other cases, a format that is required in one protocol may be optional in another.

The user can also instruct the system by command to take one of the options in a protocol. When it is necessary to depart from the common route, the user simply overwrites the prompted command with some other command.

BALLOTS programs perform online editing of the data elements on input/update formats. By testing the input data element values according to certain rules or against internal files of valid codes, the system immediately determines whether or not they are valid. After editing the data, if an error is detected, the system redisplays the input/update format, beginning with the first line in which an error occurs. The correct lines above this point are not redisplayed, although the user can have this done upon command, if needed. A two-digit code, indicating the nature of the error, now appears in front of each invalid field. When the errors have been corrected, the format is transmitted a second time and the data are then accepted.

When all the formats needed to perform a function have been filled in by the user and accepted by the system, the transaction is considered complete. The system then responds "ENTRY PROCESSED—ID = <number>—PDQ = <number>." If the bibliographic record is from the MARC file or has just been created, a machine-generated ID number is assigned to the record, and the record will be added to the appropriate file. If a record already in a BALLOTS file is used, the additional order or catalog information is appended to the existing record. A Print Data Queue (PDQ) number is a key assigned to the entry for overnight batch processing of a transaction where printed outputs are to be produced.

The user has immediate access to all the information input in a day and can examine an updated or just-created record as soon as the system has accepted its entry. Access to new records is limited to the use of the ID index until the following day. From then on, the records can be located through any of the available indexes.

All printed outputs except the Se-Lin spine labels are printed on a high-speed printer at the Academic Computing production services center. Members of production services support BALLOTS production around the clock. During BALLOTS online production hours, from 8:30 a.m. to 5 p.m. Monday through Friday, when the library staff are searching BALLOTS computerized files

```
 BFI            MRC        73-149449         ORDER       S              EAM-LOG
FIN PN BROWN, TOM AND T OIL AND ICE     -RESULT:      1 BOOK IN MRC
ORI
Brown, Tom, 1941-
  Oil on ice; Alaskan wilderness at the crossroads, by Tom Brown. Edited, with
an introd., by Richard Pollak.  San Francisco, Sierra Club [1971]
  159 p.  map.  21 cm.  (Sierra Club Battlebook)  $1.95

  1. Environmental Policy - Alaska.  2.Oil and Gas leases - Alaska.  I.TITLE
73-149449
CAL:HC109.A47E57
HC109.A47E53  301.3/1/09788  0871560461
SST:3S   CP:CAU   L:ENG   REC:AM     MS:C
```

Figure 1. Full Bibliographic Display Format.

and inputting data at the CRT terminals, operators and library staff communicate with each other via telephone about problems with hardware and software. The operators notify the library if any part of the system must be taken out of service. Production services is also responsible for seeing that the terminals are working properly. All BALLOTS batch production programs are run during Academic Computing's third shift (midnight to 8 a.m.). These jobs are run on a regular daily, weekly, and monthly schedule. A courier delivers printed outputs to the library every morning.

LIBRARY VIEW

The Acquisition Department

When BALLOTS was in the design stage, the Acquisition Department was promised a system that would, to a large extent, eliminate the paper in-process file, which, owing to its single access point, generally hindered order searching. In this regard, BALLOTS was eminently successful. The bibliographical searches and the receiving, claiming, and canceling personnel no longer plow through copies of orders that represent in-process materials; no manual files are retained. The variety of access to BALLOTS files has added to the efficiency of the search process and has significantly reduced the repetitive, error-prone typing of data. Additionally, typing orders and interfiling order slips are tasks that are no longer required; orders, requester notices, etc., are now generated by the computer. Claims and cancellations to vendors are now machine-generated (largely automatically), thereby decreasing the manual staff input formerly required. The BALLOTS automatic claim support has increased the service that now can be offered to requesters by ensuring timely, regular claims for materials, rather than waiting for serendipity. All of this translates into a staff saving of six positions or 33 percent of the Order Division.

Contrary to expectations, the imminent implementation of BALLOTS and the required training in late 1972 did not intimidate the staff. In time, everyone in the Order and Gift and Exchange divisions was fully trained in the system, even a person six months from retirement. People in the Serials and Binding and Finishing divisions were trained as required. Although the rate of learning

```
 BI1        S-IPF     73-149449            ORDER          S                 EAM-LOG
ORI
  SST 3S        REC AM            CP CAU            L ENG          TSTI Y
 TSUT
  ME- PN Brown, Tom, 1941-
  TST Oil on ice;
 TSSB Alaskan wilderness at the crossroads,
 TSRT by Tom Brown. Edited, with an introd., by Richard Pollak.
   ED
   PP San Francisco, Sierra Club
    D [1971]
   PG 159 p.
  ILL map.
   SZ 21 cm.
  LPR
  CRD 73149449          CRDS                         NUC
   LC HC109.A47E57                                                        MS C
  LCA
   DC 301.3/1/09788
 ISBN 0871560461
  SUP                                                                      GPC
  PUX
  RIP
```

Figure 2. Bibliographic Input/Update Format. Bibliographic information for a new title may be updated, as required, in the ORDER function.

varied, no one failed to master the use of BALLOTS.

Work processes have changed since BALLOTS became operational, with batching of tasks the most notable change. A limited number of available CRT terminals has necessitated scheduling terminal use and thus the batching of work. It has been possible to broaden searchers' duties; where they were formerly restricted to "African" or "science" searching, these narrow specialties may now be eliminated in favor of a general list of duties. Also, searchers now assume some responsibilities for claims and cancellations. The old routine of acquisition processing is now far from routine.

Although ordering and receiving backlogs have essentially been eliminated, there are new challenges for library administrators who must manage formerly manual departments that are now almost totally integrated with the BALLOTS services. First, the distinctions between acquisition and cataloging have blurred, and a departmental procedural integration is now underway. Nothing less than processing certain types of materials at time of receipt and producing catalog cards and spine labels will certainly become part of the Acquisition Department. Books may then bypass the Catalog Department and go from the receiver to the Binding and Finishing Division for stamping and labeling.

A second challenge is the value that staff place on their services once they are fully trained in the BALLOTS system. A significant learning process is required to master the BALLOTS acquisition functions; but does such learning significantly alter the personnel classification and pay of a bibliographical searcher? This is a question that has not yet been fully resolved.

The Catalog Department

In the past year, the Catalog Department has evolved from technical services based on manual procedures plus some automation support to an automated technical processing operation with some residual manual support. All staff members have been trained to use the BALLOTS system in some capacity and every functional unit utilizes the system in its daily work.

In 1973-74, the production level increased 3 percent over the previous year, and the arrears were reduced by 5.7 percent. These advances were made despite a 5.6 percent reduction in the effective work force for the entire reporting period. BALLOTS was a major factor in the increased productivity of the department. With the implementation of each module, production dropped during the periods of acceptance testing and staff training. Following a month of adjustment, there was a steady increase in production until implementation of the next module.

As of November 1974, approximately 80 percent of all titles cataloged were cataloged through BALLOTS (includes original cataloging and copy processing). Of all added copies processed, 30 percent were processed through BALLOTS and 36 percent of the added volumes were BALLOTS processed. By early 1975, BALLOTS is expected to process 90 to 95 percent of all titles handled by the department. Much manual processing was still necessary when the department began using the first module (BALLOTS MARC), but with the added capability of each successive module the only categories currently processed manually are manuscripts, sheet maps, and nonroman, nontransliterated languages.

Card preparation functions have been most affected by BALLOTS. Card duplication, heading typing, card set preparation, and card arranging were major activities in the manual system. These functions have been nearly eliminated, producing a positive offset of 5.5 FTE. All residual card duplication has been transferred to the Photoduplication Division, relieving the Catalog Department of all card duplication. Mainly as a result of BALLOTS card production capability, fourteen typewriters were released from the department for use elsewhere in the library.

Involvement in BALLOTS development, testing, and training was a time-consuming but essential activity for several key members of the department. Work with BALLOTS staff in the development effort on each module, review of system specifications, development of training materials, acceptance testing, and hands-on training had a considerable impact on the work and availability of these key staff members. Several staff members were involved full-time and several others part-time for one to two months with each module that had a major effect on cataloging procedures.

Work patterns have changed as a result of online bibliographic processing. Access to the terminals is scheduled for staff throughout the day with open periods at noon and in the late afternoon. This scheduled access requires that work be batched and well organized before the staff member comes to the terminal, and it affects each staff member's sequencing of preparatory work and other departmental activities.

Catalogers have the option of keying in their original cataloging or giving worksheets to support staff for input. The criterion for a cataloger's continued use of the system should be the manner in which the cataloger utilizes the system. If it is used only for input of bibliographic records, the input should be done by support staff. If the cataloger uses online files as a cataloging aid, this use should continue.

Differences in file organization between manual and machine systems have forced a reexamination of reference structure and search strategies. The card catalog tends to bring files together through reference structure and inverted entries. Machine file indexes are structured in such a way that files are split. The differences in required reference structure and search strategy between the two types of files have made necessary the training and reorientation of the staff in the maintenance and effective use of the machine-based files.

Several other areas affected by BALLOTS are discussed below, though the listing is by no means exhaustive:

1. Titles with MARC copy—are processed earlier in the flow of work, reducing the handling and the processmg time lag. A procedure will soon be initiated to process these books in the Acquisition Department receipt function. The books will then bypass the Catalog Department and go directly to end processing.

2. BALLOTS distribution function—provides an online control of books in the department, to the level of a cataloger's desk if necessary, greatly reducing the frequency and time necessary for requests for books in process.

3. Standing search requests—provide a more systematic approach in matching LC copy with books on the holding shelves and reduces the required staff time for this function.

4. Title II filing—has been reduced by about one-third since cards are not filed if the title is included in the online MARC file. With

an expanded MARC scope, Title II filing may be eliminated altogether.

5. Statistical counts—have been simplified as a result of BALLOTS-generated statistics.

The Catalog Department staff have enthusiastically accepted the BALLOTS system and generally adapted quite well to an online environment. The system has had a very positive impact on the department.

The Total Library

The possibility of realizing labor savings was conceived in the original BALLOTS design. To measure the savings, four offset studies have been conducted. The first was a theoretical model done prior to implementation; it estimated labor savings of $160,000. The second, third, and fourth studies were done at progressive intervals during the implementation of BALLOTS as a production system. Each of the latter studies addressed itself only to modules in BALLOTS that were in full production at the time of the study. As each new module introduced new facilities and services, the tendency has been for the offset to increase with each study. However, in comparison with the original estimate of $160,000, the results have been modest. Currently, the offset is estimated at 11.5 FTE positions, all at a clerical level, equivalent to about $88,074 when 15 percent staff benefits are included. (This figure is based upon a beginning salary level; offset is actually higher if longer term employees are considered.) Some additional offset is expected.

It may be thought that BALLOTS has realized no offset in professional time. This is not true in that certain activities assigned to professionals were eliminated through procedural changes (e.g., proofreading of overtyped headings on cards). Strictly speaking, these changes were not required by automation, but in fact were implemented in connection with it. Of course, much of the beneficial offset realized by these procedural changes has in itself been offset by the time required to train and supervise the support staff. But this will not go on forever at the intensive pace that was required during development. Indeed, the greatest evidence that significant additional offsets will be realized is the fact that throughout the development of, training for, and installation of numerous modules, production has consistently risen as staffing has declined. As the system stabilizes, less training and supervision will be needed, and additional procedural changes will be implemented. Foremost among the latter is physical repositioning and procedural integration of acquisition and cataloging to permit a straight-through flow of library materials. It is expected that this physical move will be followed by significant organizational change, aimed at obtaining additional efficiencies. No organizational changes are planned until the integrated operation has been sufficiently studied and observed to know what new procedures will make best use of the staff and the system. In combination, it is hoped that such changes will produce maximum realizable offset.

HARDWARE AND SOFTWARE

The BALLOTS CRT terminals are located in the Stanford main library in the Acquisition and Catalog departments. These terminals are connected via twisted pair cables to a multidrop box (Stanford-built modem) that acts as a shared data set, and then to a PDP-11/40 minicomputer in the academic computing branch of the Stanford Center for Information Processing (SCIP). The PDP-11, in turn, is connected to an IBM 2701 parallel data adapter that is connected to a selector subchannel on the 360/67 computer. The 360/67 runs BALLOTS along with general time-shared and batch campus computing jobs. BALLOTS runs as a subprocessor under ORVYL, the time-sharing monitor developed at Stanford. ORVYL uses the virtual memory capabilities of the 360/67. MILTEN, the terminal executive, is currently able to connect simultaneously about 125 interactive terminals of various types through both an IBM 3705 and the PDP-11 front-end communications controllers. The PDP-11 supports all the high-speed CRT display terminals. Simple display terminals such as the Tektronix 4023 are supported one to a line, while the intelligent terminals used by BALLOTS are multidropped—several terminals share a line. The BALLOTS files are stored on CDC 23142 double-density direct-access disk drives. The high-speed printer used for these jobs is an IBM 1403, which prints at about 350 lines per minute when an upper-lower case print chain is mounted.

The PDP-11 provides polling, buffering, translation, device transparency, terminal program loading, and some diagnostic capabilities. Whereas the 360/67 can interrupt the PDP-11 whenever the 360/67 has data to send, communication between the terminals and the PDP-11 is done on a polled basis. The PDP-11 continually asks each terminal if it has data to send. If a terminal is not active, the PDP-11 places it in a lower priority status and polls it less often than the active terminals. Once the terminal becomes active, it requires the more frequent polling status. The PDP-11 buffers the transfer of data back and forth between the terminals and the 360/67. In order to save core in the PDP-11, data can be transferred from the buffers in the PDP-11 directly to memory in the BALLOTS subprocessor within the time-sharing monitor. Therefore, as opposed to the implementation of the low-speed typewriter terminals, the PDP-11 implementation does not require buffering within the terminal executive (MILTEN) to handle the data.

The 360/67 sends and receives all data in EBCDIC character code. The PDP-11 does the translation for ASCII character code terminals. The PDP-11 also translates control codes, such as "clear screen" and "home cursor," to fit the particular needs of each terminal. This provides a degree of device transparency to the programs in the 360/67. The PDP-11 contains a copy of the program that runs in the BALLOTS programmable terminals. On request from one of those terminals, the PDP-11 can transmit a fresh copy of the program. This is necessary because the memory in the terminals does not retain the program when the power is turned off. The PDP-11 also supports rudimentary diagnostic and statistical services for the display terminal system.

The terminal used in the BALLOTS system is the Sanders PDS 804 programmable CRT terminal. This terminal includes a microprocessor and 4,096 bytes of programmable memory that permit specific computer programs to be loaded directly into the CRT terminal. These programs control the display of data, the keying, and the communication of the data to the main computer. This terminal can display 1,920 upper- and lowercase characters on a screen, in twenty-four eighty-character lines. Specific functions have been assigned to certain keys (such as the paging keys for displaying records retrieved from a search) to adapt the Sanders terminal to the uses of BALLOTS.

The terminal is programmed so that specified segments of lines on the screen or ranges of lines on the screen can be considered as a single data element field. These fields may be either protected or unprotected. A protected field is one in which the user cannot input data, although the system may display data there. During input at the keyboard, the cursor is prevented from entering protected fields; this constraint is part of the control program loaded in the terminal. (The cursor is a blinking underline character that indicates to the user his position on the screen.)

It should be pointed out that all of the features described here are programmed into the terminal and are not part of the hardwired logic of the terminal. This feature permits easy and convenient changes of screen design. Flexibility was one of the primary reasons for choosing a programmable terminal.

PRODUCTION COSTS

BALLOTS operating and maintenance costs are covered in the Stanford University Libraries budget. Operating costs are of five types: (1) file build and update costs, (2) online costs, (3) batch costs, (4) CRT terminal rental, and (5) CRT terminal connect time.

1. File costs (not including Library of Congress MARC tape subscription) consist of (a) costs for converting the MARC tapes to BALLOTS internal format, building the BALLOTS online MARC file and indexes, and dumping the file to tape; (b) costs for adding records to and updating the other BALLOTS online files and dumping these files to tape; (c) file storage costs on CDC 23142 double-density disks ($800 per month per IBM 2314 equivalent disk); and (d) general file maintenance activities, such as restoring a file.

2. Online costs are calculated by adding up the computing accounts used by the library for work on the CRT terminals. This online activity includes searching the files, ordering, cataloging, establishing standing search requests for MARC records not yet received on the weekly tapes, and so on. These costs vary directly with the number of library transactions.

3. Batch costs are both fixed and variable. The fixed batch costs include the costs of mounting special forms on the high-speed printer; mounting a reserved disk pack for overnight processing; and renting the IBM 2741 typewriter terminal used to print spine

labels. The variable batch costs are incurred for sorting, formatting, and printing the outputs for the library; for matching the standing search requests (SSR) file against the MARC file weekly; for purging the SSR file of outdated requests monthly; for running the weekly automatic claim program to determine orders for which claims must be produced; and for running monthly management statistics reports.

4. BALLOTS CRT terminals are rented for $270 per month with 4,096 bytes of memory. Purchase price of the Sanders 804 is approximately $8,000.

5. CRT terminal connect time is a fixed monthly charge of $1,200 for each group of from one to ten CRT terminals connected to the IBM 360/67 through the PDP-11 minicomputer.

The total monthly production and maintenance charges for November 1974 were $34,255. Of this, file costs were 56.2 percent; online costs were 18.5 percent; batch costs were 14.5 percent; CRT terminal rental costs were 7.3 percent; and terminal connect-time charges were 3.5 percent. System and procedural fine tuning and improvements underway and planned will reduce this monthly cost. In the long run, sharing common costs such as file building will reduce the cost to each library participating in a network. In addition, dividing and sharing original cataloging efforts and keying for nonMARC LC copy will mean direct savings. Currently, the Stanford University Libraries pay the entire cost of running and maintaining the system.

FUTURE PLANS

The application of computer technology to library operations, and the development of regional and national networks of libraries based on this technology, promise to provide help in solving the dilemma of tightening budgets versus increasing demands for libraries to serve their clientele more fully. In contrast to manual library systems, which make widespread sharing of library resources cumbersome and slow, automated library systems have the potential advantage of being used rapidly and simultaneously by more than one institution. When an automated system is shared by a network of libraries, the price tag of the system to each user is reduced and the rising costs of the highly labor-intensive library environment are curbed.

The benefits of automated library systems are not just economic. Shared computer systems provide libraries with access to more than the resources of their own collections. Libraries in a network can share the entire network's joint bibliographic resources with students, faculty, staff, and the community at large. Resource sharing can be optimized through coordinated purchasing and interlibrary loans, facilitated by network files accessible to all libraries in the region and by direct communication with other library networks.

Stanford has been exploring with in-state groups the possibility of a California library automation network. The plan is to utilize BALLOTS as the online vehicle for a network that would incorporate the major complementary capabilities and databases of other existing systems in the state. In addition, BALLOTS has been asked by out-of-state groups to explore the possibility of communication between the California network and other networks and bibliographic centers in the western region, where the feasibility, logical rationale, and need for the benefits of such communication all exist.

BALLOTS' approach is to seek to pool resources in order to form a reliable, flexible, and economical network to support and improve the services provided in common by every type of library in the state—public, private, large, small. The plan is to make this a regional network, adhering to national standards and capable of communicating with other systems and networks in California and other states.

CONCLUSION

The BALLOTS system design includes several unique features. The most notable of these are the flexible interactive searching capability; the standardized screen formats; the protocol structure and the command language associated with it; the programmable CRT terminal that aids the user in input and display; and the fact that an entire screen full of data is entered and processed at one time, rather than just one data element at a time.

The BALLOTS system is intended to provide a library tool used in the library's daily production environment. The system was designed with the help of the library and is being used by the regular library staff. The BALLOTS system is designed to stimulate the user's motivation. The system supplies routine data wherever possible, thus saving the user a great deal of repetitive keying. The online editing functions of the system verify the codes and either generate the appropriate data or return an error code to the user. The user receives positive confirmation each time a task is completed and a record is added to or updated in the file. Each format carries a control line identifying the function, file, and record in use. The user can refer to this information if he gets lost or confused. As a result of this careful user interface analysis and planning, no special terminal operators are required in the library. Throughout, continual efforts were made to create a system as convenient and useful as possible to the library staff.

To date, the BALLOTS system has encountered ready acceptance by its users in the library, who find the system easy to learn and use. One of the major advantages of the system is that with a minimum of clerical effort (the searching and keying done at the CRT terminal), the library can obtain for each title searched a purchase order, vendor invoice, first and second claim notices, cancellation notices, a catalog data slip, two spine labels, catalog cards, etc.

At a number of points in the system, smoothing the way for the user has meant increasing the complexity of the BALLOTS analysts' and programmers' tasks. This paper has made no attempt to describe the program structure underlying BALLOTS operations.[3]

ACKNOWLEDGMENTS

The system that this paper describes was designed, developed, and implemented by the project BALLOTS staff: Marlene Amiot, Hanan Bell, Glee Cady (former staff member), Gilbert Chang (former staff member), Wayne Davison (former staff member), Hank Epstein, Jennifer Hartzell, Tim Logan, Donn Martin, Charla Meyer, Eleanor Montague, Baxter Moyer, Norman Roth, and Lennie Stovel. Ralph Hansen, Lawrence Leonard, and Allen Veaner of the Stanford University Libraries provided section VI, "Library View." The preparation of this paper was coordinated by Eleanor Montague.

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The search routines and file service routines used in BALLOTS were developed by members of the SPIRES project (Stanford Public Information Retrieval System); the work of Richard Guertin, William Kiefer, and John Schroeder has been vital to the success of BALLOTS.

REFERENCES AND NOTES

1. SPIRES is a generalized information storage and retrieval system. During BALLOTS' development phase, BALLOTS collaborated with SPIRES to define and develop overlapping requirements between the two systems. SPIRES development provided access to and retrieval of bibliographic records created through online transactions (e.g., BALLOTS activity) or furnished from outside sources (e.g., MARC).

   All BALLOTS online files have been made available publicly through SPIRES. Nearly any terminal in the United States capable of dialing Stanford's IBM 360/67 computer can search these files. Additional information on searching via SPIRES is available in a document entitled "A Guide to BALLOTS Files."
2. U.S. Office of Education, Department of Health, Education and Welfare grants OEG-1-7-071145-4428 and OEG-0-70-5237 ran from June 1967 to March 1971 and totaled $1,168,890. During that time, Stanford direct expenditures totaled $238,700.

   From March 1971 to September 1972 Stanford funded all continuing development of BALLOTS, which represented direct expenditures of $283,580. In September 1972 a joint council on Library Resources and National Endowment for the Humanities grant was awarded in the amount of $650,000. This grant ended in November 1974.
3. For a description of BALLOTS software, see *Final Report of the BALLOTS Project to the National Endowment for the Humanities: September 1, 1972—August 31, 1974.* (Library Computing Services (BALLOTS Project), Standard Center for Information Processing, Stanford University, Stanford, California.) ■■

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The Washington Library Network's Computerized Bibliographic System

Mary Jane Pobst Reed

The Washington Library Network is developing a computer-assisted bibliographic system to speed and expand library operations throughout the state. Features include MARC format with all content designators, subject and name authority files, sorting by LC rules, and stringent quality control. Future modules will add acquisition/accounting and circulation support. Online capabilities are currently under development.

This paper describes the present batch-mode cataloging support subsystem, its history, operation, impacts, problems, and costs. Present developmental efforts toward online integrated acquisitions and cataloging support are indicated.

INTRODUCTION

The Washington Library Network (WLN) is developing a computer system to speed and expand library operations. The WLN emphasizes the sharing of resources among all types of libraries and the economies of a centralized computer-communications system to provide assistance for libraries' internal functions, boosting the power of libraries to respond to today's rapidly increasing information demands within ever-tighter funding patterns. Such a system would incorporate at least the following qualities:

• Adaptability to various computer configurations and library requirements;

• Ability to access and update current data in an online mode;

• Assistance to most library functions: order and receipt, cataloging and processing of materials, accounting, circulation, reference searching;

• Ability to handle all kinds of bibliographic records;

• Careful quality control for accuracy and completeness of data;

• Ability to intake and output MARC II formatted records, for standardized communication with other libraries' computer systems; and

• Capacity to serve multiple libraries in a network configuration.

This computer-communications system is designed with the potential to be broadened to a multistate network, to be interfaced with or be emulated by other libraries' or states' computer systems, and subsequently to become an integral part of national and international information networks.

A basic assumption is that the totality of library information in any area or state or region or in the entire nation is a people's resource which, as with the educational system, should be sustained and made available equally to all in the public interest. All citizens, regardless of domicile location or economic or physical problems, should expect convenient access to library resources and information services for their self-enrichment, economic well-being, and entertainment. With the help of new technologies, the ability of libraries to provide their constituents with wanted resources can be improved. The Washington Library Network is the outgrowth of statewide planning to realize this overriding concern.

ENVIRONMENT OF SYSTEM

Library development in Washington encompasses a long history of intrastate and interstate cooperation. An early expression of the latter is the establishment of the Pacific Northwest Bibliographic Center (PNBC) in 1940 to serve Montana, Idaho, Oregon, Washington, and British Columbia (later adding Alaska); PNBC was reorganized in 1970 to improve the interlibrary loan flow throughout the region. Based on a long-range library development plan initiated by the Washington Library Association in the 1930s, fifteen district library systems now coordinate public library services to over 60 percent of the state's population. (Only 4 percent of the population lack public library service at present, with 36 percent served by municipal and club libraries.) Active cooperation continues to expand with such endeavors as community college consortia, area programs involving various types of libraries, liberalized interlibrary loan procedures, and multidistrict patron cards. Various intrastate serials listings have been published: e.g., a statewide serials title list, a serials holdings list at the University of Washington, and a union list of serials holdings for the libraries in the Spokane area. The State Controlled Area Network telephone service has been extended to public and academic libraries throughout Washington to facilitate resource sharing. Leaders in the library profession have over the years sustained the vision and the climate for such a statewide effort as the Washington Library Network's computer system.

The chronology of data processing in Washington libraries goes back at least to 1951, when the King County Library began publication of the earliest continuous machine-based public library book catalog in the nation. From 1966 to 1968, the Washington State Library (WSL) participated in the Library of Congress' MARC I pilot project, utilizing the MARC I tapes to produce catalog cards, book cards, pocket and spine labels, and a rudimentary book catalog. In 1967 the state's library profession accepted in principle the Becker and Hayes report, *A Proposed Library Network for Washington State*, and designated the State Library as responsible for spearheading development of the Washington Library Network.[1] Additional studies by State Library personnel laid the groundwork for more specific decisions.[2–4]

On the basis of these studies and experiences, Washington librarians agreed on the desirability of developing a computer system to aid the state's libraries in coping with the ever-growing problems of handling information. A prime goal of the system was to expedite the sharing of resources among all libraries of the state, so that a citizen anywhere in the state might have access to material in any library of the state. At the same time, the system was expected to improve the efficiency and economy of libraries' operations through reduction of duplicate acquisitions, better control of bibliographic records, and improved interlibrary communication. In general, service to users was to be improved without a proportional increase in expenditures.

The system must assist all types of libraries in their appropriate internal functions and must be capable of dealing with various types of materials. Structurally, a centralized computer hardware facility was envisioned with subcenters for some area cooperative functions such as materials processing or bibliographic referral, these functions to be determined on the basis of evolving experience. Additionally, the system must be capable of becoming a node in a national bibliographic network. As a corollary, adherence to the MARC II communications format was a stated requirement as the basis for external compatibility.

With these requirements in view, computer-assisted library systems throughout the nation were surveyed and evaluated. Each system failed in some aspect to meet all the basic criteria: most were designed for utilization by a single library, e.g., Bibliographic Automation of Large Library Operations using a Timesharing System (BALLOTS); or were limited to serving only some of the desired library functions, e.g., New York Public Library (NYPL); or lacked adequate provision for quality control, e.g., Ohio College Library Center (OCLC). The one weakness seemingly common to all was an inability to create local records in the MARC II format with all content designators, and to output records in the same standard communications format. On the basis of this evaluation, it was decided that no existing system should be adapted, but a computer system must be developed to match the Washington Library Network's specifications.

PILOT SYSTEM

In 1971 the Washington State Library Systems Group and a team of consultants completed the preliminary design of a Basic Bibliographic System for the Washington Library Network. In this study the file structure and the file access and retrieval methods were defined, the major program modules were identified, and the data flow was described. This work was the basis for the computer system design for the Resource Directory Pilot Project.

In spring 1972, funding was provided by the state legislature, and a contract was entered with Boeing Computer Services (BCS) for technical design and development, pursuant to a decision that WSL would establish an in-house technical staff only for operations, not for development. The Boeing Technical Library and BCS had prior experience in library automation, having developed and operated the MECCA (MEchanized Card CAtalog) system since 1963.[5] To insure that library need would override technological convenience, WSL specified that a librarian must be head of the technical team to fulfill the contract, and the director of the Boeing Technical Library was transferred to BCS to manage the team. The contract provided that the system, when developed, would be installed in the state Data Processing Service Center (DPSC) and that the software would be under the control of Washington State.

The Resource Directory Pilot Project had the following deliverable objectives:

1. create a database of bibliographic and location records for monographs acquired by participating libraries;
2. produce a pilot resource directory for the participating libraries;
3. maintain a database of all Library of Congress MARC records;
4. provide cataloging information so that duplication of searching and original cataloging are minimized;
5. provide experience in the operation of computerized systems for producing a directory;
6. provide a cost analysis to determine the economic feasibility of a statewide resource directory and/or custom directories for areas or for individual libraries.

The pilot system as outlined in early 1972 was to evaluate the feasibility of the generalized system design and specifically to test the practicality of the resource directory function. State-level professional groups reached consensus on other requirements: rigorous quality control, development of an authority file, capability of sorting by library rules rather than the usual computer style. The form of the resource directory was defined; input, output, system logic, file layouts, and record formats were described.

The products of the proposed network included publication of a directory of the holdings of libraries throughout the state (resource directory); cataloging and processing materials; bibliographic information; and assistance for acquisitions, circulation, and reference functions. Resource directory production was evaluated as the most complex and difficult of these tasks; it was therefore selected as the focus of the pilot system, since if resource directory publication was not feasible, then the network structure as envisioned would have to be modified radically.

In 1972 the computer programs were designed, coded, and checked out, with technical expertise provided by BCS under contract. Program modules were integrated, and the system was tested. An Input Center was established at the State Library and personnel were trained in MARC editing and keyboarding for input. A Resource Directory Advisory Committee was set up, with representation from the participating libraries, consultants, and all types of libraries within the state. This group and its subgroups conferred frequently to assess progress and to discuss policy decisions. The State Library's technical services personnel worked closely with Boeing Computer Services to implement decisions and to provide detailed interpretations for programmers. In May, cataloging records in proof sheet form began to be provided from the computer for participating libraries to establish a standard pattern for local cataloging and to integrate machine-produced cataloging with extant systems. A two-day workshop was held in June 1972 for catalogers and other staff from the participating libraries. This session included an introduction to MARC editing and orientation in the system's operation.

Participants in the pilot project were six district system libraries and the Washington State Library (representing ninety libraries altogether). Early plans had included all types of libraries, but time pressures allowed for minimal training and standardization efforts, and it was therefore decided to limit participation to a relatively homogeneous group. The system libraries were chosen primarily on the basis of need: branch libraries had no information on the total system's holdings, and in two of the headquarters no central card catalog existed; the resource directory was thus an immediately useful tool to the participants. The pilot system was in action from July through September 1972, using Library of Congress MARC tapes, receiving acquisitions information from the participating libraries, and providing cataloging information from MARC records or local input for the titles ordered. The pilot development concluded in December 1972 with the publication of the pilot resource directory, BCS completing the contract within the nine-month schedule and at a cost below the contract bid. The system was installed in the State Data Processing Service Center (DPSC) in January 1973 for ongoing operation; political considerations dictated the hardware environment, though for some months service was unreliable. The tight schedule and cost restrictions necessitated some compromises in development: insufficient attention could be devoted to system design (e.g., three of the four main segments of the weekly run required human examination of output prior to starting the next segment); alternative file structures and data manipulation procedures could not be thoroughly investigated; documentation and cost analysis were delivered at a later date; optimizing of the system was not possible within the time frame; the manual operation's details could not be sufficiently analyzed; and, as mentioned above, only public library systems were included in the pilot. Of these potential problem areas, the manual interface presented the most immediate limitations to the system's operation, and will be described below.

The computer system was installed at the Washington State DPSC on an IBM model 370/145 and subsequently, when the DPSC changed computers, shifted over to a 360/65 with OS/MVT. Operation in 1973 required 200K core, four nine-track magnetic tape drives, four (now six) IBM 3330 disc drives, a 1403 printer, and an ALA print train. Programs were written in PL/1 (seventy-five routines, 16,800 statements), and BAL (thirty-two routines, 15,900 statements). Input is via punched cards, modified IBM Magnetic Tape Selectric Typewriter (MTST) and Digidata converter, and LC MARC tapes.

SPECIAL FEATURES OF THE WLN SYSTEM

The Washington Library Network computer system is designed to serve most internal library functions in a network of all types of libraries. Other networks, such as OCLC, have been limited to a few functions such as cataloging and interlibrary loan support, and single library systems, such as Stanford's BALLOTS, have provided support to most library functions; WLN was undertaken with both aspects as major considerations. (Both mentioned systems are now moving toward this combination of aspects.)

A machine-readable authority file with names, subjects, and cross-references has been incorporated. The WLN authority subsystem is now a single set of authorities; it is expected that as the online network expands to more participants, a multiplicity of authority files may exist, some shared by several libraries and some unique to a specific library or unit within a library. Central monitoring will be necessary to maintain shared authority files.

The WLN system maintains the complete MARC database, with no records eliminated or curtailed and with all content designators retained. WLN's system has the ability to output records in the fully coded LC MARC communications format; in fact, a test tape, sent in the spring of 1973 to the Library of Congress, containing WLN locally input records was run through LC's system with no problems. The data were read into LC's programs, which translate from the MARC communications format to LC's internal format, and catalog cards were then produced from LC's programs. The necessity for communication among systems has become evident as national bibliographic exchange is envisioned, and other major systems (e.g., OCLC, BALLOTS) are now making the effort to develop this capacity for outputting in standard communication format.

The sort programs enable the computer to produce listings based on filing rules developed by John Rather at the Library of Congress; these sorts are used for the resource directory, two-week interim listings of titles received, and vocabulary lists, and can sort records for CRT display.[6] The Library of Congress has purchased these sort key generating programs and incorporated them into its internal system for terminal display and book catalog production.

The quality control routines of the WLN system require stringent manual screening procedures for content and content designators. Some alterations in methods will be necessitated by the online operation, but centralized control will continue to maintain high standards. At present, input of a local record averages about twenty minutes in manual effort, including tagging, vocabulary searching, MTST keying, proofing MTST hard copy, and proofing computer listings against worksheets, but not including cataloging time.

SYSTEM OPERATION

Although the pilot system was set up in batch mode, the long-term plan is to establish an online computer network in a telecommunications environment. Since funding was unavailable for immediate development of the online system following the pilot, the WLN system has operated in a weekly batch pattern during 1973 and 1974. The 1974 state legislature voted funding for the online design and development; these efforts are underway at the present writing (spring 1975). Current operations continue in the interim batch mode as diagrammed in figures 1 and 2 and are more fully described below.

Since the pilot project ended, two more district libraries and a four-year college have become participants in the system, bringing the total number to ten (representing approximately 120 member libraries):

Evergreen State College, Olympia
Fort Vancouver Regional Library, Vancouver
Kitsap Regional Library, Bremerton
Mid-Columbia Regional Library, Kennewick
North Central Regional Library, Wenatchee

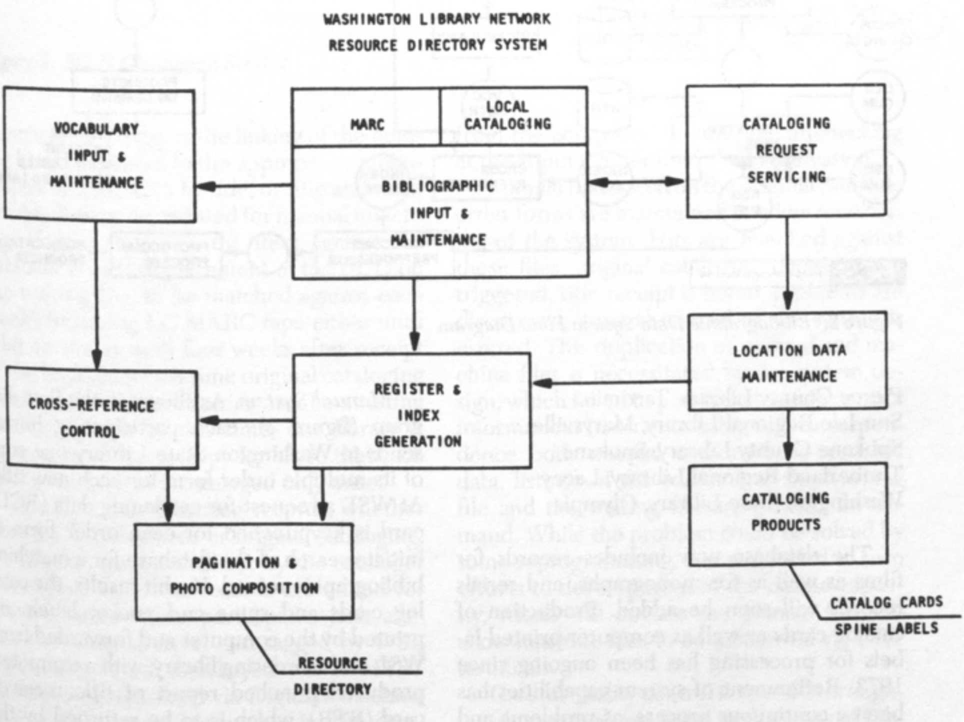


Figure 1. Generalized Diagram.

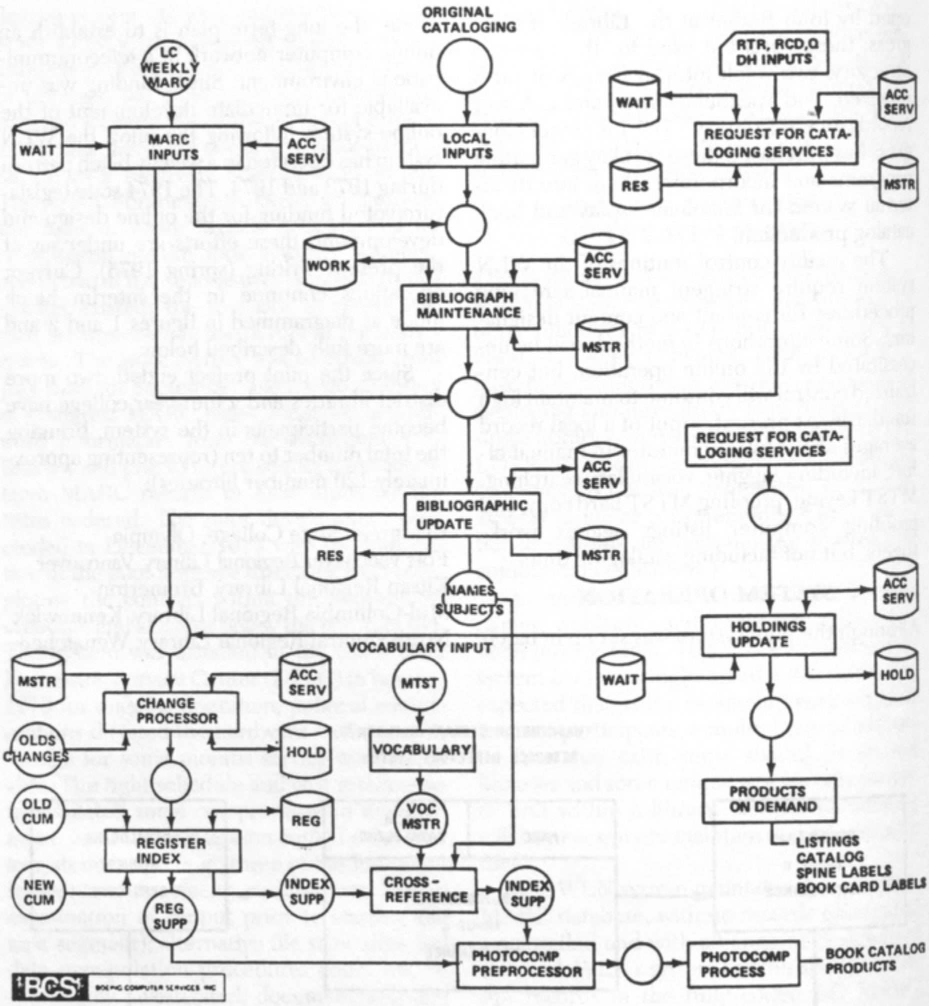


Figure 2. Bibliographic Data System Flow Diagram.

Pierce County Library, Tacoma
Sno-Isle Regional Library, Marysville
Spokane County Library, Spokane
Timberland Regional Library, Lacey
Washington State Library, Olympia

The database now includes records for films as well as for monographs, and serials records will soon be added. Production of catalog cards as well as computer-printed labels for processing has been ongoing since 1973. Refinement of system capabilities has been a continuous process, as problems and needs have become evident.

Manual System. As shown in the flow diagram (figure 3), each participating library sends to Washington State Library one copy of its multiple order form for each new title. At WSL a request for cataloging data (RCD) card is keypunched for each order form to initiate search of the database for a matching bibliographic record. If a hit results, the catalog cards and spine and pocket labels are printed by the computer and forwarded from WSL to the ordering library, with a computer-produced punched report of title received card (RTR), which is to be returned by the library at time of receipt of book. This second

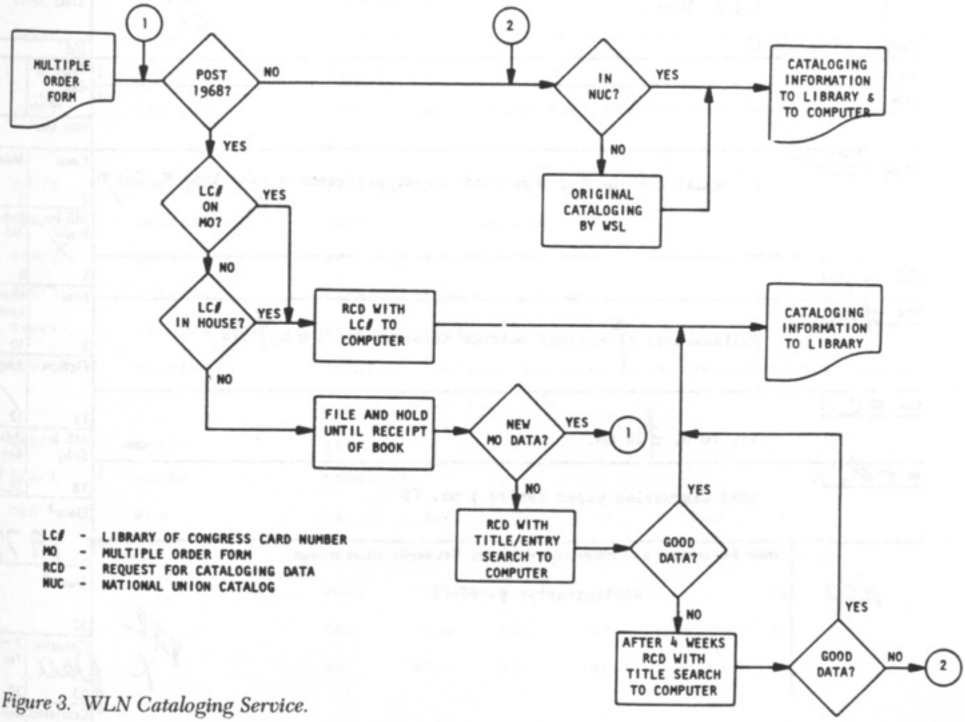


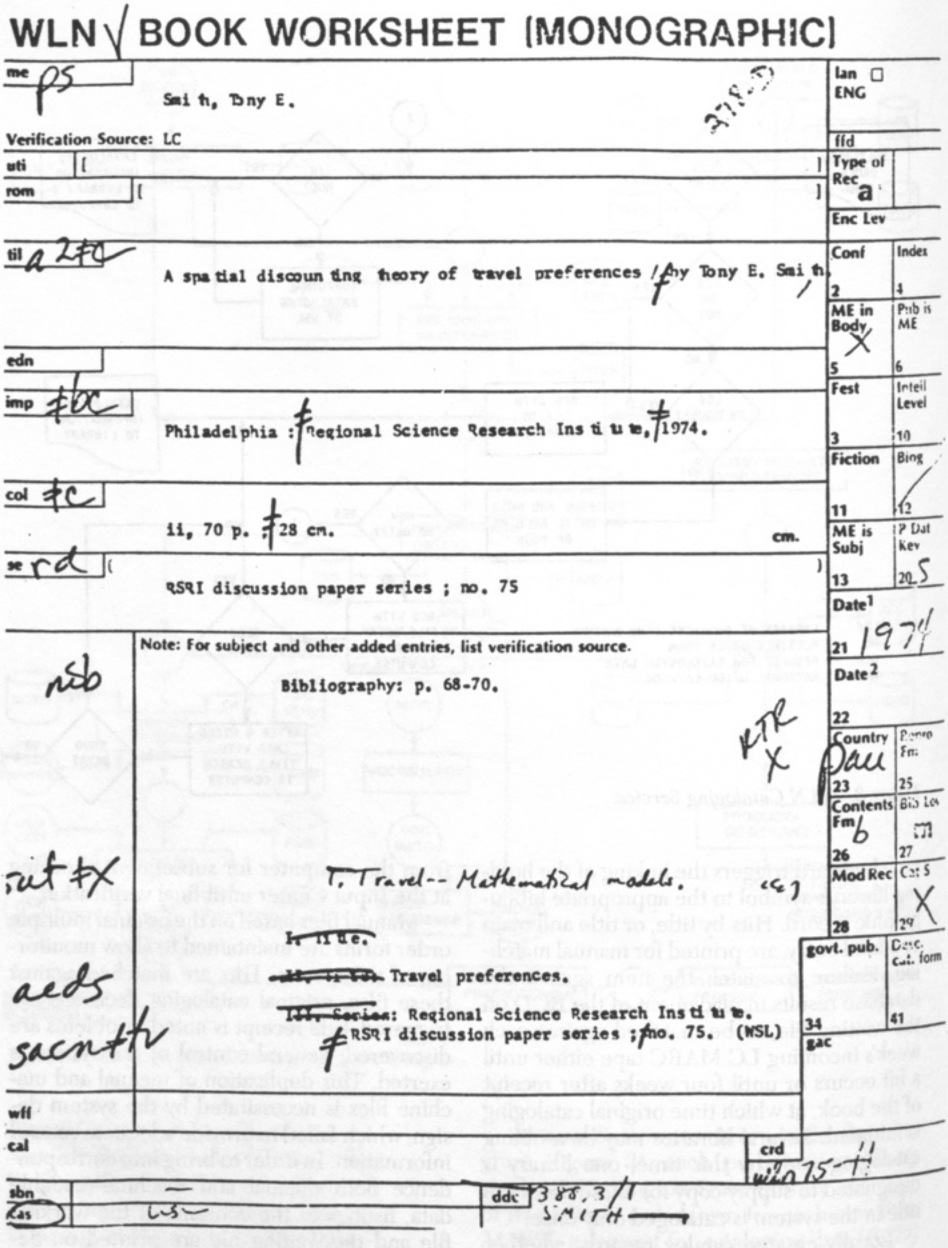
Figure 3. WLN Cataloging Service.

punched card triggers the linking of the holding library's symbol to the appropriate bibliographic record. Hits by title, or title and main or added entry, are printed for manual matching. Failure to match the item against the database results in placement of the RCD on the waiting file, to be matched against each week's incoming LC MARC tape either until a hit occurs or until four weeks after receipt of the book, at which time original cataloging is initiated. Several libraries may be awaiting cataloging copy by this time; one library is designated to supply copy for all, so that each title in the system is cataloged only once.

Locally created catalog records, whether from LC NUC source or original cataloging, are filled in on a worksheet by the cataloger (see figure 4). These records are edited for content (since some participants lack adequate cataloging tools) and tagged by WSL Input Center staff, then keyed onto an MTST cassette and translated via Digidata machine to a magnetic tape acceptable by the computer. Proof sheets (figure 5) are produced from the computer for subsequent checking at the Input Center until final verification.

Manual files based on the original multiple order forms are maintained to allow monitoring of the system. Hits are matched against these files, original cataloging decisions are triggered, title receipt is noted, problems are discovered; general control of the system is exerted. This duplication of manual and machine files is necessitated by the system design, which failed to provide adequate control information. In order to bring into correspondence both manual and machine-readable data, listings of the contents of the working file and the waiting file are printed on demand. While the problem could be solved by some reprogramming, it was decided to turn efforts to development of the online capacity, which will obviate the manual file and allow machine files to be monitored via CRT terminals.

Careful quality control is exerted throughout this manual operation in the areas of bibliographic content, adherence to accurate



WLN √ BOOK WORKSHEET (MONOGRAPHIC)

me ps

Smith, Tony E.

Verification Source: LC

uti [ ]

rom [ ]

til a 2FC

A spatial discounting theory of travel preferences / by Tony E. Smith.

edn

imp #bc

Philadelphia : Regional Science Research Institute, 1974.

col #c

ii, 70 p. ; 28 cm. cm.

se rd [ ]

RSRI discussion paper series ; no. 75

Note: For subject and other added entries, list verification source.

Bibliography: p. 68-70.

sut #x T. Travel--Mathematical models.

aeds Travel preferences.

sacn Series: Regional Science Research Institute. RSRI discussion paper series ; no. 75. (WSL)

wfl

cal

sbn

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ddc 388.3/1

SMITH

lan ENG | fld | Type of Rec a | Enc Lev | Conf 2 | Index 4 | ME in Body 5 | Pub is ME 6 | Fest 3 | Intell Level 10 | Fiction 11 | Biog 12 | ME is Subj 13 | P Dat Key 20 | Date¹ 21 1974 | Date² 22 | Country 23 pau | Repro Fm 25 | Contents Fm 26 b | Bib Lev 27 m | Mod Rec 28 | Cat S 29 | govt. pub. 34 | Desc. Cat. form 41 | gac

Figure 4. *WLN Book Worksheet (Monographic).*

MARC II content designators, authority file verification, detection of keying and computer errors, and output quality of cards, labels, the quarterly resource directory, and the individual libraries' biweekly listings of titles acquired since the latest directory issue.

Computer System. Weekly inputs include about 3,000 MARC records from LC, 250 to 300 locally keyed bibliographic and authority records in MARC format on magnetic tape, punched cards for 5,000 records of order and holdings data, and about 200 update and

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001        CRD          wln75-467                        02/14/75          1
100/1      MEPS $a      $Smith, Tony E.
245/1      TILA2$ac     $A spatial discounting theory of travel preferences /$by
                        Tony E. Smith.
260/1      IMP $abc     $Philadelphia :$Regional Science Research Institute,
                        $1974.
300/1      COL$ac       $ii, 70 p. ;$28 cm.
490/1      SERD$a       $RSRI discussion paper series ; no. 75
504/1      NOB$a        $Bibliography: p. 68-70.
650/1      SUT-L$ax     $Travel$Mathematical models.
740/1      AED-S$a      $Travel preferences.
810/1      SACN$atv     $Regional Science Research Institute.$RSRI discussion
                        paper series ;$no. 75.
040/1      CAS$a        $WSL
082/1      DDC$a        $388.3/1
008        FFD          1.        2.        3.       4.       5.x      6.
                        10.       11.       12.      13.      14.      15.eng
                        20.a      21.1974   22.      23.pau   24.      25.
                        26.b      27.m      28.      29.x     30.      31.
                        32.       33.       34.      41.i
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Figure 5. *WLN Proof Sheet.*

search notices. Weekly outputs include catalog cards and processing labels, and listings for system control (e.g., proof sheets for locally created MARC records, printout of hits on title key or title/main or added entry key searches, and computer run statistics). At two-week intervals each library receives an individualized cumulative computer listing of titles received between the quarterly publications of the resource directory. Special lists such as the annual *Washington State Publications* and a catalog of the Washington State Library's film collection are examples of less frequent products. Irregular outputs include management information such as statistics on overlap of holdings or listing of the waiting file for visual inspection. Selected records are occasionally output in either printed or machine-readable form, on request of a nonmember library, or for input to another library's computer system. A special Alaskan catalog is now being produced for the Alaska State Library and the University of Alaska Library, under contract with Boeing Computer Services.

As indicated in the flow diagrams for the batch-mode computer system (figures 1 and 2), the Library of Congress MARC tape for books is received and input weekly (film records arrive biweekly); any matches against records on the waiting file produce catalog cards and labels and link a library holding symbol to the MARC record. Matched records go to the master file; others to the residual file. Original cataloging is input through edit programs for quality control; both LC and local records then go into the bibliographic maintenance program where modifications may be made. The bibliographic update program will delete records, add new or modified records to the master or residual files, and move records from one file to the other. Both bibliographic updates and requests for cataloging feed into the holdings update program, which adds, deletes, and replaces information on the holdings file (linking bibliographic record to holding library) and passes requests to the products-on-demand subsystem, which produces RTR and catalog cards and labels according to library profiles.

The bibliographic update program also provides input to the change processor program, which maintains all changes to bibliographic content and holdings information.

The access service programs permit an LC card number search, title search, or title/main entry search. This set of routines will search any of the files. It is also possible to search by title/main entry and receive the ID number of the record from the computer.

The above programs are operated weekly and in early 1975 required 38.75 minutes of CPU time and six hours of off-line printing. Additionally, biweekly runs for local bibliographic input and two-week title listings require 8.75 minutes of CPU time and two hours of off-line printing. Monthly runs, such as authority input and merge of LC MARC cumulated tapes, require 14 minutes of CPU time and three-and-one-half hours of off-line printing.

Maintenance of the computerized name and subject authority file requires manual intervention. Terms in newly input records (1xx, 6xx, and 7xx fields) are matched by computer against the existing authority file and nonhits listed for human decision. On demand, a complete vocabulary listing is printed by the computer (figure 6) for human monitoring. Verification and cross-references (see and see also) are determined by consulting the *Subject Headings Used in the Dictionary Catalogs of the Library of Congress* (*LCSH*). As indicated in the flow diagrams of figures 7 and 8, vocabulary data (verification of headings, cross-references, and scope notes) are input as necessary via the MTST with Digidata translation, creating and maintaining the vocabulary master file. Reciprocal records are machine generated for all reference terms (i.e., see and see from, see also and see also from).

The resource directory is produced in quarterly cumulative supplements, with annual total cumulations. Sample pages are shown in figure 9. An additional list is produced every two weeks between supplements: a separate computer printout for each library, listing titles acquired since the previous supplement was produced (see figure 10). The resource directory contains all titles acquired by the participating libraries since July 1, 1972. The register-index structure is used; that is, the register volume contains complete bibliographic records numbered sequentially in order of input to the computer, and the indexes (author, title, and subject volumes) contain limited bibliographic information plus holdings and call numbers attached to each record. This arrangement permits changing holdings and call numbers without the necessity of reprinting the entire record; it also avoids the need for reprinting the register, since a record may be deleted simply by eliminating its index references, or it may be altered, reprinted, and given a new ID number so that the incorrect record is no longer indexed. Thus, each quarterly printing of the resource directory includes an additional volume of the register and the appropriate cumulative indexes. This structure has proved satisfactory; problems lie in the area of massive growth (as for any ongoing book catalog), and microform production is under investigation. Also, a book catalog is never up to the minute, requiring four to six weeks from database cutoff date to book-in-hand.

The computer programs which produce the resource directory are diagrammed in the lower left corner of figure 1. Input comes through the change processor program and the previous cumulation tape. The register and index supplements go onto a tape, with the indexes then run against the cross-reference program. Both register and index data are then put through the photocomposition precompressor program, which provides the interface to the photocomposition hardware. A commercial vendor produces the camera-ready master pages, after which the state printer manufactures the books. The photocomposition programs are those developed at the New York Public Library; considerable developmental effort was saved by New York Public Library's interinstitutional generosity.

File and Record Layouts. Eight permanent basic direct access method (BDAM) files are maintained in the system. The master file contains bibliographic records for which holdings exist. The residual file contains bibliographic records from the LC MARC tapes which as yet have no corresponding holding record. The holdings file contains a record corresponding to each active record in the

```
VOCABULARY MASTER FILE -- NAMES          22 JAN 75  PAGE  289

vop2-‡a     ‡Creagh-Osborne, Richard.±

vop1-‡adx   ‡Cream, Thomas Neill,‡1850-
            1892‡Fiction.±

vop1-‡ad    ‡Creamer, Daniel Barnett,‡
            1909-±

vop1-‡ad    ‡Creamer, J. Shane,‡1929-±

vop1-‡a     ‡Creamer, Lex.±

vop1-‡a     ‡Creamer, Robert W.±

vop1-‡a     ‡Creasey, John.±
ufp10‡a     ‡Ashe, Gordon.±

voc2-‡a     ‡Creative Educational
            Society, Mankato, Minn.±

voc2-‡a     ‡Creative Film Society.±

voc2-‡a     ‡Creative Visuals (Firm)±

vop1-‡ad    ‡Credle, Ellis,‡1902-±

vop1-‡a     ‡Creed, Virginia.±

vop1-‡a     ‡Creekmore, Betsey Beeler.±

vop1-‡ad    ‡Creeley, Robert,‡1926-±

vop1-‡a     ‡Cresse, Elae Bartlett.±

vop1-‡ad    ‡Cressey, Donald Ray,‡1919-±

vop1-‡ad    ‡Cressman, Luther Sheeleigh,‡
            1897-±

vop1-‡a     ‡Cresswell, Helen.±

vop1-‡a     ‡Cresswell, John.±

vop1-‡a     ‡Creswell, Clifford J.±

vop1-‡a     ‡Cretan, Gladys Yessayan.±
```

Figure 6a. Names.

```
VOCABULARY MASTER FILE -- SUBJECTS       27 SEP 74  PAGE  954

vot-0‡ax    ‡Sea-water‡Analysis.±
xxt-0‡ax    ‡Water‡Analysis.±

vot-0‡ax    ‡Sea-water‡Pollution.±
set-0‡a     ‡Marine pollution.±

vot-0‡a     ‡Sea-water, Distillation of.±
xxt-0‡a     ‡Saline water conversion.±

vot-0‡a     ‡Sea waves.±
set-0‡a     ‡Ocean waves.±

vot-0‡a     ‡Seabed.±
set-0‡a     ‡Ocean bottom.±

vot-0‡a     ‡Seafaring life.±

vot-0‡az    ‡Sealing‡Newfoundland.±

vot-0‡a     ‡Sealing (Technology)±
uft-0‡a     ‡Bonding (Technology)±
sat-0‡a     ‡Brazing.±
sat-0‡a     ‡Ceramic to metal bonding.±
sat-0‡a     ‡Plastics.±
sat-0‡a     ‡Rubber coatings.±
sat-0‡a     ‡Solder and soldering.±
sat-0‡a     ‡Welding.±
xxt-0‡a     ‡Containers.±

vot-0‡ax    ‡Sealing (Technology)‡
            Handbooks, manuals, etc.±

vog-0‡az    ‡Seals (Numismatics)‡
            California.±

            countries, states, cities,
            etc., e.g. Washington--Seal;
            and also under names of
            religious bodies, e.g.
            Netherlands Hervormde Kerk--
            Seal; and also under names
            of famous persons.±
sat-0‡a     ‡Emblems, National.±
sat-0‡a     ‡Signatures (Writing)±
sat-0‡a     ‡Signets.±
xxt-0‡a     ‡Emblems, National.±
xxt-0‡a     ‡Heraldry.±
xxt-0‡a     ‡Inscriptions.±
xxt-0‡a     ‡Intaglios.±
xxt-0‡a     ‡Numismatics.±
xxt-0‡a     ‡Signatures (Writing)±

vot-0‡a     ‡Sealyham terriers.±
xxt-0‡a     ‡Terriers.±
```

Figure 6b. Subjects.

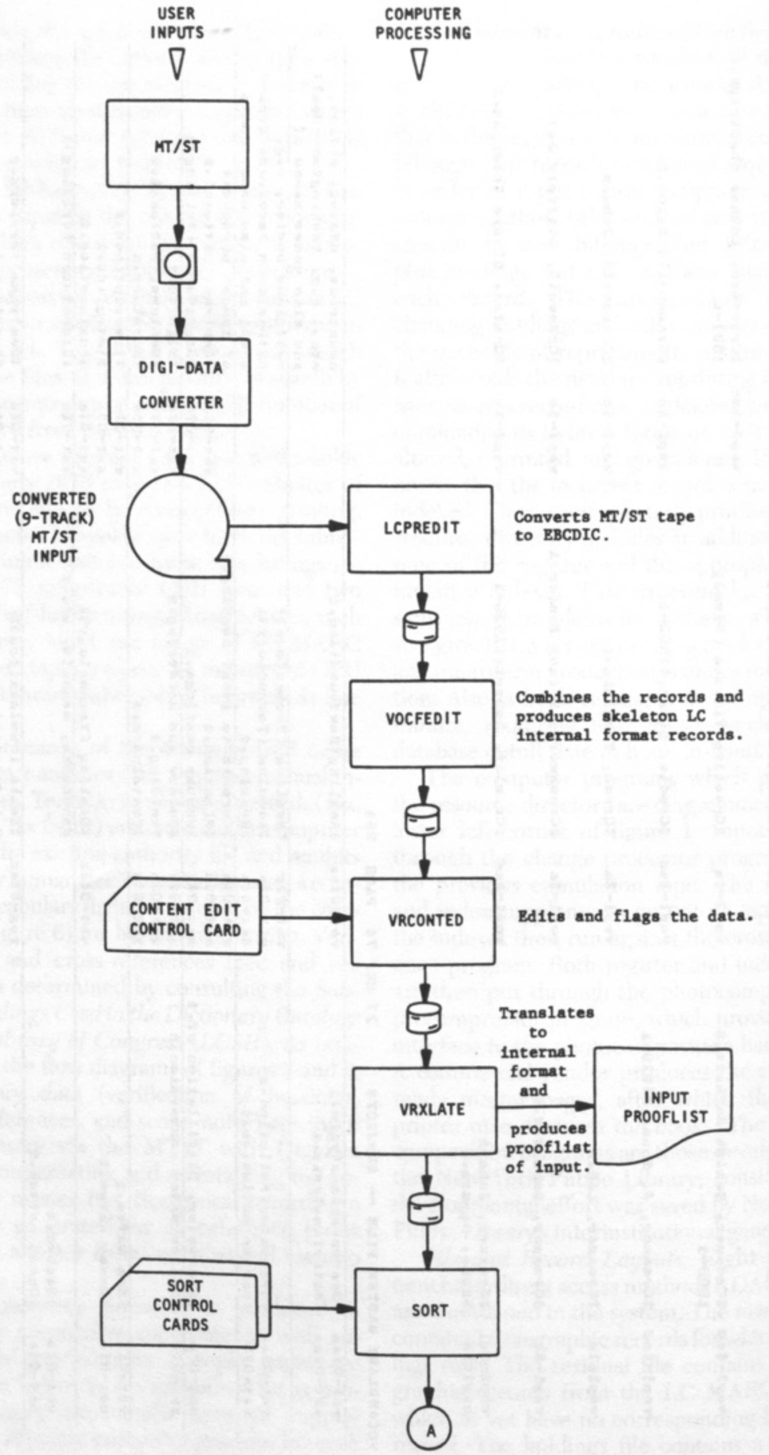

Figure 7a. Vocabulary System Flow.

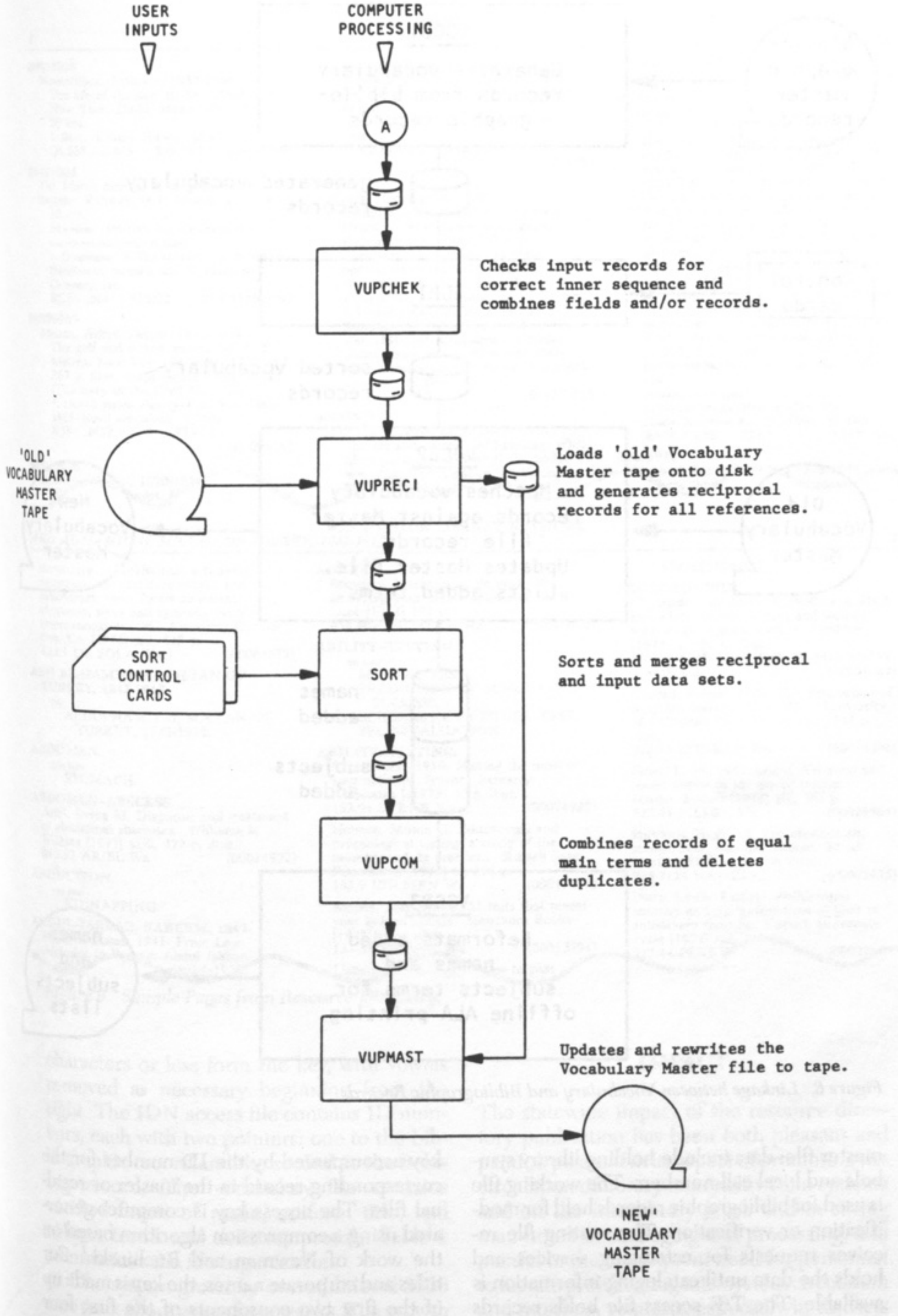

Figure 7b. Vocabulary System Flow (continued).

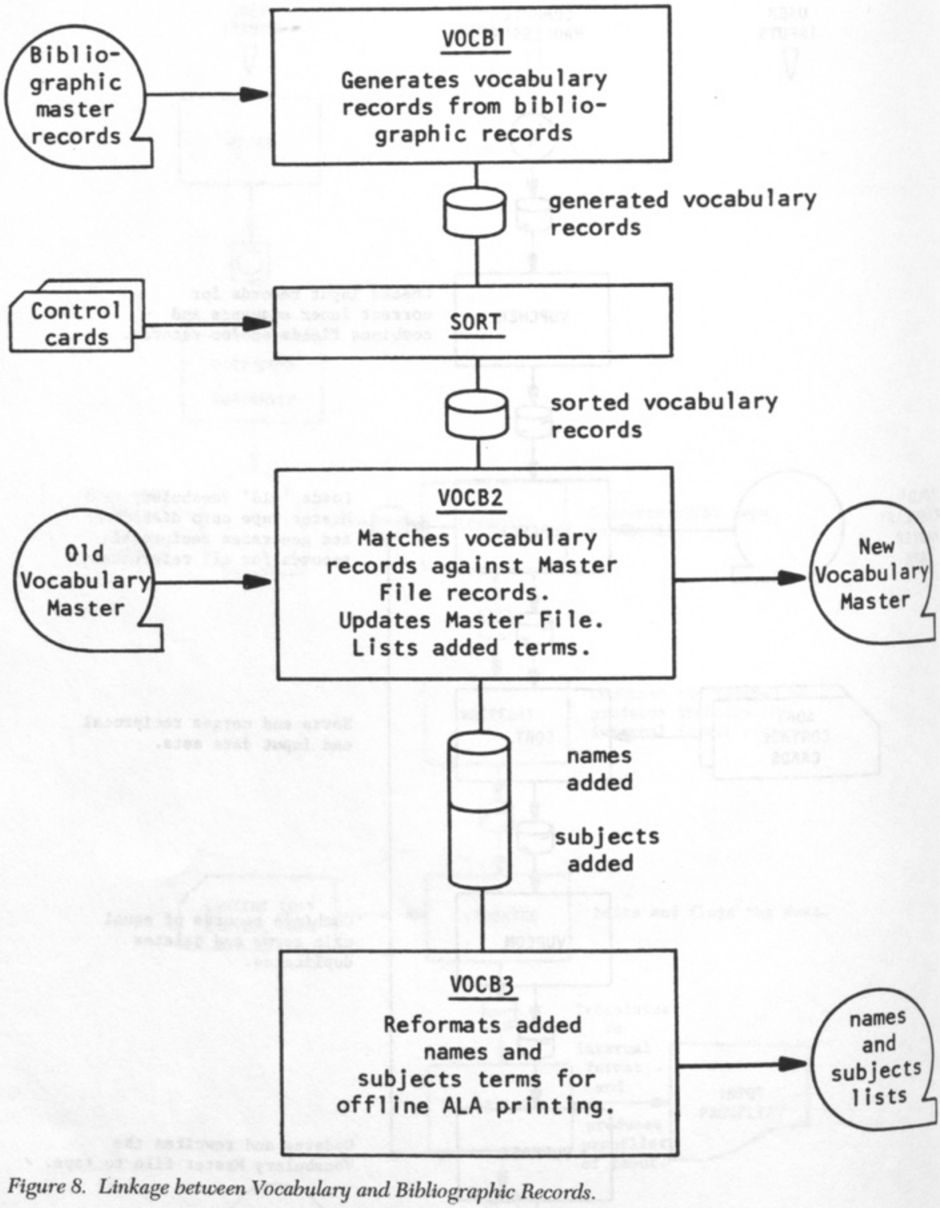

Figure 8. Linkage between Vocabulary and Bibliographic Records.

master file; data include holding library symbols and local call numbers. The working file is used for bibliographic records held for modification or verification. The waiting file receives requests for cataloging services and holds the data until cataloging information is available. The T/E access file holds records consisting of a compressed title/main entry key accompanied by the ID number for the corresponding record in the master or residual files. The access key is computer-generated using a compression algorithm based on the work of Newman and Buchinski.[7] For titles and corporate names, the key is made up of the first two consonants of the first four significant words; for personal names, six

REGISTER

1 *00055926*

00055905
Maeterlinck, Maurice, 1862-1949.
The life of the bee, tr. by Alfred Sutro. New York, Dodd, Mead, 1901. 427 p. 20 cm.
1. Bees. I. Sutro, Alfred, 1863- tr. II. Title.
QL568.A6 M3 595.799 01-005936

00055906
The Merck manual of diagnosis and therapy. Rahway, N.J., Merck, 1972- v. 18 cm.
Title varies: 1899-1940, Merck's manual of the materia medica (varies slightly)
1. Diagnosis. 2. Therapeutics. 3. Medicine--Handbooks, manuals, etc. I. Merck and Company, inc.
RC55 .M4 615.02 01-031760//r2

00055907
Mahan, Alfred Thayer, 1840-1914.
The gulf and inland waters, by A. T. Mahan. New York, Scribner, 1883. viii, 267 p. illus., maps (some fold.) 19 cm. (The navy in the Civil War, III)
1. United States--History--Civil War, 1861-1865--Naval operations. I. Title.
E591 .N32 vol. 3 973.75 02-008293

00055908
Ammen, Daniel, 1820-18...

Blackfoot lodge tales; the story of a prairie people, by George Bird Grinnell. New York, Scribner, 1892. xv, 310 p. 21 cm.
1. Folk-lore, Indian. 2. Siksika Indians. I. Title.
E99.S54 G83 398.210978 04-004056

00055914
Haupt, Herman, 1817-1905.
Reminiscences of General Herman Haupt; ... With notes and a personal sketch by Frank Abial Flower. Illustrated from photos. of actual operations in the field. [Limited autograph ed. Milwaukee, Wright & Joys] 1901. 331 p. illus., ports. 25 cm.
1. United States. Bureau of Military Railroads. 2. United States--History--Civil War, 1861-1865--Campaigns and battles. 3. United States--History--Civil War, 1861-1865--Transportation. I. Flower, Frank Abial, 1854- ed. II. Title.
973.7 04-013616

00055915
Michell, Edward Blair, 1843-
The art and practice of hawking. With three photogravures by G. E. Lodge and other illus. London, Methuen, 19...

E467.1.J73 J7 973.7/0924 B 11-022454

00055920
Lossing, Benson John, 1813-1891.
A history of the civil war, 1861-65, and the causes that led up to the great conflict, by Benson J. Lossing, LL. D., and a chronological summary and record of every engagement ... showing the total losses and casualties together with war maps of localities, comp. from the official records of the War department. Illustrated with fascimile photographic reproductions of the official war photographs, taken at the time by Matthew B. Brady, under the authority of President Lincoln and now in the possession of the War department, Washington, D. C. ... New York, War Memorial Association [c1912] 512 p. col. front., illus. (incl. ports, maps, facsims.), col. plates. 31 cm.
Published in 16 parts.
1. United States--History--Civil War. I. Brady, Matthew B., 1823-1896. II. Title.
E468.7 L88 973.7 12-007883

00055921
Rinehart, Mary ... 1876-1958.
...

WASHINGTON LIBRARY NETWORK

ABD AL-HAMID II, SULTAN OF TURKEY, 1842-1918. *2*

dictionary: abbreviations; acronyms; anonyms; contractions; initials and nicknames; short forms and slang shortcuts; signs and symbols. New international 4th ed. American Elsevier Pub. Co. [1974] xiii, 428 p.
423.1 DE SOLA WaO (00061572)

ABD AL-HAMID II, SULTAN OF TURKEY, 1842-1918.
see
ABDÜLHAMIT II, SULTAN OF TURKEY, 1842-1918.

ABDOMEN.
see also
STOMACH.

ABDOMEN--ABSCESS.
Ariel, Irving M. Diagnosis and treatment of abdominal abscesses. Williams & Wilkins [1971] xxiii, 322 p. illus.
616.52 ARIEL Wa (00014922)

ABDUCTION.
see also
KIDNAPPING.

ABDUL-JABBAR, KAREEM, 1947-
Haskins, James, 1941- From Lew Alcindor to Kareem Abdul Jabbar. ...

ABILITY.
Broadley, Margaret E. Be yourself: analyzing your innate aptitudes. R. B. Luce [1972] 192 p.
658.407 BROADLE Wa (00010626)

ABILITY--TESTING.
see also
MENTAL TESTS.
PREDICTION OF SCHOLASTIC SUCCESS.
SCHOLASTIC APTITUDE TEST.
SELF-EVALUATION.

ABILITY--TESTING.
Byrne, John, 1910- Making the most of your abilities. Science Research Associates [c1973] 60 p. illus.
153.94 BYRNE Wa (00074925)

Holmen, Milton G. Educational and psychological testing; a study of the industry and its practices. Russell Sage Foundation [1972] ix, 218 p.
153.9 HOLMEN Wa (00011448)

Kinney, Jean Brown. 57 tests that reveal your hidden talents. Hawthorn Books [1972] 96 p. illus.
131.32 KINNEY Wa (00013721)

Liebers, ... How to pass ...

ABOLITIONISTS.

ABOLITIONISTS.
Chittenden, Elizabeth F. Profiles in Black and white; stories of men and women who fought against slavery. Scribner [1973] x, 182 p. illus.
JB-322 CHITTEN WaBr WaMaS WaTPC WaSpCo (00061082)

Conrad, Robert, 1928- The destruction of Brazilian slavery, 1850-1888. University of California Press [1972] xviii, 344 p. illus.
322.44 CONRAD Wa (00014296)

Filler, Louis, 1911- comp. Abolition and social justice in the era of reform. Harper & Row [1972] xiii, 367 p.
322.44 FILLER Wa (00026964)

Hawkins, Hugh, ed. The abolitionists; means, ends, and motivations. 2d ed. Heath [1972] xv, 230 p. illus.
973.7114 HAWKINS Wa (00005625)

Perry, Lewis. Radical abolitionism; anarchy and the government of God in antislavery thought. Cornell University Press [1973] xvi, ...
322.44 PERRY ...

Figure 9. Sample Pages from Resource Directory.

characters or less form the key, with vowels removed as necessary beginning from the right. The IDN access file contains ID numbers, each with two pointers: one to the bibliographic record and the second to the holding record. The vocabulary file contains verified forms of name, uniform title, and subject terms and their reciprocals. Table 1 summarizes the file organization.

The system grows by one additional 3336 disc pack about every forty weeks. File growth is shown in table 2.

IMPACT

The statewide impact of the resource directory publication has been both pleasant and painful: pleasant in its aspect of promoting the circulation of library materials within systems and on the interlibrary level, and in saving man-hours in cataloging and processing, and painful in the consequent need for personnel to handle proliferating intrasystem circulation and interloan requests, especially in districts where no branch catalogs have previously ex-

AUTHORS

7 *Adams, Caridad Bravo*

Demand for health care when time prices vary more than money prices. New York City Rand Institute, 1973. ix, 38 p.
WA 301.34 P69tr 1969 Wa (00074165)

Evaluating public programs to save lives: the case of heart attacks. Rand, 1973. xviii, 136 p.
616.12 ACTON Wa (00073606)

Population health survey 1968: codebook and marginals. Rand, 1973. ix, 81 p.
362.1097 ACTON Wa (00052926)

Population health survey for 1969-70: codebook and marginals. Rand, 1973. ix, 137 p.
362.1097 ACTON Wa (00052925)

Population health surveys for 1964, 1965, and 1966: codebook and marginals. Rand, 1973. x, 146 p.
362.1097 ACTON Wa (00052927)

Acton, Jay
The forgettables. Crowell [1973] xii, 270 p. illus.
796.3326 ACTON WaMaS WaWeN WaTPC WaSpCo WaO Wa (00033974)

Mug shots; who's who in the new earth. World Pub. [1972] 244 p. illus.
B-920 AC...

Party planning and entertainment. [1st American ed.] A. S. Barnes [1972, c1971] 150 p. illus.
793.2 ADAIR Wa (00014722)

Adair, John, 1913-
(joint author.) Through Navajo eyes; an exploration in film communication and anthropology. Worth, Sol. Indiana University Press [1972] xiv, 286 p. illus.
970.3 WORTH Wa (00018122)

Adair, John, ethnologist
(joint author.) The first look at strangers. Bunker, Robert Manson, 1918- Rutger's University Press, 1959. 151 p. illus.
572.979 BUNKER WaKeM (00030276)

Adair, Margaret Weeks
Do-it-in-a-day puppets for beginners; how to make your puppets, create your script, and perform, all in one day. John Day Co. [1964] 89 p. illus. (part col.)
J791.53 ADAIR WaWeN WaTPC
J791.5 ADAIR WaMaS
791.53 ADAIR WaV (00030386)

Folk puppet plays for the social studies. John Day Co. [1972] 120 p. illus.
372.83 ADAIR WaBr WaKeM WaSpCo WaO Wa
J791.5 ADAIR...

(illus.) Izzard. Anderson, John Lonzo, 1905- Scribner [1973] [40] p. col. illus.
E ANDERSO WaBr WaMaS WaKeM WaTPC WaSpCo WaO
J ANDERSO WaV (00006483)

(illus.) Jorinda and Joringel. Scribner [1968] 1 v. (unpaged) col. illus.
J398.21 JORINDA WaMaS WaTPC (00021529)

(comp.) Poetry of earth. Scribner [1972] 48 p. col. illus.
J821.008 ADAMS WaKeM WaWeN WaTPC WaSpCo
J808.81 ADAMS WaMaS
821.008 ADAMS WaV (00002099)

(illus.) Twice upon a time. Shapiro, Irwin, 1911- Weekly Reader Children's Book Club ed. Xerox Family Education Services [1973] [40] p. col. illus.
E SHAPIRO WaMaS WaTPC (00032569)

A woggle of witches. Scribner [1971] [32] p. col. illus.
E ADAMS WaMaS WaWeN WaV (00002859)

Adams, Alexander B
Eleventh hour; a hard look at ...

WASHINGTON LIBRARY NETWORK

Abby. 10

American Elsevier Pub. Co. [1974] xiii, 428 p.
423.1 DE SOLA WaO (00061572)

Abby. Caines, Jeannette Franklin. [1st ed.] Harper & Row [c1973] 32 p. illus.
E CAINES WaBr WaMaS WaKeM WaWeN WaTPC WaSpCo WaV (00061292)

Abby Rand's guide to Puerto Rico and the U.S. Virgin Islands. Rand, Abby. Scribner [1973] ix, 276 p. illus.
917.295 RAND WaBr WaWeN WaSpCo (00060970)

Abby takes over. La Farge, Phyllis. [1st ed.] Lippincott [1974] 127 p. illus.
J LA FARG WaMaS WaKeM WaTPC WaV (00064345)

ABC; an alphabet of many things. Rojankovsky, Feodor, 1891- F. Rojankovsky's ABC; an alphabet of many things. Golden Press, 1971, c1970. [30] p. col. illus.
E ROJANKO WaSpCo (00022034)

The ABC and XYZ of bee culture; an encyclopedia pertaining to scientific and practical culture of bees. Root, Amos Ives, 18... Root Co., 1945

(some col.)
635.965 NIGHTIN WaO Wa (00065475)

ABC of things. Oxenbury, Helen. Watts [1972, c1971] [55] p. col. illus.
E OXENBUR WaBr WaMaS WaKeM WaTPC WaSpCo WaO WaV (00011117)

An ABC of witchcraft past & present. Valiente, Doreen. St. Martin's Press [1973] xvii, 377 p. illus.
133.403 VALIENT WaTPC Wa
133.4 VALIENT WaWeN (00029525)

ABC puppetry. Rutter, Vicki. [1st American ed.] Plays, inc. [1969] 78 p. illus.
J791.53 RUTTER WaSpCo (00058253)

ABC word book. Scarry, Richard. Random House [1971] 61 p. col. illus.
E SCARRY WaMaS WaWeN (00021891)

ABCDEFGHIJKLMNOPQRSTUVWXYZ in English and Spanish. Tallon, Robert, 1935- Lion Press [1969] 1 v. (unpaged) illus.
E TALLON WaWeN (00076201)

ABC's of a... Yerian, Cameron John. ...[c1971] ...

illus.
621.381 WILSON WaWeN (00059480)

ABC's of infrared. Bernard, Burton. [1st ed.] H. W. Sams [1970] 144 p. illus.
535.842 BERNARD WaBr (00052086)

Abc's of integrated circuits. Turner, Rufus P. [1st ed.] H. W. Sams [1971] 96 p. illus.
621.3817 TURNER WaBr (00043665)

ABC's of lasers & masers. Lytel, Allan Herbert, 1920- [3d ed.] H. W. Sams [1972] 128 p. illus.
621.366 LYTEL WaO (00007454)

ABC's of library promotion. Sherman, Steve, 1938- Scarecrow Press, 1971. iv, 182 p.
659.2902 SHERMAN WaBr
659.2 SHERMAN WaO (00017098)

The abc's of reloading. Grennell, Dean A. Follett Pub. Co. [1974] 320 p. illus.
683.406 GRENNEL Wa (00067029)

ABC's of tape recording. Crowhurst, Norman H. [3d ed.] H. W. Sams [1971] 112 p. illus.
621.3893 CROWHUR WaBr
621.38... CROWHUR WaMaS

Figure 9. (continued).

isted. While other variables probably contribute to the increase in use of library materials, growth has been so marked and so timely as to assure that the resource directory has had a profound effect.

The resource directory has from the onset been distributed to all libraries of the state; it travels on bookmobiles as well. The holdings of the participating libraries are therefore exposed to the scrutiny of patrons with resultant rise of use. For instance, the North Central Regional Library reports an increase of 10 percent from 1973 to 1974 for requests forwarded to the State Library (which is the last resort, if other locations are listed); a doubling of requests to borrow from other libraries, exclusive of the State Library; an increase of 15 percent in interlibrary lending; and an improvement in speed of response to patrons' interloan requests. Total outgoing loans for all

WASHINGTON STATE LIBRARY NEW TITLES FROM 09/01/74 TO 03/08/75 PAGE 164

Family communication; a guide to emotional health. Wahlroos,
Sven. Macmillan [1974]
158.24 WAHLROO 73-011831

Family council: the Dreikurs technique for putting an end to
war between parents and children (and between children and
children) Dreikurs, Rudolf, H. Regnery [1974]
301.427 DREIKUR 73-018183

Family crises. Neuhaus, Robert H. Merrill [1974]
362.82 NEUHAUS 73-085104

Family day care : report of a conference. Southeastern Day
Care Project, Southern Regional Education Board, 1974.
362.733 FAMILY wln74-008404

The family, from institution to companionship. Burgess,
Ernest Watson, American Book Co. [c1960]
301.42 BURGESS 60-003276

The family guide to children's television: what to watch,
what to miss, what to change, and how to do it. Kaye,
Evelyn, Pantheon Books [1974]
791.455 KAYE 73-018726

Family homes for adults. Washington (State). Dept. of Social
and Health Services. 1972
WA 360 Soifha 1972 wln72-000733

The Family Reception Center: evaluation of the program.
Sherman, Edmund A. Research Center, Child Welfare League
of America, 1973.
362.7097 SHERMAN wln74-005527

The family story in the 1960's. Ellis, Anne W. Archon Books
[1970]
028.5 ELLIS 79-010596

Family therapy. Bell, John Elderkin. J. Aronson, [1974]
616.8915 BELL 74-022276

Famous pianists & their technique. Gerig, Reginald, R. B.
Luce [1974]
786.1082 GERIG 73-018804/MN

Far infrared and submillimeter scattering : a report
prepared for United States Air Force Project Rand.
Deirmendjian, D. Rand, 1974.
551.57 DEIRMEN wln74-007549

The far side of madness. Perry, John Weir. Prentice-Hall
[1974]
616.8982 PERRY 74-002035

Farm accounting and business analysis. James, Sydney C.
Iowa State University Press [1974]
657.863 JAMES 74-016443

Farm and nation in modern Japan: agrarian nationalism, 1870-
1940. Havens, Thomas R. H. Princeton University Press
[1974]
338.1095 HAVENS 74-003475

Farm land assessment practices in the United States; a
research report. International Association of Assessing
Officers. c1966
336.22 INTERNA 68-000413

Farm, ranch & countryside guide; 500 selected vacation
ideas. Farm and Ranch Vacations, inc. trade distributor:
Berkshire Traveller Press, Stockbridge, Mass., 1974.
917.3 FARM AN 74-174454

Fascinating Alaska. Cooke, Cecil. Reed & Reed, c1947.
917.98 COOKE wln75-000047

Fascinating womanhood. Andelin, Helen B. Pacific Press
Santa Barbara, [1974]
301.42 ANDELIN 74-186358

Figure 10. Interim Title Listing.

Table 1. WLN File Characteristics

File	Access Key	Record Order in File
Master	File/set/page/record	By date added
Residual	File/set/page/record	By date added
Holdings	File/set/page/record	By date added
Working	Record ID number	By record ID number
Waiting	Record ID number	By record ID number
T/E Access	Title/entry or title only	By title/entry
IDN Access	Record ID number	By record ID number

Table 2. Number of Records in Washington Library Network Files

File Name	Avg. Record Size (Bytes)	Dec. 1972	June 1973	Oct. 1973	June 1974	Oct. 1974	Dec. 1974
Master file	648	4,613	16,500	30,600	48,000	60,600	68,900
Residual file	648	234,798	334,000	364,900	417,000	468,100	500,000
Holdings file	110	4,613	13,500	29,000	46,100	64,900	82,700
IDN Access file	16	239,411	350,000	395,000	459,600	503,400	531,000
T/E Access file	50	330,280	493,000	502,400	637,300	698,800	737,500
Vocabulary file	220	4,132	7,300	59,500	89,400	103,500	108,800

Table 3. Costs—WLN Bibliographic System, Batch Mode for Eight District Library Systems andWSL, 1974 (70,000 Titles Added)

Maintenance of system (backup, file cleanup, tuning of programs)	$104,000
Computer production costs	90,000
Card and label costs	39,000
Human labor, central operation	75,000
Resource directory (400 copies) and two-week listings	125,000
Postage and miscellaneous	15,000
Total	448,000
= $49,800 average per library	
= $6.40 per title	

district participants in 1974 were 4-1/2 times the number for 1972 (1971 to 1972 figures showed an increase of less than one-third). One district library's institutional loans increased from 3 in 1972 to 529 in 1974. These librarians are gratified at becoming lenders as well as borrowers—at the same time they have found that the personnel slack produced by computer assistance to cataloging procedures has been taken up by mushrooming readers' service efforts. The result is as hoped: improved service without proportionally increased costs. A municipal library not now participating in the system reports a decrease of 6 percent in books loaned to public libraries and an increase of 144 percent in borrowing from other libraries. The distribution of the resource directory to all libraries in the state coincides with these reported effects; circumstances indicate a relationship even though no cause–effect relationship has been proved.

Two of the district library systems have discontinued card catalogs in branches, with the resource directory as substitute, and others are considering closing off central as well as branch card catalogs. Two of the systems do not maintain card catalogs; the resource directory provides the only access to their own as well as other libraries' holdings. It is estimated that card catalog maintenance to provide information equivalent to that in the resource directory in headquarters and branches for participating libraries would cost $1,263,800 per year.

Availability of cataloging data has also benefited participants; the bibliographic record is available from LC MARC for more than 90 percent of the titles and in the remaining cases is provided by one library for the use of all.

One participating system eliminated a six-month cataloging backlog within eight weeks after joining the system. This system has since eliminated three persons from technical services (two by attrition and one by transfer to public services) while maintaining the same output in technical services.

For both participating and nonparticipating libraries, the resource directory is a book selection tool, and some nonparticipants who lack cataloging tools use it as a source for cataloging data.

In several of the participating systems, patrons and librarians in the branch libraries had no at-hand information on holdings anywhere in the system other than the specific branch. Librarians report a marked increase of circulation rate within district library systems, especially where branches now have information not previously available regarding materials held in the district. The total circulation for participating district libraries for 1974 is 12 percent above circulation in 1972, and one district reports an increase of 27 percent from 1972 to 1974.

With this evidence, other libraries have been eager to participate in the system's benefits. Unfortunately, manpower and space limitations at the State Library, and the restrictions of the batch process and central input/output control, have effectively prevented expansion of the services.

PROBLEMS OF BATCH SYSTEM

The major bottleneck in the batch-mode system has been the manual operation dealing with computer input and output. In order to maintain quality control, these procedures have been centralized, and throughput for the State Library and eight system libraries has so glutted the pipeline that no additional libraries can be added under present circumstances. While quality control will continue to be a major emphasis in the online system, the man-years necessary to exercise adequate control will be in a much smaller ratio to the traffic in the system, since participating libraries can directly query the database for bibliographic records and input holdings against files. Local input will still require verification for authority and content designator control, in one or more locations. Retention of all locally input records is now accomplished at the Input Center; the online system will permit keying from a participating library, with only verification at a center for quality control. Present file maintenance and handling of hard copy for both bibliographic and authority data, plus tagging, keying, and editing all input for the computer, and cutting and distributing cards and labels require a staff of 7.3 full-time equivalents (FTE). It is estimated that four FTE might maintain quality control for the throughput of fifty-five to seventy-five libraries, when the participating libraries will deal directly with the system via online terminals.

Another burden in the manual operation has been updating of the vocabulary system; any new name or subject that does not match a term in the file is printed out for human inspection. An added subfield on an already verified term will cause the entire subject to be printed out and requires verification. Any changes in the LC authority listing necessitate manual input of changes. These problems will be alleviated in the design of the online system, so that previously verified subfields may be appended to previously verified main terms and accepted by the computer even though they have not appeared together previously, and one-for-one substitution of a new name or subject can be made to the vocabulary file and then be reflected automatically in each related record.

Receiving, sorting, and mailing the catalog cards and labels is also a chore that is expected to be decentralized with the online system. Area processing centers are anticipated; these would have the capability of printing products and distributing materials to the area libraries. Some processing centers may serve a single large library. Specific patterns of implementation are still under discussion.

The weekly operation of the system has resulted in such attenuated turnaround that input of local records, from tagging and editing to keying to proofreading to final verification, spans a minimum of two weeks, and often four or more weeks when corrections must be input between proofing and verification. Vocabulary update can occasion similar overlong delays in availability of the information. The online system, with immediate update and access, should not be subject to these difficulties.

The physical growth of the resource directory has already been mentioned. While microform production is one potential solution, it is also expected that libraries having display terminal access to the database will no longer require hard copy. Thus, the resource directory may be needed only by small libraries and bookmobiles; probably readers and COM fiche or cartridges will be used in these instances. It is contemplated that custom catalogs might be produced for individual libraries or groups of libraries. Several terminals are anticipated for the larger libraries, to satisfy both processing and patron use.

HOLDINGS OVERLAP AND COST DATA

Tally of holdings overlap is provided on demand by the computer. The following data represent titles acquired by the participating libraries between July 1972 and January 1975; the overlap may be underrated because some of the same titles may have been acquired by some libraries before or after that period of time. Unique titles totaled 54,528* at the end of December 1974, with each title held by an average of 2.1 libraries. Titles held by only one library were 58.4 percent of the total. Of the titles held by more than one library, the average number of libraries holding each title was 3.6. The overlap might be expected to decrease as academic libraries are included; present participants, except for the State Library, which holds 30.5 percent of the uniquely held titles, tend to have similar acquisition patterns.

Costs of the present batch-mode bibliographic subsystem are shown in table 3. Catalog cards cost $.35 per set (two main cards and subject and added entry headed cards) and $.05 per additional main card; labels cost $.07 per set of one spine label and two book card/pocket labels. The resource directory, if continued with the same number of libraries and titles added in 1975, will cost an additional $26,500 for 400 copies, since the end-of-year total cumulation would be larger (July 1972 to end of 1975).

CHRONOLOGY OF RECENT DEVELOPMENTS

The Washington Library Network system was from its inception intended to be eventually transformed into an online operation; the original batch construct was adopted under time and money pressures. After the pilot resource directory was produced in December 1972, a request was made to the state legislature in 1973 to fund the next developmental stage, which was to bring the cataloging module online and to add the acquisitions module to the system. Funding was not appropriated at that time. The Council on Library Resources granted $25,000 in spring 1973, which was used to make a survey of statewide library needs relative to an acquisitions module.[8]

In 1973 the state legislature created a new agency, the Data Processing Authority (DPA), to improve the efficiency of computer utilization throughout state government. Under the auspices of the DPA, a Library Automation Committee was formed in 1974 with representatives from the universities, four-year and community colleges, public libraries, and the State Library. This committee is charged with overseeing the development of an integrated computer system to assist the operations of all libraries of the state of Washington. Areas of investigation and coordination include the online development of the bibliographic system, integration of the cataloging module and the acquisitions/accounting module, which is in operation at Washington State University, design of circulation and serials control modules, and evaluation of approaches to retrospective conversion.

In 1974 the state legislature appropriated funds for online development of the bibliographic system; this effort is now in the advanced design stage along with design for integration of cataloging and acquisitions.

The online acquisitions system developed at Washington State University will, with some modifications, become the next module to be added to the bibliographic data subsystem.[9] The integrated system will furnish preorder search and verification services, maintain in-process records for all forms of materials, maintain fund accounting records, furnish management information, and create products for participating libraries in accordance with profiles: purchase orders, claims, fund reports, acquisition lists, and such; and will attach holdings information to bibliographic records as materials are acquired.

The integrated acquisitions /bibliographic modules are planned to be implemented by the end of 1975, with some fifty libraries participating within the following year-and-a-half via CRT terminals. During the autumn of

*This figure does not match the 68,900 in table 2, since the master file contains some records to which no holdings have yet been attached.

1975, pilot operations of the acquisitions system will be undertaken at Western Washington State College and Seattle Public Library.

The online system will incorporate machine-readable authority files, full MARC coding at both input and output points, location symbols for titles held, bibliographic information, order and claim routines, an accounting subsystem, and catalog cards and book processing materials, with the capability for custom book catalogs on demand. Quality control continues to be a major emphasis.

CONCLUSION

The foregoing is a description of the Washington Library Network's computer system as it has functioned for about three years, assisting eight district library systems and the State Library in cataloging/processing materials and producing union book catalogs.

Admittedly a cumbersome procedure at present, the batch system is being redesigned and will be implemented by December 1975 in an online mode. This style of operation will permit decentralization of input and initial editing, and obviate the extensive manual files now maintained centrally. In the online operations, the center will function chiefly for final quality control and for system monitoring and adjustment, with search of database, input of order and receipt notifications, and local cataloging in full MARC format input from remote terminals for central verification. In combination with an online acquisitions/accounting subsystem, this segment of the WLN will become a powerful tool for library operations. In 1976, circulation and serials control subsystems are to be added.

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