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Contemporary Technology in Libraries

Beth M. Paskoff
Issue Editor
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Introduction

Beth M. Paskoff

This issue of Library Trends on contemporary technology presents a view of the impact of technological change in libraries. The nine articles examine the ways in which librarians are applying technology to their collections, to their services to users, and to the management of the library. As librarians, we are aware every day of changes brought about by technology. This phenomenon is not new to the profession, as Susan K. Martin reminds us in her article in this issue. Libraries have always been among the first social institutions to utilize new technologies, whether it was the introduction of incandescent lights in the stacks or public access copy machines.

As we face the last decade of this century, librarians are beginning to feel at ease with the most recent technological changes that have been introduced to all aspects of our professional lives. Wallace and Boyce have observed that our profession "is inherently dependent upon technology and must respond to new developments or risk becoming obsolete" (Wallace & Boyce 1987, p. 159). We relish the opportunity to rearrange reference departments to provide space for another piece of equipment to access yet another database. We enthusiastically abandon the Postal Service for electronic communication of interlibrary loan requests. We are certain we have made the right decision about the software and microcomputers that are (or are not) in our libraries. But are we as knowledgeable and comfortable with technology as we think we are?

Librarians are aware that their newest employees may be more familiar with technological applications than their more seasoned colleagues. Library schools have revised and enhanced their curricula to
provide courses on information technology, online retrieval, general library automation, and online technical services. Some master's degree programs now require a minimum level of "computer literacy" of all of their graduates. In order to keep up with these technological changes, experienced librarians must search for ways to upgrade their skills. In 1987, when the Association of College and Research Libraries surveyed its membership, it was reported by almost half the respondents that they want access to continuing education, especially courses covering technology updates (Rader 1988, p. 55).

Most members of the profession, however, do not attend such courses. Instead, they have relied on the old-fashioned printed word as the basis for continuing education and to learn what their colleagues are doing in other libraries. This issue of Library Trends can serve as a review of the role of contemporary technology in libraries today.

Although there have not been any other issues of Library Trends devoted per se to the applications of technology in libraries, various aspects of technology and their impact on libraries have been addressed. Within the past five years, for example, there have been articles on copyright protection for databases, electronic security systems, the evaluation of software, and electronic publishing in library and information science literature (Miller 1983, pp. 199-209; Bahr 1984, pp. 29-38; Hannigan 1985, pp. 327-48; Lee et al. 1988, pp. 673-98). There have also been issues devoted to significant technological subjects, such as "Public Access Online Catalogs" (Spring 1987) and "Automating Intellectual Access to Archives" (Winter 1988).

In the opening article, William Saffady reminds us of our history. He traces the historical development of automated circulation control from "precomputer" data processing systems to the current circulation control programs and turnkey systems for microcomputers, minicomputers, and mainframes. The alternatives to card catalogs and automated reference services are reviewed, leading up to the latest applications of technology. Saffady concludes by highlighting aspects of acquisitions and serials control systems in libraries.

Danny Wallace and Joan Giglierano examine the role of microcomputers in libraries, from the identification and selection of appropriate hardware and software to specific library applications. The use of general purpose software—such as word processors and spreadsheets—by library managers is examined, and examples of the use of such software for library networks, desktop publishing, and statistical analysis are provided. Microcomputer systems for library-specific purposes are also described. They conclude by providing a look at the future of microcomputers in libraries.

Librarians buy software for their own use but may also find that their patrons expect them to introduce microcomputer software into the library collections as well. Beth Paskoff looks at the selection, cataloging and classification, storage, and circulation of microcomputer soft-
ware collections. Given the diverse nature of libraries, there is not always agreement within the profession about the best way to introduce software to library collections, and Paskoff cites examples of the ways libraries have dealt with the problems that this format has created. The issue of compliance with copyright laws is also addressed.

F.W. Lancaster provides a cogent review of electronic publishing and the ways that it has evolved since the early 1960s. In tracing the development and application of this technology, he takes us from the use of computers to expedite printing to the use of electronic publishing in computer conferencing and electronic distribution of information. Recent developments in hypertext and hypermedia publications are also considered.

In Pamela Andre's article on optical disc technology, she discusses this newest of technologies to be applied by librarians. She begins by reviewing the current projects that are underway at the Library of Congress, the National Library of Medicine, and the National Agricultural Library, as well as a recent CD-ROM product from OCLC and the Western Library Network. These projects include such diverse applications as the distribution of the MEDLINE database as a CD-ROM product, CD-ROM collections of material on such diverse topics as Agent Orange or irradiation of food, and the Input System for the Optical Disc (ISOD). Actual optical disc applications at several academic libraries are evaluated. Three statewide systems of public libraries that are using optical disc technology are also explained.

Steven Brown discusses the application of telefacsimile in libraries as well as its mechanical and financial limitations. This technology enables librarians to meet the demand for "instant" document delivery and as such has been considered for use in libraries for several decades. It was not until the newest generation of telefacsimile machines that fast, clear, and economical transmissions have been available. As a result, library applications are being reconsidered. Brown describes the impact that telefacsimile has had on document delivery in individual libraries, as well as the growing network of telefacsimile users, and he reports the results of recent regional and national studies of telefacsimile.

Focusing on another means of interlibrary communication, Becki Whitaker describes the application of electronic mail in libraries. She presents both the benefits and obstacles to use of this technology. General office applications such as correspondence, committee work, and teleconferencing are explained, as are library specific applications such as electronic acquisitions, document delivery, and reference services.

We can imagine the distress of patrons who thought they knew how to use a library but are confused when confronted with the newest technologies. Loretta Caren describes "Library Connections," a new bibliographic instruction seminar that was developed to introduce faculty to the full array of electronic information retrieval services at the
Rochester (New York) Institute of Technology. This program includes access to the online catalog, electronic mail reference services, online and CD-ROM databases, and document delivery. She notes that the seminars were intended to explain the various library connections to the users, but they have also helped to establish new connections for input from patrons about future library services.

In the final article, Susan K. Martin writes about the effect that emerging technologies are having on library management. She reminds us that libraries are not all the same, and they will each cope with new technologies in different ways. Changes caused by technology in libraries include the delivery of information and the organizational structure of libraries. Martin concludes with several projections about the library of the future.

We began planning this Library Trends issue more than two years ago. Contemporary technology is a very dynamic aspect of librarianship, and some of the applications of technology that were considered innovative at that time have now become well established in libraries. Other applications of technology are still in their formative stages or have not materialized as we expected them to. It will be interesting for us to read in some future issue of Library Trends how librarians in the next century will evaluate the ways their predecessors utilized technology in the 1980s.

References

Library Automation: An Overview

William Saffady

Since the 1960s, libraries have used technology in general, and computers in particular, to automate a wide range of administrative, public, and technical services tasks. Designed as an overview of major facets of automation activity, this article surveys the current state of computer applications in six areas of library work: circulation control, descriptive cataloging, catalog maintenance and production, reference service, acquisitions, and serials control. For each area, the discussion briefly indicates the motives for automation and describes current dominant approaches, citing examples of representative products and services.

Circulation Control

Library interest in automated circulation control is, in large part, based on a long-standing awareness of the problems inherent in manual circulation systems. These problems include labor-intensive and time-consuming recordkeeping work routines, inaccuracy, high personnel turnover, an inability to generate statistics about circulation activity, and the lack of an interface between circulation files and other library files which contain much the same bibliographic data. Circulation control is one of the most widely automated library operations, and it is often the first and simplest activity to be automated in a given library, possibly because circulation control systems bear an obvious resemblance to inventory management, retail charge card operations, and other transaction processing activities which have been successfully automated in general business applications.

While specific circulation policies and procedures may be subject to considerable local variation, the major component of circulation
control—the check-out/check-in procedure—is typically performed in a straightforward manner that is easily understood by computer application developers and systems analysts lacking formal library training. As library users, many data processing professionals have experienced the circulation activity firsthand and are at least broadly familiar with its purpose and nature. Because the bibliographic data required for automated circulation control are often less extensive and complex than those required to computerize such activities as cataloging and acquisitions, data conversion costs, software development time, and storage requirements may be substantially reduced.

Perhaps more than any other library activity, the historical development of automated circulation control has reflected changes in state-of-the-art data processing technology. Through the mid-1970s, most automated circulation control systems were custom-developed for a single library or library system. As early as the 1930s and extending into the 1960s, a number of libraries used keypunched cards in combination with sorters, collators, and other unit record equipment as an alternative to manual record keeping. Tabulating keypunched cards with information about books, borrowers, and due dates could be sorted to select overdue items or to identify all books on loan to a given person.

Such "precomputer" data processing systems, several of which were developed for academic libraries by methods and procedures analysts and operations research specialists, were typically based on inventory control models used in business. With the introduction of computers for business applications in the mid-1960s, a number of libraries developed computerized circulation control systems based on batch processing techniques. Such systems were usually implemented on a computer located in a data processing center operated by a university, municipality, corporation, or government agency with which the library was affiliated. In the typical installation, keypunch or key-to-tape devices were used to convert information about individual circulation transactions to computer-processible form. The resulting data were then batched for processing at predetermined intervals, a computer writing individual borrower numbers into item records contained in a master circulation file maintained on magnetic tape and printing a list of all items in circulation for library reference.

While some of these batch-processing circulation control systems remain in use, they are now mainly of interest for their limitations and impact on the design of subsequent systems. As a particular disadvantage, the printed lists produced by batch-processing systems necessarily reflect the status of a library's circulating collection at the time when the last batch of transaction records was processed. Part of the information contained in such lists is necessarily invalidated by circulation transactions occurring after that time.

By the mid-1970s, library automation specialists had begun to concentrate on the development of online, real-time circulation control
systems which process circulation transactions as they occur. Because pertinent data files are updated immediately, such real-time systems accurately reflect the status of a library's circulating collection. Printed lists are replaced by online terminal inquiries to determine the circulation status of specific items.

While real-time circulation control systems have been custom-developed for individual libraries, a number of vendors offer generalized, preformulated approaches to the computerization of circulation control that eliminate the need for customized system development and speed the implementation process. Such preformulated approaches, currently the dominant method of automating circulation control, can be divided into two related groups: (1) prewritten circulation control software intended for execution on a computer system operated by or for a given library; and (2) turnkey systems, consisting of preconfigured combinations of hardware and software marketed as self-contained products.

Introduced in the early 1970s, the earliest prewritten circulation control software packages and turnkey circulation systems were single-purpose products designed specifically and exclusively for library circulation activities. While such single-purpose systems remain available, library administrators, systems analysts, automation planners, and product developers are increasingly emphasizing integrated, multifunctional turnkey systems and software packages which combine circulation control with other capabilities. In addition to circulation control, the most complete integrated system implementations include interrelated application modules for cataloging, online catalog access by library users and/or staff, acquisitions, and serials control (perhaps supplemented by materials booking), a community bulletin board system, and electronic message transmission. In some cases, circulation is a standard integrated system component which may be implemented alone or in conjunction with other functions; in others, circulation control is an optional application module which must be purchased separately.

Whether designed as single-purpose products or as integrated system components, prewritten circulation software packages and turnkey systems can be implemented far more quickly than customized circulation control systems which may require months or perhaps years to develop. Speed of implementation is an especially important consideration in applications where automation of the circulation activity will result in a cost reduction. Similarly, prewritten software packages and turnkey systems minimize or eliminate requirements for local software expertise. Libraries acquiring such products usually do not need to hire programmers. In fact, customer programming is specifically prohibited by most vendors. Because the system design is predetermined, user training is limited to operational considerations. As a distinctive advantage of turnkey implementations, procurement-related tasks are greatly
simplified by the availability of a preconfigured combination of hardware and software components that are specifically designed to work together. With a single source for central processing equipment and peripheral devices, the necessity of dealing with multiple hardware vendors is eliminated, as are potential problems of equipment compatibility.

While prewritten circulation control software packages are available for computers of all types and sizes, medium-sized and larger public and academic libraries have typically relied on mainframe- and minicomputer-based products. Examples for IBM mainframes include the NOTIS software package, originally developed by Northwestern University for its own use; IBM's own DOBIS/LIBIS program; and the TECHLIB/STATS implementation of the BASIS software package which is marketed by the Information Dimensions subsidiary of Battelle. Originally developed by libraries in the Minnesota State University system, the PALS software package is marketed by Unisys for use with its own mainframe computers, while the LIAS system, developed by Pennsylvania State University, operates on Honeywell computers.

Examples of circulation software packages for popular minicomputer systems include Comstow's Bibliotech system for Digital Equipment's VAX product line; the Georgetown Library Information System (LIS) for Digital's PDP-11 Series models; the Washington University BACS system for Data General and other minicomputers which run under the MIIS operating environment; and the VTLS and Inlex systems for the Hewlett-Packard HP-3000 product line. Minicomputer-based turnkey circulation control systems are available from CLSI, Geac, Data Research Associates (DRA), Dynix, OCLC, Universal Library Systems, and other vendors. Reasonably priced and designed for readily available hardware configurations, microcomputer-based circulation control programs have proven particularly popular with small public, school, and special libraries. Vendors include Follett, Gaylord, Easy Data, Data Trek, Aball Software, Nichols Advanced Technologies, Scribe Software, Winnebago Software, and Richmond Software.

While the earliest circulation control programs and turnkey systems forced libraries to accept predetermined loan periods, borrower categories, and other operating parameters, most newer products flexibly support a varied range of library requirements. Unlike earlier systems which contained rigidly coded procedures to control charging, discharging, and related activities, all newer products are parameterized—i.e., they allow libraries to specify the conditions under which items will be circulated, file inquiries made, and printed output produced. Rather than being written into programs, particular operating parameters are selected by libraries from a range of possibilities. The resulting flexibility broadens the range of applications which a given system can address and is particularly important in installations where a single prewritten software package or turnkey system will be shared by many libraries.
AUTOMATED CATALOGING

Descriptive cataloging is an intellectual activity requiring considerable decision-making and one that is time-consuming. As a result, many libraries experience cataloging backlogs which impede the flow of materials into circulating and reference collections thereby preventing library catalogs from representing those collections fully and accurately. Recognizing that the cost of descriptive cataloging can approach or even exceed the value of certain materials, many libraries do not catalog paperbound books, low-cost government publications, or other relatively inexpensive items. In some research libraries, materials of presumably limited interest may be placed in off-site storage facilities with only an abbreviated catalog record created. In most libraries, conventional descriptive cataloging is not even considered for individual titles in large microform sets, even though such materials may significantly augment a library’s resources in particular subject areas, and the failure to catalog them impairs their utility.

To simplify decision-making, to save time, and to reduce costs associated with descriptive cataloging, libraries have historically relied on cataloging copy—i.e., descriptive cataloging information prepared by other libraries, especially the Library of Congress. The automation of descriptive cataloging depends on the availability of such cataloging copy in computer-processible form. In the late 1960s, the Library of Congress developed the MARC format for the communication of bibliographic data on magnetic tape and began distributing machine-readable cataloging copy through its MARC Distribution Service. Since the late 1960s, MARC formats have been developed for various types of library materials, and the scope of the MARC program—once limited to English-language monographs—has broadened steadily and significantly. The LC MARC database—the accumulation of Library of Congress cataloging data in machine-readable form—now contains more than 2.5 million records, most of them cataloged since the inception of the MARC program.

Although MARC tapes can be purchased from the Library of Congress for input to local computer systems, most libraries obtain access to MARC data through products and services developed by publishers, computer system developers, time-sharing services, and other intermediaries. Among the earliest of these MARC-derivative products were computer-generated micropublications such as MARCFICHE, produced by MARC Applied Research, and Books in English produced by the British Library.

Created by computer-output microfilm (COM) technology, both products provided more timely and varied access to LC cataloging data than could be obtained through the conventionally printed National Union Catalog, which was itself discontinued in favor of a COM implementation in the early 1980s. As an equally timely and flexible alternative, several search services, including DIALOG and WILSONLINE,
offer online access to the LCMARC database. A growing number of vendors supply the MARC database on CD-ROM disks or digital optical videodiscs accompanied by software which supports the retrieval of specific cataloging records and the printing of card sets. Examples include the BIBLIOFILE system from the Library Corporation in Washington, D.C., the LASERSEARCH system from General Research Corporation, and the MINI MARC II system from Library Systems and Services Incorporated.

Although these products and services are important, most libraries obtain access to machine-readable cataloging records through one of the bibliographic utilities—organizations which maintain large databases of cataloging records and offer online access and other services to subscribing libraries. Examples include the Online Union Catalog implemented by the Online Computer Library Center (OCLC), the Research Libraries Information Network (RLIN) operated by the Research Libraries Group, the cataloging support service operated by the Western Library Network (WLN), the Cataloging Support System (CATSS) offered by Utlas International, the LIONS system operated by the New York Public Library, the AGILE II service offered by Auto- Graphics Incorporated, and Brodart’s Interactive Access System (IAS).

While they differ in database size and composition, the number and nature of their subscribers, and the specific capabilities they support, these bibliographic utilities each maintain a database of MARC records obtained from the Library of Congress and other sources, supplemented by original MARC-format cataloging contributed by subscribing libraries. Working at local terminals, participating libraries can retrieve cataloging copy, modify it to meet local requirements, and order printed card sets, machine-readable cataloging records on magnetic tape, and other bibliographic products. Local workstations are also used to input original cataloging records for use by other subscribers. Supporting thousands of online terminals accessing millions of machine-readable records, the bibliographic utilities are among the world’s largest and most intensively utilized computer-based information services.

**Computer-Produced Catalogs**

The automation of descriptive cataloging addresses only one part of the cataloging activity. In addition to using computers to facilitate access to cataloging copy, libraries are interested in computer-based solutions to the much discussed problems of card catalogs. The most frequently cited of such problems include substantial space consumption; the purchase of expensive cabinets and supporting furniture; labor-intensive and time-consuming catalog maintenance routines which are intensified by changes in cataloging rules affecting the choice and form of entries; and limited convenience and retrieval capabilities.

These problems can be minimized or eliminated by the replacement of card catalogs with computer-based book-form or online cata-
logs. Broadly defined, a book-form catalog contains successive bibliographic records listed in a page format on paper or microforms. Among the earliest applications of library automation, computer preparation of book-form catalogs can lower production time and costs while eliminating the labor-intensive file maintenance routines associated with card catalogs.

As an alternative to computer printed or typeset catalogs, computer-output microfilm catalogs have been widely implemented by libraries and library systems since the early 1970s. A number of service bureaus, book jobbers, bibliographic utilities, and other vendors have developed software to produce COM catalogs from library-supplied data, thereby eliminating the need for in-house COM recorders and customized programming.

Compared to paper-based book catalogs, COM catalogs offer several advantages, the most important being economy of production, durability, and compactness. Several companies, including Auto- Graphics and Information Design, have introduced display devices designed specifically for library COM applications. These devices, which feature preprinted instructions and simple controls, employ large reels of 16mm or 105mm microfilm, the latter containing several hundred uncut microfiche. In most cases, a library's entire catalog will fit on a single reel which remains inside the reader and need not be handled by the user.

While COM catalogs have been widely implemented, libraries seeking high-performance alternatives to card catalogs are increasingly turning to online catalogs. Broadly defined, an online catalog is an organized, machine-readable accumulation of bibliographic records which are maintained on disks or other direct-access computer storage media for retrieval by library users and staff members working at interactive terminals or appropriately configured microcomputer workstations. In addition to saving space and automating file maintenance, online catalogs permit remote access by authorized persons equipped with compatible terminals, and they can support information retrieval operations—such as keyword searching of titles and series names—which are not conveniently possible with card or book-form catalogs.

Online catalogs may be custom-developed for specific library installations or purchased as prewritten software packages or turnkey systems. Examples of custom-developed online catalogs include the Library of Congress Computerized Catalog, the MELVYL system at the University of California, the LIAS system at Pennsylvania State University, the Library Computer System (LCS) at Ohio State University, and the Dartmouth College Online Catalog. Prewritten software packages suitable for online catalog implementations include BRS/SEARCH from BRS Information Technologies, a powerful information retrieval program that is available in mainframe, minicomputer, and microcomputer versions; INMAGIC, a versatile data management program for
minicomputer and microcomputer installations marketed by Inmagic Incorporated; and MINISIS, a program for Hewlett-Packard minicomputers produced by the International Development Research Centre. As an alternative to prewritten software packages designed to operate on computers owned by a given library, several vendors offer turnkey information storage and retrieval systems which include preconfigured combinations of hardware and software components suitable for online catalog implementations. Examples include the STAR system from Cuadra Associates and the MARCIVE/PAC system from Marcive Incorporated.

Since the mid-1980s, however, online catalog implementations have been dominated by integrated library systems which combine database management and catalog access capabilities with circulation control, acquisitions, serials control, and other operations. Such systems may be implemented as complete turnkey configurations of hardware and software or as prewritten software packages designed to operate on a library-owned mainframe, minicomputer, or microcomputer. Vendors include CLSI, Geac, Notis, Dynix, OCLC, Virginia Tech, Data Research Associates, Carlyle, Comstow Information Systems, Universal Library Systems, Sobeco, Sigma Data/Centel, George-town Medical Library, Washington University, IBM, Inlex, Sirsi, Utas, Innovative Interfaces, Eyring Research Institute, Easy Data, Data Trek, and Unisys.

Among the newest and most widely publicized approaches to online catalog implementation, a growing number of vendors offer public access catalog systems which employ CD-ROM storage technology. Examples include the IMPACT system from Auto-Graphics, LASERGUIDE from General Research, THE INTELLIGENT CATALOG from the Library Corporation, and the LEPAC system from Brodart. In such implementations, the library provides a machine-readable version of its catalog, typically consisting of MARC format records on magnetic tapes obtained from bibliographic utilities or other sources, to a CD-ROM system vendor who indexes and otherwise prepares it for conversion to one or more CD-ROM disks. The disks themselves are created by a mastering process in special manufacturing facilities, and the library receives a specified number of disk copies plus menu-driven software designed for public catalog access at microcomputer-based workstations. Updated by periodic replacement in the manner of book-form catalogs, such CD-ROM catalogs are increasingly mentioned as an alternative to computer output microfilm for union catalogs and similar implementations.

**Automated Reference Service**

Since the late 1960s, many publishers of printed bibliographies, indexing and abstracting journals, and other reference works have offered machine-readable versions of their products for use in computer-
assisted reference applications. Initially intended for government, corporate, and academic libraries supporting research in scientific and technical disciplines, such machine-readable reference sources have become widely available in business, the social sciences, and the humanities. In addition to databases which correspond to printed publications, a growing number of reference sources have been developed specifically for use in computer-based systems and have no printed counterparts. While the earliest machine-readable databases were bibliographic in character, nonbibliographic numeric and directory-type databases are increasingly commonplace.

During the late 1960s and early 1970s, a number of libraries purchased machine-readable bibliographic and nonbibliographic databases for processing on in-house computers using custom-developed information retrieval software. Most libraries, however, lacked access to the hardware and software resources required to implement such systems. Through the early 1970s, the needs of such libraries were addressed by fee-based search services operated by the producers of machine-readable databases or other organizations such as large research libraries. Such services, which operated in the offline, batch processing mode, were replaced in the mid-1970s by services offering online database searching on a time sharing basis to libraries equipped with conventional terminals.

Now widely utilized by libraries of all types and sizes, online search services can be divided into two broad groups: (1) multidisciplinary services—including DIALOG, BRS, ORBIT, WILSONLINE, DATA-STAR, and ESA-IRS—that provide database coverage of a varied range of subjects for a broad clientele; and (2) specialized services—such as the NLM SEARCH SERVICE, STN INTERNATIONAL, LEXIS, and WESTLAW—that provide online access to one or more databases relevant to a single subject discipline, profession, or activity, such as medicine, law, or engineering. Various types of specialized search services provide online access to databases containing a specific type of information such as news. Examples include the NEXIS, VU/TEXT, DATA TIMES, and NEWSNET search services.

While they differ in the number and type of databases offered and in the specific retrieval capabilities supported, multidisciplinary and specialized search services share a common operating methodology: they purchase or otherwise obtain bibliographic and nonbibliographic databases in machine-readable form from their producers, convert the databases to a form required for storage on their computers, and allow libraries or other subscribers to perform various retrieval operations on such data using prewritten database management software. The software features a nonprocedural query language which permits a user at an online terminal to initiate literature searches or other information retrieval operations by entering specified commands. While their query languages are relatively easy to learn, online search services are more
often providing menu-driven interfaces for novice users. Some services also offer private file capabilities which allow libraries to establish their own databases.

As a recently implemented supplement or alternative to online search services, an increasing number of bibliographic and nonbibliographic databases are available on CD-ROM disks. Accompanied by information retrieval software, such CD-ROM reference products permit database searching at local microcomputer workstations (over 100 titles were available at the time of this writing). Offered on a subscription basis, they can prove less expensive than online searching for databases that are accessed frequently, although infrequent updating, slow response time for complex searches, and other performance limitations may make them unsuitable for some applications. As a hybrid implementation with potentially attractive cost/performance characteristics, several vendors combine CD-ROM searching of backfile data with online access to the most current information.

ACQUISITIONS

More informed decision-making through improved statistical analysis and reporting of procurement activity is the most frequently cited motive for automating acquisitions operations. Since the 1960s, automated acquisitions systems have been implemented in at least four different ways: as a custom-developed program designed to operate on a computer owned by a library or its parent organization; as an acquisitions-specific prewritten software package or turnkey system; as an application module supported by a multifunctional integrated library system; or as a time-sharing service offered by a bibliographic utility or a book jobber.

Each method has advantages and limitations. Customized acquisitions systems, an implementation option in any automated application, can be developed to a particular library’s specifications but are expensive and time-consuming to create. Prewritten acquisitions-specific software, and the acquisitions application modules supported by integrated library systems, can minimize the worst implementation problems associated with customized software development, but a library must have access to required hardware and system software components. Turnkey systems, consisting of preconfigured combinations of hardware and software, are available as both acquisitions-specific products and as integrated systems. In the latter group, the integration of acquisitions with cataloging and circulation in a single system offers several advantages, including the ability to establish a preliminary bibliographic record at the time an item is ordered.

All of the foregoing approaches require a substantial capital investment which can be minimized if automated acquisitions capabilities are obtained on a time-sharing basis through a bibliographic utility or bookseller. Because charges are incurred as the acquisitions facility is
used, this approach is especially attractive to libraries with modest annual volumes of acquisitions activity. Use of a bibliographic utility for acquisitions offers other advantages as well. Its database can be used for bibliographic verification, and data can be transferred from cataloging records to facilitate order preparation. In addition, the use of a single system for acquisitions and cataloging simplifies staff training requirements, while the immediate online availability of information about the holdings of other libraries supports cooperative collection development. Acquisitions systems offered by booksellers typically feature online access to inventory data with electronic ordering capabilities.

**Serials Control**

Current serials automation activities are directed toward two types of tasks—the bibliographic control of serial publications and the management of serials collections in individual libraries. The task of bibliographic control is the establishment of definitive bibliographic information about serial publications.

Among automated approaches to this task, R.R. Bowker offers machine-readable versions of its various printed guides to serial publications including Ulrich's *International Periodicals Directory*. The International Serials Data System (ISDS) and the International Centre for the Registration of Serials are charged with responsibility for the establishment and maintenance of a comprehensive machine-readable registry of bibliographic information about serials published throughout the world. In the United States, the Library of Congress has developed a MARC format for serial publications and participates in the CONSER program which creates and maintains a high-quality machine-readable database of cataloging records. The CONSER database is maintained by OCLC, and CONSER records are disseminated through the MARC distribution service.

To manage local collections, a number of libraries and several vendors have developed systems which automate one or more aspects of serials processing, including union list production, ordering, check-in, claiming, and the routing of received issues to designated persons. Computer-based production of union lists of serials is routinely supported by data management software or word processing systems. Such lists may be printed on paper or microfiche. The last option is especially useful for very long lists that will be mailed or otherwise distributed to multiple locations. As an example, microfiche is the output medium for the California Union List of Periodicals (CULP) which contains information for over 63,000 periodicals held by 700 California libraries. The CULP database is also accessible online through BRS.

As with conventional book acquisitions, computers can be used to minimize the labor-intensive sorting, filing, and other paper-handling work routines associated with manual serials processing. A number of
libraries developed customized serials control systems during the 1960s and 1970s. The PHILSOM system, developed by the Washington University School of Medicine Library, is perhaps the most famous example. As an alternative to the time and expense associated with customized system development, libraries can obtain access to serials control capabilities on a time-sharing basis through subscription service companies. Examples of such time-shared serials control services include F.W. Faxon's LYNX system and the EBSCONET system offered by EBSCO Subscription Services.

Several companies and other organizations have developed pre-written software and turnkey systems designed specifically for serials control. The INNOVACQ Acquisitions and Serials Control System, for example, offers a comprehensive range of serials ordering, check-in, and claiming capabilities. It can download records from bibliographic utilities and transfer serials records to a local circulation control or public access catalog system. Among microcomputer-based products, OCLC's SC350 Serials Control System can retrieve bibliographic information, local data, and publishers' addresses from the OCLC online union catalog. It facilitates the check-in of received issues, produces claims and claim cancellations, maintains binding instructions, and prints bindery slips. It can also transmit serials records to OCLC's union list component. As an alternative to single-purpose implementations, several integrated library systems support serials control modules, and others have announced such capabilities for future implementation.

Bibliography


Microcomputers in Libraries

DANNY P. WALLACE AND JOAN GIGLIERANO

Writing an article dealing with any aspect of the use of microcomputers is somewhat like taking a still photograph of a hurricane. It may be possible to suggest something of the nature of the thing, but a static medium such as an article or a photograph cannot possibly capture the complete scope and impact of such a dynamic phenomenon. Although microcomputers are in many ways a natural, evolutionary outgrowth of previously existing computer developments, their effect has surely been revolutionary in its breadth and depth. Despite great advances in the use of shared computer systems and telecommunications networks, the mainframe computer was and is the province of the wealthy institution. The minicomputer brought computing power to mid-sized institutions, but was still beyond the grasp of most small institutions and virtually all individuals. The microcomputer has made automation accessible to nearly every small business or individual with a desire and need for a computer. The availability of relatively inexpensive, independently operated personal computers has brought automation to people, situations, and tasks that might otherwise never have been automated. At the same time, microcomputers used as intelligent terminals have led to great improvements in the use of larger computers.

The greatest impact of microcomputers may be that they have done so much to demystify the computer. The computer, previously the carefully guarded tool of highly specialized scientists and technicians, has become accessible to everyone. It has become clear that the use of this wonderful tool, seemingly so complex and unfathomable, can be learned in a very short period of time by virtually anyone. The computer is not just a tool for complicated, large-scale, long-term projects; it can
now be effectively used to solve common everyday problems as well. As computing has become available to the nonspecialist, it has become possible for computers to find their way into virtually every aspect of human activity, including a wide variety of library uses and applications.

**Microcomputer History and Development**

The microcomputer was made possible by the introduction of the microprocessor in 1971. Although computers aimed at the individual user had been made and marketed before that time, they were of rather limited capability, were physically cumbersome, were difficult to use, and cost too much to appeal to more than a handful of highly motivated specialists. The microprocessor, which was developed for use in handheld calculators, placed all of the essential elements of a computer's central processing unit on a single tiny square of silicon. The microprocessor was quickly adapted to other uses, including video games, control and monitoring functions in machinery and vehicles, and microcomputers.

Although there is some disagreement as to the identity of the first true microcomputer, kits for building rather primitive microcomputers appeared as early as 1973. The July 1974 issue of *Radio-Electronics* featured an article on the building of a "personal minicomputer" based on a microprocessor (Titus 1974, p. 29). A typical home-built microcomputer had very limited abilities, used a teletype and punched paper tape for input and hard copy output, relied on a television for monitor output, allowed for program and data storage on cassette tape, and required the manipulation of toggle switches to accomplish basic tasks such as loading data from a tape, running a program, or sending output to a printer. These kits had limited appeal and did not find their way into the mass market, but these kits did have a significant impact on computer enthusiasts and led directly to commercial developments that had a more far-reaching effect.

A major landmark year for microcomputer development was 1977. In that year, the first commercially produced microcomputers were introduced. The most notable of these were the Apple II, the Commodore PET, and the Tandy/Radio Shack TRS-80 Model I, which constituted the first efforts of three of the most successful microcomputer companies. Despite differences in appearance, these three products were in most ways quite similar. Each provided the purchaser with a box housing the microprocessor, a limited (by 1988 standards) amount of computer memory, and a keyboard. The Commodore also provided a built-in monitor; monitors were optional for the TRS-80 and Apple II, each of which could use an ordinary television as a monitor. Each initially made use of a cassette tape recorder for primary long-term storage, although floppy disk drives were very soon added to the options lists. The compact packaging and relatively low price of these computers and others introduced in the late 1970s made them very attractive to
computer enthusiasts, to some small businesses, and, perhaps most importantly, to educators. Suddenly, in 1977, teaching programming skills, making effective use of computer-assisted instruction, and employing computers for other educational purposes became economically feasible even for small schools. Apple and Commodore in particular quickly rose to prominence as providers of computers and software to schools.

The five-year period beginning in 1977 was one of fantastic growth in the fledgling microcomputer industry. Many new products were introduced, some of which were great successes while others were less successful and were eventually dropped from the market. Even successful companies had their problems and sometimes introduced products that were dropped from the market almost immediately. The microcomputer software industry came into existence during this period, and many currently successful software producers grew from products developed and produced during the late 1970s. This five-year period of rapid growth and diverse developmental activities reached a climax in 1981 with the introduction of the IBM PC, the machine that finally brought an element of standardization to microcomputer technology. Although that standardization is not and cannot be universal, the introduction of a product from IBM, the computer industry’s one traditional giant, was bound to have a profound impact on the industry as a whole. “IBM compatible” quickly became a major catchphrase, and both producers and consumers of microcomputer hardware and software immediately divided into two camps. These two groups included those who eagerly embraced the IBM standard and moved to develop additional products and services based on that standard, and those who rejected the IBM standard in favor of some other hardware manufacturer, usually Apple. The latter group has become especially prominent since the introduction of the innovative and influential Apple Macintosh in 1984. Although the preferences of different people for different computers is an unusually emotion-laden topic and is often expressed as if it were a matter of open warfare (Magid & Marty 1988, pp. 70-77), the real conflict is probably a matter of truly personal factors rather than the clear superiority of one computer over another. The big difference between IBM fans and Macintosh aficionados appears to center upon subjective distinctions in what people in the two groups do and how they do them, although those distinctions are frequently expressed as if they represented an objective reality that should lead to the absolute dominance of one group over the other.

Microcomputers in Libraries

Pratt (1984) has described the literature on microcomputer use in libraries as being “a mile wide and an inch deep” (p. 248). Despite four years of developing use and a rapidly growing literature since the publication of that statement, it is for the most part still accurate. The
literature to date is mostly descriptive rather than analytical, mostly pragmatic rather than theoretical. It is clear that the microcomputer has very quickly become a standard and nearly ubiquitous part of the repertoire of tools for use in libraries. It is equally apparent that librarians are still in an era of discovery with regard to microcomputers, exploring their uses and limitations, and accepting them into libraries with a mixture of enthusiasm and caution. Much of the literature seems to reflect a search for uses for a new tool rather than effective exploitation of available tools to meet well-defined needs. Many of the earliest reports on the use of microcomputers in libraries are arguably more valuable as philosophical statements of acceptance of a new way of doing things than as descriptions of valid applications of computer procedures for the accomplishment of needed processes. The later literature has shown a certain degree of maturity, reflecting more carefully planned applications of tools to tasks. This growing sophistication of use is probably in part a matter of the availability of increasingly capable hardware and software, and in part a matter of an increase in the sophistication of librarians as consumers and developers of microcomputer systems. Early microcomputers were not really amenable to the solution of complex tasks, but as microcomputers with increased processing speed, greater storage space, and more sophisticated input and output devices have become available, librarians have eagerly sought new ways of making use of the increased capacity of the machine. Similarly, those librarians who pioneered microcomputer use in libraries frequently had little or no prior automation experience. They were poorly prepared to select and use microcomputer hardware and software. More recent developments have taken place in an environment of increasingly sophisticated hardware and software and increasingly knowledgeable librarians.

There have been very few research reports dealing with microcomputers in libraries, and the cumulative impact of research that has been done is negligible. This does not necessarily reflect any fault on the part of authors interested in the use of microcomputers in libraries. The professional literature of any new area of interest typically begins with descriptions of products and their application in specific environments and develops a research component gradually. One problem in assessing and using the literature of microcomputer applications in libraries is the necessarily ephemeral nature of the literature. By the time a review of a particular software package has appeared in print, that software package may have been revised so extensively that the review is no longer valid. Case studies of the experiences of individual libraries are of interest but suffer from the same problem: by the time the case study appears the library may no longer be doing what was described. Directories and catalogs of hardware and software are potentially useful as a means of making comparative judgments but also suffer from becoming quickly out of date.
IDENTIFYING AND SELECTING HARDWARE AND SOFTWARE

The selection of specific hardware and software is a potentially difficult task. Although the availability of software for library-specific tasks is still somewhat limited, it is increasing very rapidly. Libraries also need general purpose software such as word processors, data management packages, spreadsheets, and communications programs. There are dozens of commercial offerings in each of these areas, and being an informed consumer is a difficult task. The proliferation of hardware presents an equally formidable selection problem. The availability of a large variety of IBM-compatible "clones" at bargain prices makes basic hardware selection problematic, and the situation is greatly aggravated with regard to selection of peripheral devices such as printers, monitors, and modems.

The problems of selecting hardware and software for use in libraries have been addressed by a number of authors usually in the form of general introductions to microcomputer use with comments on the application of microcomputers to library problems, or as sections in other works on the use of microcomputers in libraries (Chen & Bressler 1985; Kesner & Jones 1984; James E. Rush Assoc. 1984; Costa & Costa 1986; Rorvig 1981; Walton & Taylor 1986). The problem with any selection guide is its inherently ephemeral nature. The availability of microcomputer hardware and software changes so rapidly that any listing in book form will inevitably be out of date before it is published. Such books can, however, act as guides to general principles of selection and do provide some idea of the varieties of hardware and software available at the time the book was prepared.

The periodical literature of library science is only marginally better than the monographic literature as a source of information to guide microcomputer and software selection. Several periodicals do include product reviews and articles on microcomputer use including Library Journal; American Libraries; School Library Journal; Library Hi Tech; Information Technology and Libraries; Access: Small Computers in Libraries; Library Software Reviews; and Database. Periodicals, however, suffer from the same timeliness problems as books, although to a somewhat lesser extent (the degree of time lag depends upon the publication; some product reviews appear as much as a year after they are written). Although articles and reviews in library science journals may be valuable primarily as retrospective sources of information, the advertisements in these periodicals can act as indicators of the varieties of specialized hardware and software available. In such a rapidly changing environment, awareness of what is currently being offered can be essential, and constant monitoring of advertisements is one way to maintain that awareness.

The best sources of up-to-date information on general purpose hardware and software are probably microcomputer periodicals, such as Byte; Personal Computing; PC World; PC Magazine; PC Week. These publica-
tions provide frequent comparative reviews of hardware and software and also act as primary news sources for developments and changes in the microcomputer industry. The advertisements carried in microcomputer magazines can also be useful sources of information, and most advertisers are more than willing to send further product information.

A final very important source of information on microcomputer products is personal contact. Whenever possible, some sort of hands-on experience with the product should precede the decision to acquire it. Many software vendors will provide demonstration programs either free or for a small fee. Unfortunately, even small prices for demonstration programs can accumulate rapidly, and the quality of demonstration programs is quite variable. The best are scaled-down versions of the product, capable of exhibiting most of its characteristics. The worst are more promotional than demonstrative in nature and amount to disk-based advertisements for the product. The prospective customer rarely has any means for assessing in advance which approach will be taken in a demonstration program and therefore has a substantial likelihood of investing in a demonstration program that does not provide an adequate demonstration. Vendors of library-specific hardware and software are conspicuous presences at most library association conferences, and librarians should take advantage of such opportunities to encourage the vendors to demonstrate their wares.

Personal contacts can also be made at local microcomputer expositions or at meetings of microcomputer user groups. Microcomputer expositions or fairs are regular occurrences in many localities and provide an opportunity to see new hardware and software offerings and explore with vendor representatives the specifics of pricing, service availability, and vendor support. User groups often sponsor presentations by vendors and also act as clearinghouses for sharing experiences. Although expositions and user groups are unlikely to focus on library-specific hardware or software, they can provide a very valuable opportunity to learn about general purpose hardware and software.

**Library Applications of Microcomputers**

Microcomputers have been used in libraries in a wide variety of ways, most of which fall into three major categories: (1) provision of microcomputer hardware and/or software for public use, (2) use of microcomputers as intelligent intermediaries to larger systems, and (3) use of microcomputers as stand-alone systems for supporting library functions.

Some of the earliest uses of microcomputers in libraries involved providing microcomputer hardware and/or software to library patrons, mostly in school and public libraries. This role of the library as a "computer resource center" (Costa & Costa 1986, p. 117) is a very natural extension of the library’s traditional function of providing patrons with the information they need in the form in which it can best be used (Polly 1986; Dewey 1984).
The use of microcomputers as access mechanisms for larger, remote computers allows for effective use of distributed processing. Information can be input, edited, and formatted locally prior to being uploaded to a remote computer and can similarly be downloaded to the microcomputer for later processing. The overall effects are a reduction in demands placed on the larger computer and on telecommunications systems and the ability to make use of downloaded data for local purposes. A microcomputer accompanied by appropriate communications hardware and software has become the preferred tool for online retrieval from commercial database services. The adoption of the OCLC M300 (a modified IBM PC) for use in interacting with the OCLC system was a major advance in the use of microcomputers as access mechanisms for large computer systems. A microcomputer running specialized communications software is now the standard means for accessing bibliographic utility databases.

Although the public use of microcomputers and the use of microcomputers in providing access to remote computer systems are significant parts of the library microcomputing environment, the most active and arguably most problematic area is in the use of microcomputers to directly address library problems. Such uses can be divided into two broad categories: (1) the use of general purpose hardware and software to accomplish library tasks, and (2) the use of hardware and/or software specifically designed and developed for library purposes.

The Use of General Purpose Software in Libraries

General purpose microcomputer software, such as word processors, data managers, and spreadsheets, has an obvious potential for application to the office operations that make libraries like other businesses. Spreadsheets can be used to manage budgets and prepare fiscal reports, data management packages can be used to maintain name and address files, and word processors are indispensable tools for the voluminous and repetitive correspondence essential to library operations. There are also many ways in which general purpose software can be imaginatively used in tasks more directly related to the primary functions of libraries. As Sherouse (1982) has pointed out, an advantage of using a general purpose software package rather than a package designed specifically for library use is the ability to flexibly tailor the product to meet local needs (p. 46). This can be of value when the librarian perceives commercially available library software as being too rigid, or when the librarian deliberately wants to deviate from standardized practices. In some cases, and this was universally true prior to the development of software designed to support library operations, adapting general-purpose software is the only available approach to automating a function other than writing a totally new program. Adapting a general purpose package may also be an economical approach, particularly if the package can be used for several library functions. Special
purpose software is frequently expensive, and buying several packages to support a library's needs may involve a substantial investment. If those same functions can all be achieved through the use of one general purpose package, the investment will usually be much less. The use of general purpose software for a variety of purposes also means that the user needs to learn only one set of commands and routines. Unlike many library-specific programs, general purpose software rarely requires any special hardware configuration. The computer that is used for general office functions can also easily be used for library operations, making the required hardware less expensive and adding a further element of simplicity of operation. A final advantage is that any community is likely to have a number of users of a general purpose program, and these users can act as a support group and source of advice. Similarly, every popular package is the subject of a variety of books and articles that can add to the librarian's understanding of the software and its use.

The literature on the use of general purpose software for library tasks is large and quite diverse. Most of the literature has concentrated on the application of data management packages, such as the dBase series, or spreadsheets, such as Lotus 1-2-3. Beiser (1987) has provided a fairly comprehensive view of the use of dBase III for library purposes, with applications for mailing list management, bibliographies, community resources files, newspaper indexes, abstracts, serials union lists, reference archives, acquisitions, serials control, catalog production, registration, overdues accounting and processing, reserve operations, circulation, statistical processing, and more. Data management packages have also been used for maintaining profiles of faculty research interests (Pastercz 1985, pp. 265-76; Borovansky & Machovec 1985, pp. 300-05), managing serials functions such as check-in and binding (Evans & Ewing 1986, pp. 111-21), maintaining a sheet music index (Carter 1983, pp. 52-55), creation of a bibliographic retrieval system (Armstrong 1984, pp. 197-201). Clark (1985) and Auld (1986) have provided books on the use of spreadsheets in libraries to accomplish such tasks as preparing summaries of library activities, overviews of collection use, conducting studies based on Output Measures for Public Libraries (Zweizig & Rodger 1982), and assessing data from various statistical reports.

An important new variety of general-purpose software relates to desktop publishing. Every business is involved in one way or another with the production of various kinds of publications, and libraries generally have rather extensive publishing needs. Desktop publishing systems allow for the local production of high quality camera-ready copy for publications such as newsletters, promotional or educational materials, and reports. Among the advantages of desktop publishing are:

—High quality output: documents give the impression of having been typeset by professionals.
—Versatility: most software packages offer a variety of typefaces, type sizes, and graphic effects.

—Flexibility: the system's operator can make changes to the page layout right up to the last minute before the document is printed.

—Substantial savings in time and money: the traditional publishing cycle is streamlined and typesetting costs are eliminated (Carson 1988).

High quality desktop publishing is still a rather expensive proposition. The software itself is costly, and effective use of the software requires a high capacity microcomputer with a sophisticated monitor and a laser printer. The costs can be reduced by doing only the input and layout locally, and by having the actual printing done at a printing or photocopying shop. Even if all work is done within the library, it is probable that the overall cost of most small publishing jobs will be considerably less than if all setup and layout work is done by a printshop. Given the potential for added production control and decreased costs, it seems likely that many libraries will become heavily involved in desktop publishing in the next few years.

Another recent development with considerable potential for benefiting libraries is the development of various approaches to connecting microcomputers and other computers in networks. Although it has been possible to link microcomputers in geographically confined spaces for quite some time, until recently such networks have been of very limited flexibility. In instructional settings, it is possible to link computers such that the instructor's microcomputer can monitor activity on student microcomputers and perhaps send messages to students regarding their performance. Dial-up systems in which a microcomputer acts as a centralized source of information or programs are also a possibility. The network environment that is currently generating the greatest interest, however, is the local area network (LAN). In a LAN environment, a relatively diverse set of hardware and software, perhaps including different types of microcomputers, printers and other peripheral devices, and maybe even larger computers, can be tied together so that resources can be effectively shared within a relatively limited space. A detailed description of the use of LANs in libraries has been provided by Kemper (1987). The nature of a local area network can be summarized quite succinctly:

The devices linked by a LAN are physically connected by one of several types of transmission media (wire or cable). While provision is often made for remote connection by modem to other networks or computing facilities, such connections are not necessary to the operation of the LAN. The area covered by a LAN varies; it is usually confined to a single building or one floor or section of the building, although larger LANS can extend up to several miles. The LAN is normally owned by a single organization. (Levert 1985, p. 9)

The advantages of LANs lie in effective use of resources, such as sharing a single printer among a number of microcomputers, and in the ability to readily transmit information from any microcomputer in the network to any other device in the network. It is thus possible for workers who need to exchange messages or data to do so without leaving
their desks and without generating unnecessary printed memos or documents; a document can be created by one person, proofread by another, edited and amended by a third, and set up for desktop publishing by a fourth, all by passing machine readable files among workstations in a local area network.

The adaptation of general purpose programs to library purposes is not without its problems. As Beiser (1987) has pointed out, "not everything that can be done in dBase should be done in dBase" (p. viii). It is incredibly easy to invest an inordinate amount of time and effort in developing library-oriented products based on general purpose software. The apparent cost advantage of the software may be balanced or overbalanced by the high cost of adaptation. Some library tasks are simply not amenable to the use of general purpose tools. Most data management packages, for instance, rely on fixed length data fields. Although it is certainly possible to use such software to build bibliographic databases, the inherently variable nature of the records in such databases usually makes such an application inefficient. If the database is large enough, the limitations of a data management package such as dBase may make its application ineffective as well.

Another disadvantage of adapting general purpose software is the inability to effectively exchange data with other libraries. It is possible to exchange data in the form of files formatted for a particular data management or spreadsheet package, but in practice such exchanges are generally problematic. Although standardization of data in microcomputer systems for libraries does not appear to have been a very pressing concern, it is now possible to think in terms of microcomputer-based systems that make use of MARC records for bibliographic data. If the MARC standard dominates microcomputer systems in libraries in the manner in which it has taken precedence in larger computer systems, and there is every reason to believe that it will, libraries making use of systems adapted from general purpose programs will probably find themselves excluded from opportunities to benefit from the interchange of data among libraries.

Special Purpose Software for Libraries

Although software designed for other purposes can be adapted for library functions, the most effective solution frequently lies in the use of programs written specifically to address library problems. The development of library microcomputer software began very shortly after the introduction of the first commercial microcomputers and has continued in a rapid, if not very systematic, manner.

The general history of the development of microcomputer software for library-specific purposes has been one of overcoming hardware shortcomings. The earliest commercially available microcomputers were, in 1988 terms, distressingly slow, could store very limited amounts of data, and depended on ridiculously inconvenient input, output, and
storage mechanisms. Keyboards were not adequately similar to typewriter keyboards, monitors could display only a limited number of characters and frequently could display only uppercase characters, printers worked unbearably slow to produce products that were only marginally legible, cassette tape storage devices were slow and cumbersome, and early disk storage systems were capable of storing comparatively small amounts of data.

Despite these limitations, it was clear that microcomputers had much to offer librarians, and viable, if limited systems, were developed. Many of the earliest systems were developed by individual librarians who already had, or were willing to acquire, the skills necessary for writing their own programs. Other librarians worked with programmers in their own institutions or communities, sometimes hiring them on a contract basis, sometimes inveigling the assistance of friends or colleagues. Many of the products of these efforts were distributed to other librarians through various—mostly informal—means and thereby came into moderately widespread use. Some of these products were later transformed into commercial endeavors, and some currently successful commercial software is based on early programs developed by or for individual librarians.

As roadblocks have been removed or reduced by the advancing development and refinement of microcomputer hardware, library-specific software has become increasingly more sophisticated and more capable, but there are still limits to the abilities of microcomputer software. Even very small libraries maintain records that are large in microcomputer terms, and maintain large numbers of such records. This has generally meant that microcomputer software for libraries has necessarily been compromised in various ways. Many microcomputer-based circulation systems, for instance, make use of very abbreviated records, maintain data only for materials that are currently checked out, and even then are capable of coping with a very limited number of transactions and borrowers. The production of catalog data has typically meant reliance on records that are of an abridged nature and that do not in any way conform to the MARC standard for machine-readable cataloging. These limitations are being overcome as faster microcomputers with greater storage capacities become available and affordable, but software development always has a tendency to lag slightly behind hardware availability.

As a result of the size and number of many library records, advances in microcomputer storage devices have been especially important to the development of microcomputer-based programs for libraries. Tape storage gave way to single-sided diskettes, single-sided diskettes were quickly replaced by double-sided diskettes, recording density for diskettes has been progressively increased, and diskettes have been replaced, or at least augmented, by various fixed disks of ever-increasing capacity. A very important recent development is the widespread use of
optical disc systems which allow for very high capacity storage, making it possible to design library microcomputer systems that access fairly large databases of full MARC records (see Andre's article in this Library Trends issue).

Several catalogs of library-specific software have been published (Dewey 1987; Gates 1985; Miles 1986; Nolan 1982; Nolan 1983; Walton & Taylor 1986). These catalogs uniformly suffer from the same limitations noted earlier in regard to sources of information on the availability of software: none are truly comprehensive, and all are to some extent out of date by the time they are published. These listings do, however, provide some indication of the varieties of software that are available and are valuable as clues to what can be expected in terms of the processes that can be automated on a microcomputer, the hardware required for their automation, and the approximate cost of the software. The listings are purely descriptive, however, and do not provide any real input into the comparative evaluation of the products described.

Walton and Taylor (1986, pp. 510-18) have provided a listing of subject categories for library-specific software. These categories include acquisitions control; audiovisual, equipment and facilities management; bar code label production; bibliography production; catalog card and label production; cataloging; circulation/overdues; computer-aided instruction; documents control; gateway software; indexing; integrated system; interlibrary loan; inventory; online catalog; readability estimates; retrospective conversion; school library budget management; selective dissemination of information; serials control; shelf space management; statistics; and utility software. Other authors have developed other categorizations, but it is clear from examining any of these directories that systems are available to address nearly every library function.

One of the problems of choosing a library microcomputer system is the fantastic variation in capability and configuration of the programs available. Prices range from under one hundred dollars to several thousand dollars. Hardware requirements range from an Apple II or Commodore 64 with minimal internal memory and a single floppy disk drive to a fully configured IBM PC or Apple Macintosh with a high capacity hard disk and a laser disk drive. Many of the programs are available for a variety of different computers and configurations; others are available only for one fixed configuration of a specific brand of computer. Most of the programs require a specific operating system environment, and some require other additional software, such as a programming language or general purpose applications package. Some of the systems described also require specialized hardware, such as a bar code reader, a printer with a special tractor drive for forms, a tape backup system, or a specially modified keyboard. In some cases the specialized software and hardware are provided in a “bundle” at one price, in others the purchaser has the option of acquiring hardware from the software vendor or independently, and in others the responsibility of acquiring appropriate hardware is left entirely up to the software purchaser. Some systems
are vended by well-known suppliers of other services to libraries, some exist for the sole purpose of providing library automation systems, and some operate primarily in nonlibrary markets but sell one or two library-directed products. Service after the sale includes such options as no service, provision of regular updates at no cost, provision of updates for an additional charge, personalized service through telephone help lines, and on-site installation and service. Some vendors provide only software service while others service both hardware and software.

The extreme variability in software capability, hardware requirements, and vendor services makes selecting and effectively using a microcomputer system for library purposes very complex. A further complexity lies in the inevitable need to update the system. Software vendors are constantly trying to improve and expand their products, removing errors, making existing processes more efficient and more effective, and adding new processes. As hardware options and capabilities increase, it is natural for software producers to respond by making it possible for their products to make use of new hardware. Although the software producer will necessarily try to make the incorporation of revisions as easy as possible, changing from one version of a program to an updated version is always somewhat disruptive, and the greater the change in the program, the greater will be the disruption. Some librarians may be tempted to avoid this disruption by not implementing new revisions. This will generally have two major negative impacts: (1) the library will be denied increased effectiveness and/or efficiency, and (2) the library may be cut off from vendor support services, since most vendors aim their support operations at the most recent versions of their products.

Another potentially painful but usually inevitable decision most librarians will have to make involves the future need to replace one microcomputer software package with another. This can happen for a number of reasons: (1) the needs of the library may grow or change such that currently used software is no longer adequate, (2) new software may be introduced that can achieve the same ends as the current software in a more efficient or more effective manner, (3) the hardware required to operate the software may no longer be available, and (4) vendor support may no longer be available either because the vendor has gone out of business or because the vendor has chosen to drop the specific software product from its offerings. No matter how carefully the selection of software is handled, it is very likely that one of these factors will eventually lead to a need for new software.

Far too frequently the realization that the software currently in use must be replaced comes as an overwhelming shock. This is an outcome of an inappropriate way of thinking that can be termed the "permanent system syndrome." The permanent system syndrome leads people to believe that the means they select for achieving a particular task will never be in need of modification or replacement. Although this belief is
rarely appropriate, it is true that many manual library systems have had much longer product lives than most automated systems will have. Even the longevity of manual systems, however, may be a result of reluctance to change rather than lack of a need to change.

Another prominent malady is the "perfect system syndrome," in which it is believed that there must be some one system that will address all of the library's needs in a particular area. If that system does not appear to currently exist, the perfect system syndrome sufferer frequently decides to wait for its appearance rather than adopting an imperfect system now. Anticipation that the perfect system is just around the corner, or fear that a package selected now will have to be replaced at some point in the future, frequently leads to a decision to delay automation altogether. The perfect system syndrome and the permanent system syndrome often work together to prevent librarians from adopting reasonable attitudes toward automation. The librarian suffering from either syndrome risks allowing the library to lag increasingly behind the times and therefore remain increasingly inefficient and ineffective. There is no perfect system for any task, and there are no permanent systems.

THE FUTURE OF MICROCOMPUTERS IN LIBRARIES

Microcomputers have had a significant effect on libraries and will continue to do so. As microcomputer technology becomes cheaper, faster, and more powerful and as the user population and the library profession become more computer literate, the library as it is known today may be dramatically, if gradually, transformed—or it may disappear completely. The microcomputer, properly integrated into present library operations, will make it possible to do more in terms of processing materials, providing services, accounting for use of funds, and evaluating the effectiveness of activities. Microcomputers will impact the library environment physically and philosophically and will profoundly change the nature of education for the profession of librarianship.

It is likely that microcomputer prices will continue their downward trend, although there have been some counteracting factors, such as a recent, but presumably temporary, worldwide shortage of memory chips (Schier 1988, pp. 1, 112-13). IBM kept the architecture of its personal computer virtually unchanged for six years during the early 1980s, providing a static target for the manufacturers of competing clones. The result has been an abundance of affordable, dependable, generic microcomputers, allowing fiscally conservative institutions like libraries to confidently contemplate their purchase. One prediction is that the time is not far off when stripped-down PC clones will be retailed in the United States at between $250 and $300; other authors have estimated that the cost of computer components relevant for library operations is likely to decline about 25 percent per year without adjusting for inflation (Anderla & Dunning 1987, p. 65; Baumol & Blackman
"The movement toward small computers in libraries has meant that many institutions hitherto unable to afford automated systems now find them within reach" (Kesner & Jones 1984, pp. 13-14). The trend toward inexpensive generic computers will strongly affect which and how many computers libraries of all sizes buy, from whom, and how much they cost (Beiser 1985, pp. 42-43).

In addition to becoming less expensive, microcomputers are expected to become smaller, faster, and more powerful: "By 1990 we shall know with precision the ultimate bounds to miniaturization of electronic components and figure out the limits to the development of computer systems based on current materials, concepts, designs" (Anderla & Dunning 1987, p. 277). The development of resistance-free and heat-free superconductive circuits will affect the capabilities of microcomputers, as will the development of photonics, or laser computers, that use light instead of electricity for processing; and so-called biological computers (Carlson 1985, p. 53). It is likely that the vast research and development efforts occurring in the public sector, with the Strategic Defense Initiative, and in the private sector, where the generational turnaround in systems design is said to take place every six months, will trickle down to the larger society, but at a much slower pace (Anderla & Dunning 1987, p. 178; Kesner & Jones 1984, p. 25). When the investment in microcomputer hardware and software is made by individuals and small institutions, the tendency is to stay with their choice, even if it means staying behind when IBM announces a new "upwardly compatible" system as it did in 1987 with the PS/2 series (Beiser 1985, p. 43). In the early and mid-1980s, writers on the future of microcomputers in libraries speculated that future problems would cluster around software and staff training, not hardware power (Chen & Bressler 1985, p. 6; Kesner & Jones 1984, pp. 155, 210). For libraries, the critical need is for the capacity to store and access large amounts of information, making developments in storage more important than those in the computational ability of microcomputers (Pratt 1984, p. 261). Storage is probably the area which will see the most dramatic developments in the near future; there is a sense in the literature that we are at a watershed in the history of computers [that] presages their application as an everyday tool for work and leisure (Anderla & Dunning 1987, p. 276). Specifically, developments in high density random access memory and optical discs are expected to transform the field in the next five years or so (Anderla & Dunning 1987, pp. 175, 278; Kesner & Jones 1984, p. 25).

Microcomputers have developed and are evolving rapidly and are touching the lives of those in industrialized nations at an unprecedented rate. One prediction is that computer penetration may be 40 to 50 percent in industrial nations by the end of the 1990s, compared to the present 5 to 10 percent (Anderla & Dunning 1987, p. 277). Some writers appear certain that microcomputers will lose their novelty and become
"just another everyday tool like the telephone"; their ubiquity in people's businesses and homes has already made them familiar and popular to many, at least at certain educational and socioeconomic levels (Pratt 1984, p. 263; Kesner & Jones 1984, p. 25). The gap between the computer literate and proficient information rich and the information poor—those without knowledge of and/or access to information technology—is a polarization within society which raises direct questions about libraries' roles in meeting the needs of their users or potential users. A 1983 report on microcomputers in education stated that, although libraries have traditionally bridged the gap between rich and poor with books, it is unlikely that they can perform the same service with computers ('Legal Challenges...' 1983, p. 780). For some, especially the affluent and children who are products of well-to-do school systems, expectations of what libraries can and should deliver will be raised by their own computer literacy and familiarity. For those on the other side of the information divide, needs will be much different. Who are the libraries' clients and how will they be served given the yawning educational gaps that exist? What are libraries' responsibilities to meet or surmount these gaps? Should it be a mission of public libraries to strive for the spread of electronic literacy, as many have for the print equivalent? These are questions for which there are no easy solutions, but they must be posed in any discussion of the future of microcomputers in libraries. In the 1980s, libraries will be forced "to economize, standardize procedures, reduce staffing levels, and make more efficient use of existing facilities, monies, and personnel, [plus] provide a wider range of user services and enhanced administrative and intellectual control over information housed in their collections" (Kesner & Jones 1984, p. xi).

These conflicting demands on most libraries will continue for the foreseeable future, and the microcomputer is a tool that can make it possible to cope successfully with this situation. While microcomputers in libraries will not take the place of staff nor do away with the mountains of paper generated by our society anytime soon, they do offer new, sophisticated modes of managing information and utilizing the intellects of those who work in libraries. Some library forecasters predict the merging of public and technical services as a result of automation (Harrington 1986, p. 18), the reasoning being the need for fewer professionals in technical services and the capacity for much more sophisticated user services. The latter is at least partially due to the microcomputer, with its potential to provide enormous increases in access to information in the library's collection and from outside sources (Dowlin 1980, p. 2269). De Gennaro (1981) has suggested that the main impact of new technology in the future will be on reference services and access to online catalogs by the public (pp. 1045-49). The microcomputer will both enhance the traditional role of the library as a repository of books and make the development of new roles possible. Microcomputers will allow libraries to adopt the role of information
centers, should they choose to do so, providing specialized bibliographies and other more personalized services, for example, and being able to respond to user requests through the computer rather than requiring face-to-face contact (Mason 1984, pp. 1219-20). "The new technology makes possible new services which provide added richness to the options available to the user" (Mason 1984, p. 1220).

The microcomputer is a powerful information retrieval and collection management tool. Its ability to store and manipulate large amounts of data will grow as the technology develops. Resources will shift and priorities will change as microcomputers are integrated into library operations. Funds formerly allocated to technical services areas, such as cataloging, may be shifted to other areas that have a more immediate public impact, such as enlarging the collection and assisting patrons in its use (Kesner & Jones 1984, p. 7). Microcomputers are effectively used for interactive teaching, lending themselves to computer-assisted bibliographic instruction, specialized library orientations, and other forms of routine library education. Using them in this way will free the reference staff from some of their more routine duties and allow them to put time into more challenging activities. Another use of their interactive capabilities is in simulation programs for administrative planning purposes, allowing library managers to see the effects of decisions in advance and helping them to "determine how, under [any] given set of circumstances, they can maximize library services at the lowest possible cost" (Kesner & Jones 1984, p. 13). Other changes in the library management environment brought about by automation, which can be extrapolated to the influence of microcomputers, include new employee behavior and work patterns stemming from factors like improved productivity and expansion of control due to improved management data, new relationships between jobs and job classifications, new opportunities for individuals as computers expand assignments and tasks, expanded staffs including new people with skills outside librarianship, and new responsibilities for middle managers as they cope with the accelerated pace of change (Watson 1987, p. 183). Statistics collected and analyzed with the help of microcomputer software will provide an important management tool, increasingly necessary in the climate of accountability.

The microcomputer will have distinct effects in the way libraries conduct business. The change will not come overnight and will occur at different rates for different institutions, but there does not seem to be much question that microcomputers will need to be incorporated into libraries if they are to survive. "We are no longer merely automating our traditional library operations; we are multiplying our capabilities and raising the level of expectations of library staff and users alike" (De Gennaro 1981, p. 1048). This is especially true in academic and special libraries at present, where the phenomenon of end-user searching of databases is occurring most. If librarians do not provide competent
services and impress their users as being conversant with existing technology, they will lose both credibility and clientele. If the library cannot offer users access to information in an efficient, timely fashion, many will find it more expedient to bypass the library altogether and find the information themselves or do without it. Some fear that the role of the information intermediary will disappear; others foresee that “information intermediation—facilitating the flow and communication of media-encoded information—is of growing importance as the volume and complexity of such information increases, and as the society becomes more complex and more adept at using the knowledge that exists” (Giuliano 1979, p. 1838).

De Gennaro (1983) predicts that libraries will continue to participate in networks for shared cataloging and bibliographic resources, but sees decentralization as the outstanding characteristic resulting from the adoption of turnkey operations based on powerful mini- and microcomputers (p. 680). “The challenging task facing librarians in the years ahead is to determine which functions and services are best provided by local systems and commercial vendors, and which are best provided by the utilities and networks” (p. 684). The decentralized aspect of the microcomputer and its software also allows a modular approach to library automation, allowing libraries to tailor their systems to fit their particular needs, and to replace or upgrade components as they become obsolete (Swanson 1982, p. 1058; De Gennaro 1983, p. 683).

The effect of microcomputers in libraries has been, and will continue to be, a widespread redefinition of library services and user expectations, which will become ever more tied to a need for development of existing staff and to changes in the requisite minimum skills for the professional library degree. At this transitional period, continuing education, in-service and on-the-job training and retraining, and close coordination of training workshops through university computer centers or similar resources are all critical to keeping abreast of the rapidly evolving technology and its library applications. “The microcomputer environment for both hardware and software has changed radically in the last few years, offering expanding opportunities for library automation, but making it difficult for information professionals to keep up” (Bichteler 1986, p. 4). As microcomputers become common tools, as computer literacy among prospective librarians grows and evolves to proficiency, the content and focus of staff education may change but the need for it will not.

It is conceivable, and perhaps desirable, that microcomputer literacy will become a prerequisite for admission to library school. Some undergraduate and graduate programs in other disciplines now require this of students, and students are sometimes required to own personal computers (Bowe 1987, p. 57), which does not seem unreasonable for our field as well. The days have passed when the criterion for an adequate librarian was liking books. Aptitude for computer technology, though
not necessarily wizardry at it, should be required of those accepted into
graduate library programs, to best train them to serve their future
patrons. The present norm of the one-year master’s program, already
under fire, cannot really begin to address all the technological issues as
well as those of traditional librarianship unless beginning students are
already oriented to the electronic environment and vocabulary. Other-
wise, too much time is lost in bringing them to the point where the
jargon and discussions make sense. The education of librarians must
include a greater emphasis on the future and on courses on all the
communications technology available (Dowlin 1980, p. 2270).

Richard W. Boss (1984) wrote that “by 1990, the majority
of medium-sized and large libraries in North America will be automated:
by the end of the century a majority of all but school libraries will have
implemented systems” (p. 1189). Given the technological developments
since then, it is likely that this automation will come about through the
use of microcomputers.

REFERENCES
Anderla, Georges, and Dunning, Anthony. 1987. Computer Strategies 1990-9: Technolo-
System as the Basis for Bibliographic Information Retrieval.” Journal of Information
Science 8 (June), pp. 197-201.
Press.
Baumol, William J., and Blackman, Sue Anne Batey. 1983. “Electronics, the Cost Disease,
and The Operation of Libraries.” Journal of the American Society for Information
Science 34 (May), pp. 181-91.
lishing.
and Technology Libraries 6 (Summer), pp. 3-20.
Borovansky, Vladimir T., and Machovec, George S. 1985. “Microcomputer-Based Faculty
Profile.” Information Technology and Libraries 4 (December), pp. 300-05.
(June 15), pp. 1183-89.
Bowe, Frank. 1987. “Making Computers Accessible to Disabled People.” Technology Re-
view 90 (January), pp. 52-59.
Journal 110 (February), pp. 50-55.
Graham.
Carter, Nancy F. 1983. “Sheet Music Index on a Microcomputer.” Information Tech-
nology and Libraries 2 (March), pp. 52-55.
York: Neal-Schuman.
Clark, Philip M. 1985. Microcomputer Spreadsheet Models for Libraries: Preparing Doc-
uments, Budgets and Statistical Reports. Phoenix, AZ: Oryx Press.


Microcomputer Software in Library Collections

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Introduction

The proliferation of computers, especially microcomputers, during the last ten years has had a profound impact on the structure and operation of libraries and has altered the character of their collections. As a result, librarians have modified the principles and practices that determine their collection development policies. This process of transformation raises a number of pressing questions. Why would libraries, which traditionally have acquired information in printed form—such as books, journals, reports, and newspapers—or at least in a form which could be seen—such as microfiche and filmstrips—want to add computer software to their collections? What are the issues which librarians need to be aware of as they introduce microcomputer software to their collections? How have librarians successfully integrated software into the existing flow of information? Many librarians have confronted these concerns, but others are still uncertain about the role of software in library collections.

The ALA definition of software is “computer programs, routines, procedure, and other documentation associated with operating a computer system.” (American Library Association [ALA] 1983, p. 210). The physical format of this software may be a disk—i.e., a “round metal disk coated with a magnetizable material on which data can be recorded and stored along concentric tracks as small magnetic spots forming patterns of binary digits or bits” (ALA 1983, p. 75). A diskette or floppy disk is one type of disk, made of soft plastic which can store information on one or both sides. They come in three standard sizes: 3.5 inches, 5.25 inches, and 8 inches. Intnner (1988) listed twelve categories of software, includ-
ing word processors, spreadsheets, graphics, statistics, communications, utilities, compilers, games, education, integrated packages, and specialized programs, with some software belonging to more than one category (pp. 9-10).

As microcomputer software became a collection development issue a decade ago, librarians questioned whether this new format was appropriate for collections in various types of libraries. Nordine argued that academic librarians should acquire software because they have the skills to organize information, and that software is just like any other library material except in the way that it is read (cited in Walch 1985, p. 406). He also reminded librarians that if we do not assume responsibility for software collections, someone else will, and we may regret not having authority over this form of information. Librarians at North Texas State decided that they “must take the philosophical stance that information, regardless of format, should be collected by an academic library if it is important to the educational goals of the university” (Galloway et al. 1986, pp. 650-54).

Woolls and Loertscher (1986) expressed similar opinions about microcomputers and software in school libraries, noting that “it is appropriate for leadership in microcomputer programs to come from library media specialists” because this “is the educational professional with the most training in the selection of reference and research materials to expand the curriculum beyond the textbook” (pp. vii-viii). Also, the library media specialist traditionally is the one who introduces new technology to the school.

Public libraries, which may already include videocassettes, art prints, and educational toys in their collections, found it logical to add software as well. “Give people what they want but could not afford to buy themselves” reflects the attitude of public librarians who were quick to meet a new demand (Polly 1986, pp. 20-22). They learned to cope with the new problems of selecting, acquiring, organizing, storing, and circulating microcomputer software in libraries.

**Selection**

A collection development policy covering software will include specific information about the scope of the collection, selection criteria, the policy about multiple copies, hardware compatibility, selection responsibility, and funding. Dudley (1986) reported that “those libraries with software policies basically extended their current acquisitions policies by recognizing software as information in a different format, acquired with the same guidelines used for any format, to be integrated into a library’s existing collection” (pp. 704-06). Examples of some specific collection development policies can be found in the SPEC Kit on *Microcomputer Software Policies in ARL Libraries* (1986). Although developed by academic libraries, they can serve as examples for other types of collections.
It is necessary for library administrators to decide whether the collection will be restricted to instructional software or if recreational, utility, or other types of software will be purchased as well. Instructional software, or courseware, may include tutorials, simulations, or drills. Recreational software, including games and interactive fiction, is popular in public libraries but is often excluded from the collections of academic libraries. Utility or productivity software includes word processing programs for writing and spreadsheets for the manipulation and analysis of numeric data. Some libraries choose to provide only educational software, arguing that utility software should be purchased by the owner of any computer, while other librarians believe that reference collections should now offer the software version of commonly used printed tools such as dictionaries (Hannigan 1985, pp. 327-48).

It is also necessary to decide if software will only be selected to run on certain types of hardware such as the IBM PC (and its compatible clones) or Apple computers. Libraries may limit their software to that which can be used on their public access computers. Other libraries provide a variety of software which may not be usable in the library but which meets the needs of their clients. As prices of personal computers drop, more library users will have their own hardware but may need a greater variety of software for occasional use. It is advisable to have a policy to deal with requests for specific types of software or for particular titles. Rather than attempting to anticipate demand, a library may prefer to buy software only when a need is evidenced by one or more requests.

These same selection policies may also be used for public domain software and shareware, or separate policies may need to be articulated. Public domain software is not copyrighted and is available to the user free of any charge. User support is not available, and accompanying documentation is often poor or nonexistent. Shareware, or user-supported software, is copyrighted but is not advertised or reviewed in the usual ways. Librarians can learn about shareware at local microcomputer clubs or on electronic bulletin boards and download a copy to disk. After trying the software, libraries that intend to retain the copy can pay a nominal fee (usually $10 to $50) to the author. This fee will register the user who will receive any documentation for the software and revised versions of the program (Camille 1987, pp. 74-81).

Selection responsibility for software may be assigned to those who select books and other media on the same subject (science, business, or education) or for the same audience (children, young adults, adults). Other libraries may designate a special selector or a software selection committee. Piele (1986) suggested that if an outside group, such as a personal computer users group, participates in the selection process in a library, it is important to specify who will have final authority to decide what software will be added. This advice applies to school libraries.
where teachers may become more aware of the software collection when they are encouraged to participate in the selection process. Academic libraries in particular may find that some of the monographs which they acquire will arrive with one or more unanticipated software disks. A collection development policy will need to be clear about what is to be done with such software, and who will have authority to make the decision to keep or return the material.

Swigger (1986) has reminded librarians who might be apprehensive about deciding which software to acquire that the selection of software for a library's collection requires the same skills necessary to select any other material for the collection. When reading reviews or examining software, the selector should look for an evaluation of the age and skill level required to make use of the program, as well as an assessment of its subject content. Librarians, like their clients, should also look for software that is easy to use, especially those programs with help screens and manuals written in nontechnical language. Many librarians have developed selection criteria to be applied to software purchases. Dewey (1987) suggested nine guidelines for selecting software: documentation, user friendliness, capacity, speed, vendor support, hardware compatibility, sophistication, integration, and references (pp. xiii-xiv). He did admit, however, that few pieces of software would meet all of these criteria.

Library publications that review software include American Libraries, Booklist, Choice, Library Journal, Library Software Review, Micro-Software Report, School Library Journal, School Library Media Quarterly, Small Computers in Libraries, Technical Services Quarterly, and Wilson Library Bulletin. Some of these publications may focus their reviews on particular types of programs. Choice, for example, does not review productivity software. Various publications for educators, such as EDUCOM Bulletin, Childhood Education, Educational Technology, Science Teacher, or T.E.S.S.: The Educational Software Selector also offer reviews and advice. The International Software Database provides online information about software as do some other online sources and bulletin boards although these may not include reviews.

Reviews of software may also be found in a variety of computing journals such as A+, Bulletin Board Systems, Byte, Creative Computing, InCider, InfoWorld, Interface Age, Microcomputing, PC Magazine, PC World, Software Reports, and Software Reviews on File. Reader service cards found in most such publications are a convenient way to get more information about software that has been announced or advertised in the current issue. Lists of best-selling software can also be used to identify popular programs in high demand. Glossbrenner's (1984) How to Get Free Software, is a 400+-page guide to public domain software for many types of computers, although it is now becoming out of date.

An alternative approach to selection has been used at the Liverpool (New York) Public Library. One afternoon each month, the group of
software selectors visits local computer stores to preview, use, and purchase software. They are given a 25 percent discount and have the advantage of already being familiar with the new software in the collection (Polly 1986, p. 21). If in-person purchases are not possible, software may be ordered from many of the jobbers already used by libraries. It is also possible to order directly from the publisher. Walch (1984) reported that 38 percent of the sixty-eight software producers in his survey offered "approval purchases," but he does not identify the names of the companies.

As is true when any new medium is first collected, librarians will have to decide which source of funds will be used for software purchases. Not all software is expensive, and some may be free, but many popular programs cost several hundred dollars each. In an already tight budget, purchasing software will mean that some other purchases will not be made. Funds may be allocated from existing budget lines, such as those for books or audiovisual materials. In other libraries, the funds could come from allocations for materials for children or young adults or reference materials. Software purchases may not even need to be differentiated within these categories if the library does not intend to specify the amount of money spent on this particular format. Alternatively, a special fund for software may be designated which could be used for all purchases, regardless of the intended audience.

CATALOGING AND CLASSIFICATION

Of the many considerations involved in the inclusion of software in library collections, the problem of cataloging received the most attention in the library literature. Part of the problem is similar to that encountered whenever a new format is introduced to library collections. Inevitably, some time is required before descriptive cataloging policies and practices are documented. In the case of computer software, the difficulty is compounded by the fact that the rules in chapter 9 of AACR2 for cataloging machine-readable data files were published in 1978 when microcomputers and their software were only beginning to be developed. As a result, the rules are not adequate to meet the needs of catalogers.

The representatives of the American Library Association, the Canadian Library Association, and the Library Association are aware of the existing difficulties, but the process of changing any international rules is a slow one. To help librarians deal with the existing rules, the American Library Association published Guidelines for Using AACR2 Chapter 9 for Cataloging Microcomputer Software (1984). Unfortunately, as Dodd and Sandburg-Fox (1985) observe, this thirty-two page pamphlet did not solve the problem: "On more than one occasion we discovered the inadequacies of both chapter 9 and the Guidelines" (p. xi). Both Dodd and Sandburg-Fox are experienced catalogers who had participated in preparing the Guidelines. Their criticisms are espe-
cially telling because, in spite of the best efforts of catalogers to stay current, the technology is changing so frequently that it has been impossible for any set of rules or guidelines to anticipate all contingencies and developments. In 1987, a draft revision of chapter 9 was published (Gorman 1987). This version was the result of discussion, reflection, and compromise by British, U.S., and Canadian catalogers and will provide a transition to the rules in the new chapter 9.

When chapter 9 was first released, one of the most awkward aspects of the cataloging was the use of the term machine-readable data files as the general material designation. This broad term was not familiar to users and, even in well-cataloged collections, users who were searching for software sometimes did not recognize this designation as indicative of the material they wanted. One of the compromises in the draft revision of chapter 9 was to change the general material designation to “computer files,” which may prove to be clearer. Nesbitt (1986) has encouraged user-oriented cataloging of software and suggested that computer software or microcomputer software are terms which librarians can use and are more likely to be understood by the user.

AACR2 makes provision for including such specifics as program language and system requirements in the descriptive cataloging of software. Catalogers should be able to load the software to “see” this information, especially if the accompanying documentation is incomplete. As is often the case in other nonprint formats, such vital information as producer, programmer, edition, or even publication date may be difficult to identify. When assigning subject headings, catalogers should resist the temptation to use “software” as a heading. They should select meaningful subject headings which can then be followed by a subheading such as “software.” Additional subheadings may be used to indicate instructional or recreational functions of the software (Nesbitt 1986, pp. 23-24).

In libraries that have large or rapidly growing software collections, there will be enough material to catalog so that one or more individuals will be able to develop some expertise and confidence in dealing with this format. However, many libraries rely on Cataloging in Publication (CIP) to meet most of their cataloging needs and they are not accustomed to producing large quantities of original cataloging. CIP has not been available for software, but the Library of Congress has planned a pilot study on the feasibility of providing CIP for microcomputer software. This will provide a large-scale test of the chapter 9 rules, the appropriateness of subject headings, and the use of LC and Dewey schedules to indicate subject (Weihs 1988, p. 42).

Richards (1983) candidly noted that those who come to libraries to use software do not care about the cataloging issues that confront librarians (pp. 68-69). What the users are interested in, and rightly so, is access to the software. As recently as December 1985, only 30 percent of ARL libraries were cataloging software using AACR2. What is the
alternative? Libraries with smaller software collections or those that are comfortable with not having full cataloging for part of their collections have relied upon title lists and abbreviated cataloging records.

**Storage**

After selecting, acquiring, and cataloging the software, librarians will have to determine the conditions under which it will be housed within the library. Some libraries want to integrate their software collections into the stacks with the book collections. In such situations, the written documentation for the software can be kept with the disk. Other libraries have not permitted any software to be kept in the stacks including software that may accompany a monograph. The concern is that stack conditions are hazardous to software. Libraries that do not house software in the general stacks may choose to store it in a reserve book collection, as part of the reference collection, or in a separate computer lab.

Whether the software is stored with the rest of the collection or in some separate area, any documentation that comes with the program or anything else to be used with the software should be labeled to show how many pieces are to be used together. This will make it possible to restore misplaced items to the proper set. This is similar to the situation which exists in libraries with many audiovisual sets.

Care must also be taken in labeling software. Extra layers of paper labels on the disks themselves may catch in the disk drives of the computer. By now, most librarians know that paper clips should never be used on software, even temporarily. Unlike books, computer disks are susceptible to having their contents changed through a variety of processes, even though the disk itself will appear unaltered. Olson (1983) offered suggestions for storing disks to prolong their useful life. These include keeping them away from magnetic surfaces—including the top of the disk drive—and sources of static electricity. They should also be protected from dust, smoke, and hair by storing them in closed containers. She noted that: “Computer disks should not be folded, bent, heated, squeezed, sat on, exposed to the heat of the sun, carried in pockets, chewed by dogs, or used as frisbees. Such treatment usually results in a blank microcomputer screen.” These are certainly contemporary words to live by.

Dustproof boxes for disks may be purchased from library supply vendors. Special plastic pages with pockets which can be kept in three-ring binders are also available. Some libraries use these plastic pages but hang them in file cabinets in the reference department. Other libraries put software into diskette carrying cases and label them with color-coded dots to indicate what kind of hardware should be used with particular programs. The boxes of disks are kept behind the circulation desk where patrons request the programs they need.

Libraries do not usually keep backup copies of the items in their collections. If a book is lost or damaged, a replacement copy may be
purchased only if the librarians have determined that there is expected continued demand for that particular title and edition. Librarians sometimes follow a different practice when dealing with software. Because of the initial expense of purchase and the many ways that the information on a disk can be erased and, also, because the small size of a disk makes it easy to steal, librarians have been concerned about buying software only to see it lost or damaged. One solution is to keep the original copy of the software in a secure location and circulate only a backup copy. Copyright restrictions, described later, should be observed in such cases.

Circulation

An additional decision to be made by librarians is whether the software in the collection should be allowed to circulate and, if so, under what conditions. Libraries that circulate information in other formats may initially assume that software can be circulated as well. A variety of libraries have indeed come to this conclusion. However, before beginning to circulate software, these libraries need to decide how to deal with the problems of potential damage to the software and copyright violations.

In spite of the long-term preservation problems associated with paper, most librarians are content to process their books, put them on the shelf, and let them circulate. As noted earlier, these same librarians are frequently more concerned with the preservation problems associated with the software in their collections. In some cases, they have used this concern to justify not circulating the software or severely restricting circulation. There are clearly a variety of ways to damage software, but these should not necessarily be used as arguments to prohibit software circulation. Libraries also circulate books which users can leave out in the rain, or let their dogs chew, or mutilate by ripping out pages. The potential for damage in these cases has not been thought to be sufficient reason for restricting circulation.

Precautions similar to those recommended for storage of software can be taken to protect it while circulating. A label can be affixed to the software packaging with a warning that it should be kept away from magnetic fields. This is especially important in libraries which use a magnetic strip as part of a security system. If the staff were to follow the routine procedure of passing library materials through a magnetic field to "sensitize" the item before it circulates, the information on a disk might be erased or scrambled. Most of the electronic detection systems will not erase software although each library should verify this point with the manufacturer of the security system. Circulating software should also be "write protected" so that the contents cannot be accidentally changed through use. There is, however, little that libraries can do to prevent intentional changes made by borrowers. A determined abuser can probably find a way to tamper with software, just as some users of print sources will mutilate them.
Libraries do, in fact, successfully circulate software. For several years, the Minneapolis Public Library has circulated software with surprisingly few problems. Patrons check out the software from the reference desk and are specifically reminded that software must not be left in the book drop because of the potential for damage to the disk. The librarians found that only seven pieces of software were damaged in the first 1,100 circulations (Smisek 1985, pp. 108-09). The Liverpool (New York) Public Library does often find software in its bookdrops. They have reported that, in spite of this rough treatment, the software has not been damaged (Polly 1986, p. 22). This is probably due to the protective container provided for software that circulates. The North Central Regional Library in Washington State is even more optimistic about the ease of circulating software. As with their books, they successfully circulate software through the mails to their rural clients ("Software Comes by Mail..." 1985, p. 29).

The Del Ray School in Orinda, California, purchased $10,000 worth of software with a grant which required that purchases must be available for loan. The librarian recruited enthusiastic parents who staff the software lending library which is open once a week. The collection is available to everyone in the community, not just to the school's students and their parents. The library has reported no problems with theft or damage to the software. In Sacramento, California, the Educational Research and Development Department has provided each school in the county with an Apple computer. The central library conducted a study of software which circulated to an experimental group of teachers in the county. In two years only six disks were damaged, three by the same faulty disk drive. The damaged disks were replaced by the vendors at no charge. The library does not make archival backup copies of software because it considers this practice to be too time-consuming (Berglund 1986, pp. 39-40).

While many public and school libraries have reported their success in circulating software, academic libraries have been less likely to offer this service. A survey of 293 academic libraries by Choice found that only 10 percent circulate microcomputer software, while a study of ARL libraries found that only 88 percent circulate software to their users (Dudley 1986, pp. 704-05; ARL 1986, p. 2).

The policies of most libraries that circulate software indicate that the circulation time is significantly shorter than that allowed for print material. The period may be as short as one day and is rarely longer than one week. There is frequently an additional restriction on the number of pieces of software which may be borrowed at one time. Fines for overdue software may be more substantial than are those for other materials.

Libraries that collect software but do not choose to circulate it will of course need to provide a suitable array of computers for in-house use. Even libraries that do circulate software may have public access microcomputers for their users who do not have personal computers. The
expense of purchasing and maintaining hardware, including printers, has discouraged some libraries from contemplating such acquisitions. Finding the required space, providing sufficient wiring, and allocating staff to supervise the area are additional concerns. Libraries that have acquired microcomputers may find it necessary to schedule the use of the hardware during busy times and perhaps to schedule the use of popular software as well. Some librarians have gone so far as to suggest the screening of potential users to reduce the chances that they will make copies of software or otherwise violate copyright laws (McKirdy 1988, p. 121; Uppgard 1987, pp. 28-32).

**Copyright**

Most articles in the library literature which discuss software, whether from the point of view of selection, storage, or circulation, mention the problems associated with copyright protection. Some aspects of these issues are confusing and the ALA Office of Copyright, Rights and Permissions has published a statement from the ALA legal counsel which succinctly explains the law and how librarians can apply it (Reed & Stanek 1986). McKirdy (1988) recently reviewed the legal history of copyrighted software and related issues (1988, pp. 98-125).

Two broad areas of concern involving copyright and software are ownership and copying. Although many purchasers of software believe they own the software when they pay for it, they may not. The publishers frequently have a notice on the plastic shrinkwrap around the software which indicates that it is "licensed" and not sold to the individual. The statement generally indicates that opening the package constitutes acceptance and agreement to the licensing conditions and restrictions listed on the package. Such restrictions do not permit the simultaneous use of copies of the software and prohibit loading the program on several computers at the same time. This stipulation is of particular concern to circulation librarians, as are other terms which may specifically prohibit lending the software.

To date, there have been no court cases involving circulation of software by any kind of library. However, legal counsel to the American Library Association has advised that "in the absence of authority to the contrary, one should assume that such licenses are in fact binding contracts" (Reed & Stanek 1986). Reed and Stanek also suggested that librarians can avoid the standard license by noting on their purchase orders that the library intends to circulate the software. The statement should say: "Purchase is ordered for library circulation and patron use." When the order is filled, the supplier is agreeing to the librarian's conditions. This simple precaution has been considered sufficient to enable librarians to circulate the software under normal circumstances.

The other copyright problem is that of copying software. One aspect of this issue deals with exactly what constitutes a "copy" of a program. Clearly a reproduction of the program on another disk is a
copy, just as making a photocopy of a printed page is a copy. Those who purchase (not license) software are usually permitted to make one archival copy for their own use. Only one copy, either the archival copy or the original, may circulate or be in use at any time. ALA recommends that if the circulating copy is stolen or damaged, the library should contact the publisher (or copyright owner) before circulating the "archival copy." Also, all software and all library computers which are capable of making copies should display a warning about the protection of computer programs under the copyright law.

Until 1982, there was another concern about copying software. Because of the nature of computers, a "copy" of the program is made when the software is loaded on the computer. In 1982, Congress determined that such a copy is not an infringement of copyright protection (Warrick 1984, pp. 9-12). Such hair-splitting is not surprising when one considers the high financial stakes involved in microcomputer software sales.

It is possible for software publishers to program protection mechanisms into their software. These may limit the number of times it can be installed or prevent any copying at all—even to make a backup copy. These protections are not as successful as even the most sophisticated software companies would like. As Walch (1984) observed, "there is a select group of computer aficionados that especially enjoy the challenge of cracking the protection code and making copies" (p. 408). It has also been noted that "the software safecrackers can find ways to unlock protected programs faster than new locking mechanisms can be thought up...[and] publishers are coming to realize that copy-protection has little impact on savvy users bent on unauthorized copying (Beiser 1986, p. 42).

If there are so many legal restrictions on the use of software, how can a library ever allow diskettes to be used without having a lawyer at the circulation desk? In general, staff should be aware of the restrictions and the reasons for them so that library policy will be uniformly applied. Some libraries put a warning on their software, such as: "The copyright laws regarding the use of software are very stringent. The misuse by only a single borrower may jeopardize the library's continuation for all. No copying of any documentation or software is permissible" (Berglund 1986, p. 40). In other libraries, staff may read a similar statement to the patrons or have the patrons sign copies of the statement after they have read it themselves. This serves to inform borrowers of their obligations and to protect the library.

In Montana, one public library solved the problem of copyright restrictions on software by purchasing 370 public domain software programs available for the IBM-PC. These programs, which are not protected by copyright, include word processing packages, games, and self-help software such as tax preparation instruction. The reference department in the library copies the software onto blank disks provided
by the user. The library has encouraged another library in the area to acquire all of the public domain software for Apple computers so that the two libraries can share these popular resources ("Public Domain Software..." 1986, p. 28). A special library put its extensive collection of public domain software on compact disc with remote access so that even those users who do not actually come into the library can use the software (Welsh & Martin 1988, pp. 29-30).

Librarians should determine if their institutions have acquired site licenses for some software which would enable them to use multiple copies. It is also possible to negotiate with the publisher for backup copies when the program does not permit copying (Talab 1987, pp. 36-39). More than 40 percent of software publishers in one survey provide for multiple-copy licensing at a reduced cost and 38 percent reported that they would provide free backup copies (Walch 1984, pp. 405-10).

As the microcomputer software industry has become more competitive, software companies have revised their restrictive copying policies and librarians and other users can now purchase name-brand software that is not copy-protected. For example, in September 1986, Ashton-Tate announced that they would offer "an unprotected version of dBase III+ or Framework II for an upgrade fee of $45 to registered users of these programs" (Beiser 1986, p. 42). Microsoft and Lotus, other leading publishers of microcomputer software, have also removed copy limitations (Fersko-Weiss 1987, pp. 195-222).

**Conclusion**

In the next few years, a new generation of "computerliterate" library users may create increased demand for software in all libraries. We can expect further refinements of the cataloging rules for software, and perhaps even CIP for the majority of commercial software. Librarians may even be able to expect simplification of the selection process if compatibility standards are introduced by the software industry. Copyright restrictions are likely to remain a problem for librarians who work with software as they are for those who handle book and journal collections.

Librarians have responded very effectively to the development of microcomputer software by creating opportunities to introduce this technology into library collections. The number of articles about software in libraries indexed in *Library Literature* has increased dramatically in the past few years, and new journals devoted to aspects of this topic are now available. As librarians publish descriptions of their successful methods for dealing with this new technology, they will save other librarians from some of the pitfalls and frustrations involved in the development of policies and procedures for the selection, acquisition, cataloging, storage, and circulation of this new and burgeoning form of information. This is how the library profession has accommodated itself to innovation in the past and how it will do so in the future.
REFERENCES


Electronic Publishing

F.W. Lancaster

The term electronic publishing can be interpreted in several different ways. In the most pedestrian interpretation, computers and related devices are used for economy and convenience in producing a conventional print-on-paper publication. In the most sophisticated interpretation, the full capabilities of the electronic media—including motion, sound, and interactive features—are exploited in the creation of completely new publication forms. Various other possibilities exist between these extremes.

An attempt has been made in Table 1 to show the most important stages involved in the evolution of electronic publishing from the early 1960s to the present (and, indeed, on into the future). This is a complex evolutionary process, having many diverse facets, and any attempt to reduce it to a single table must necessarily be an oversimplification. Nevertheless, the table provides a useful framework for the proposed discussion. It identifies a number of steps involved in the application of electronics to publishing (presented roughly in chronological order) and attempts to show their impact on the creators, distributors, and users of publications.

Computer Used to Print

The first step is the use of electronic devices to generate publications (through “computer typesetting” [photocomposition]). Since the products thus generated were “conventional” print on paper, this development had little immediate impact on the reader except that it may have helped to slow the escalating subscription costs for certain publications and perhaps to allow them to be produced more rapidly.
In order to photocompose, one must build a machine-readable database. From the publisher's standpoint, this in itself is the major benefit of the operation. Data manipulation—including sorting, error checking, and indexing operations—are greatly facilitated when the data are in machine-readable form. This was particularly important to the publishers of the large indexing and abstracting services. More importantly, after the printed publication had been generated, the machine-readable database was still in existence and could then be used to generate other information products and services (the second step depicted in the table).

Once publishers began to deal with machine-readable data, it became possible for authors to submit material to them in machine-readable form. Although this was theoretically possible from the beginning of electronic publishing, it is only recently that rapidly decreasing costs and the wide availability of personal computers have made this a practical proposition (Armbruster & Yates 1982; Shotwell 1982). The author who chooses to work at some type of terminal may have the advantage of access to various machine aids, including programs for the editing of text, for checking of spelling, for building of indexes, and so on (Coke 1982). The same terminal may also allow access to various personal files and other sources of information needed in the creative task of composition.

Having a database in machine-readable form also makes possible "on demand publishing." That is, a publication can be generated and distributed as and when it is ordered by a consumer. Starr (1983) has referred to the publication of directories in this way and points out that a laser printer can generate pages ready for binding at a rate of about two per second. It has been suggested that future bookstores might keep only one display copy of each item and generate copies for sale when requested.

On demand publishing has other advantages for the consumer. Since the machine-readable database is easily updated, a purchaser can always buy the latest version of certain types of publication. Moreover, customized formatting of output might also be possible. Carried to its logical conclusion, perhaps, a publication would be "printed" onto some reusable medium, somewhat resembling a videotape or videodisc (Maurer et al. 1982; Shneour 1983) and it would perhaps incorporate movement and sound as well as text and static illustrations.

**Electronic Distribution**

The second and third stages of the evolution depicted in Table 1 refer to the distribution of publications in electronic form. In the second stage, publications are distributed in electronic form as well as in the form of print on paper. In the third stage, however, completely new publications emerge only in the electronic medium. Because of cost and limited demand, many of these could not be produced economically in a
<table>
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<th>Use of electronics</th>
<th>Significance/Impact</th>
<th>On creator</th>
<th>On publisher</th>
<th>On reader/user</th>
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<tr>
<td>Print on paper</td>
<td></td>
<td>Author can work at terminal and submit material to publisher in machine-readable form</td>
<td>Financial economies</td>
<td>Possible cost containment and submit material to publisher in machine-readable form</td>
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<tr>
<td>Distribute publications also distributed in paper form</td>
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<td>New products and services</td>
<td>By-product database</td>
<td>New tools</td>
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<tr>
<td>Distribute new publications</td>
<td>Editors/compilers conceive of new projects</td>
<td>New products and services</td>
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<td>New capabilities</td>
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<tr>
<td>Allow computer conferencing</td>
<td>Collaborative authorship facilitated</td>
<td>New products, including informal journals</td>
<td></td>
<td>Access to data not otherwise available</td>
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<tr>
<td>Produce new textual presentations</td>
<td>Author can plan presentation of textual information differently</td>
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<td>Access to &quot;knowledge base&quot; of new level of authority derived by consensus</td>
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<tr>
<td>Present information in new ways, including movement and sound</td>
<td>Authors conceive of new ways of presenting information, with less reliance on text New art forms</td>
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<td>Interaction among users and authors, and users and users</td>
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<td>&quot;Reading&quot; becomes more &quot;participatory&quot; and &quot;experiential&quot;</td>
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paper form; others are not suitable for printing on paper because of the frequency with which the data presented must be updated.

In the 1960s, the electronic distribution of information had a very limited impact because it largely took the form of distribution via magnetic tapes for use on large mainframe computers. The impact increased dramatically in the 1970s as online networks fell into place and continues to increase as the networks expand, costs decline, and the volume of resources accessible online multiplies. In the 1980s, various forms of electronic publication are accessible online (via conventional computer networks or through television) while others may be distributed in magnetic tape, videotape, optical disc (including CD-ROM), or other form.

It is possible to do various things with a text in electronic form that one cannot achieve so effectively with print on paper. Most obviously, one can search it by computer and thus provide services for retrospective searching and selective dissemination of information. This allows one to conceive of completely new approaches to the packaging of information. For example, rather than subscribing to a single journal, a scholar could have his or her profile of interest matched against the articles accepted into a wide range of electronic journals. In effect, the “network” would create a journal tailor-made to fit the interests of the individual.

The ability to access sources online has a profound impact on the economics of information distribution. In the online environment, the consumer pays only for what is used. A publication need not be “owned” to be readily accessible. This is particularly important for libraries: many sources of information can be made available to users that could not be available if the library were required to purchase and store the source.

**Computer Conferencing**

Collaborative authorship is possible in the print-on-paper environment but is rather difficult to accomplish especially if more than two authors are involved. Facilities for computer conferencing and electronic mail, readily available through many networks, make it much more feasible for publications to be produced through the cooperative effort of several authors. This allows the production of new types of publication of great authority, the result of a consensus reached by a group of experts. A prototype of such a “knowledge base” has been prepared by the National Library of Medicine (Bernstein et al. 1980; Siegel 1979).

Computer conferencing networks make possible other unconventional approaches to publishing. The author can become his own publisher, entering an item into the network and allowing readers to access it. In the same way, informal journals or newsletters can be created within the network.
Perhaps more importantly, readers and authors can communicate easily among themselves. Thus readers can share opinions about a particular publication or can enter into a dialogue with the author. All of these dialogues can be made available to be read by other users of the conferencing facilities. Carried to its logical conclusion, an article in an electronic journal can be linked to a series of evaluative comments or reviews contributed by various readers of the article (Roistacher 1978).

**Hypertext**

In all of the developments discussed so far, electronic devices are used to produce conventional print on paper or to display on some type of terminal a publication that closely resembles print on paper. In fact, one could say that electronic publishing has tended to simulate the printed page in much the same way that many early printed books were handcrafted to resemble illuminated manuscripts. Putting the *Encyclopaedia Britannica* online does not create an electronic encyclopedia and displaying a Shakespearean sonnet at a terminal does not create "electronic poetry." In a true electronic publication, presumably, the author does not conceive and design his work as narrative text on a printed page; instead, he considers how the full capabilities of the electronic media can be used to present the message to be conveyed.

Although the printed book has been with us for only 500 years—a very short time in the complete history of human communication—it seems very difficult to break conceptually from its traditions, conventions, and limitations. For example, virtually all of the experimentation that has taken place with "electronic journals" has assumed that information will be presented as it has been presented in science journals for the past 300 years—as static text and static illustration. Indeed, these experiments have virtually concentrated on how best to display conventional text electronically, how to give the reader some idea of where he "is" in this text, and how to help him to move around in it effectively. The authors of one major study on the electronic journal have been quite explicit on its limitations: "No assumption is made in this description of the design of the *Computer Human Factors* journal that the product is anything but an initial mounting of conventional paper structures on to electronic media whether it is appropriate to do so or not" (Shackel and Pullinger 1984, p. 39). Other investigators, while focusing on textual display, have at least recognized that an electronic text need not be as static as text printed on paper:

Electronic transmission could have an effect on writing and reading, not only by encouraging the writing of marketable material, but by favouring smaller units of information. The shorter the article, the better for identification and transmission; better still, the information in it can be broken up into small blocks, like articles in a concise encyclopaedia. The user would have then to piece together his own packages from the blocks: the original writer then becomes a brickmaker, and the user a builder, perhaps even an architect. (Line 1982, p. 145)
While the printed book does have many virtues, its static quality is its major limitation. Once produced it is difficult to update. Moreover, the user of the book cannot readily change it in any way—highlighting and annotation are possible, but rearrangement of the text is virtually precluded by the physical format.

An electronic publication, on the other hand, can be dynamic rather than static. One possibility is to incorporate some form of hypertext capability.

Hypertext (Nelson 1981; Conklin 1987; Smith 1988) is a text presentation system in which the user is free to direct its movement in a way that is logical to him instead of being restricted solely to the sequence that is logical to the author. It combines flexibility of access, ability to comment in context, and ease of locally modifying the text to make it highly specific to individual needs and specifications. More specifically, Nelson speaks of making rapid, arbitrary jumps, where material stored in one place may offer a link, much like a footnote, to material stored in another, in either the same or a different document. Such an arrangement is highly dynamic since the reader can pursue various pathways through the text and can make various comments or annotations as he proceeds. In addition, the text could be constantly updated through computer conferencing among a group of subject specialist authors. Thus this form of presentation is not prespecified, but transforms the organization of its contents into a more useful form for each individual reader (Weyer 1982).

Thursh and Mabry (1980) have developed an electronic textbook using the hypertext principle. An electronic textbook can look much different from one printed on paper. It need not be designed to be read in one particular sequence. It may allow many alternative reading pathways or be capable of reorganization into various sequences to meet the needs of different instructors, courses, or students. At any point, a student may enter an annotation, comment, or question to an instructor. Instructor responses can also be incorporated and, for any portion of the text, a student could get access to the questions and comments of other students and/or the responses of several instructors. Furthermore, the text itself can be constantly updated by means of computer conferencing.

Likewise, one can visualize an electronic encyclopedia that is reorganizable under the control of the reader. For example, information on coffee could be dispersed throughout various volumes and pages of a conventional encyclopedia. Not only would the electronic encyclopedia allow the reader to bring all relevant passages together, but it would also allow him to preserve all these passages on some local storage medium. Electronic publication, then, can affect the presentation of narrative, both by promoting conciseness and by creating a more dynamic presentation whose sequence can be changed and expanded in places by the reader.
Weyer (1982) has discussed the dynamic book in some detail. He sees the major difference between the electronic book and the conventional book as being the ease with which the former can be searched for specific passages or factual information.

**HYPERMEDIA PUBLICATIONS**

While text can be made dynamic and reorganizable, narrative text might be much less important in electronic publications in which animation, electronic models, moving pictures, and sound can be employed by the author. Several electronic forms, including optical disc and interactive television, offer the possibility of incorporating sound to supplement or reinforce the use of text and graphics. In fact, Greenagle (1981) has pointed out that, when the television set becomes the reader's terminal, sound is actually expected:

> The research also revealed that people reading an article on their TV screen expected that a noise of some sort should also come from that set; they have been conditioned to expect sound as well as video, and were somewhat disconcerted by the silence—'sensory deprivation' is what psychologists would term it. (p. 179)

The advantages of being able to use sound within a publication are obvious: articles on music can include brief passages from the works of various composers, some biographies may incorporate the voice of the subject, and other articles may be illustrated by bird song or animal sounds. The graphics capabilities of electronics are even more exciting. However good the quality of an illustration in a printed book, this illustration is entirely static. This makes little difference when a static object is depicted, as in the reproduction of a famous painting, but it is a definite restriction when an author is trying to describe how something works. Electronic publications can include not only static illustrations but also motion picture segments as well as animation or electronic analog models.

Electronic display permits the use of very effective analog models. It is possible to model a scientific experiment in, say, chemistry or physics, as well as to produce working models of various types of equipment. It is not difficult to realize that electronic publications need not be restricted to the static properties of the printed page. The true capabilities of electronics in publishing are only reached when completely new and dynamic publications emerge. A true electronic encyclopedia, then, would incorporate dynamic analog models of equipment and experiments. In an encyclopedia for children, for example, a rather lengthy narrative description of what makes an airplane fly, accompanied by a few static diagrams, could be replaced by an electronic model of the plane. This type of publication would be truly interactive and the "reader" would become, in effect, an active participant in the publication. In fact, such a publication might closely resemble what we now think of as an electronic game.
The same capabilities could be extended to other types of publication. Consider the capabilities of future journals in scientific/technical fields. Rather than describing what happens when stresses of a particular type are applied to some structure, a journal in applied mechanics could demonstrate these effects. Moreover, since computer programs can be incorporated into a contribution to an electronic journal, the reader could actually perform new data manipulations, varying the loads or stresses, for example, and observe the effects. Future publications can be truly interactive. The possibilities are limited only by the imagination.

Yankelovich et al. (1985) have coined the term *hypermedia* to refer to publications having:

- the functionality of hypertext but with additional components such as two- and three-dimensional structured graphics, paint graphics, spreadsheets, video, sound, and animation. With hypermedia, an author can create links to complex diagrams, texts, photographs, video disks, audio recordings, and the like. (p. 19)

The ability to combine textual information, visual images (static and moving), and sound into an interactive system has stimulated work on what Negroponte (1979) has referred to as "books without pages." In Negroponte's system, developed at MIT, the reader sits in a chair whose arms are fitted with a joystick and touch-sensitive pad. These facilities can generate whole-wall displays (including a zoom capability) of text or graphic information as well as sound. Moreover, the reader can move the material around and, as it were, browse in an "information space." Different sources (i.e., databases) can be brought together on separate but adjacent screens, and the reader is given some capability to annotate and store in an electronic notebook. One derivation of Negroponte's work is the Spatial Data Management System (SDMS), based on optical disc technology, which is said to store static and moving pictorial information in a "spatial location," allowing the user to search, browse, and retrieve in an "information space." The basic system comprises two monitors, a microcomputer, and an industrial disc player. One capability is "vicarious travel": a user can take a simulated trip through a selected geographic area using a joystick to control the speed and direction of the travel. This feature is now being used by the U.S. Army to teach spatial orientation and navigation skills. Such interactive optical disc technology is considered to have great potential in a variety of instructional applications ("Instructional Applications" 1982).

While imaginative works have been little affected by electronics up to now, there is no reason to suppose they will remain unaffected. The electronic novel, for example, can be quite different from the conventional novel. As with other types of publications, it can incorporate sound and movement; it can also allow the reader to choose which direction he wants the plot to take.

Krueger (1983) has given a rather detailed discussion on some of the possibilities for creative writing in electronic form. One is kinetic poetry.
(expression through the animation of words). In this form, poetry becomes a kind of dance:

The words and letters could constantly be in a state of flux, moving around the screen, juxtaposing with other words, transforming themselves into new words, picking up new letters and disbanding—in ways limited only by the imagination of the programmer poet. A sequence of such interactions could constitute a poem. (p. 198)

Krueger suggests the possibility that, in interactive poetry, the words could even travel around the reader ("participant") through, for example, holographic projection:

Words displayed on a lighted graphic floor could follow the participant or be chased by the participant....Allowing a word to interact physically with a participant is a symbolic statement, for the word is then no longer a vehicle for communicating meaning, but an entity behaving on its own. Given the impact of television and film, and the fact that computers are slowly acquiring the ability to speak and understand speech, the written word may one day be obviated. Thus, it seems appropriate to give it life, allow it to leave the page, interact with the person who wrote it, and leave the scene. (p. 199)

**Conclusions**

Yankelovich et al. (1985) point out that publications in electronic form can "offer substantial advantages over paper books in providing aids for connectivity, audiovisualization, dynamics, customizability, interactivity, and rapid information retrieval..." (p. 18). Electronic publications are not ipso facto superior to those printed on paper. What is certain is that a true electronic publication is very much more than print on paper presented electronically. Electronic publishing will come into its own when authors learn to free themselves from earlier conventions and limitations and exploit the full capabilities of the electronic medium.* The hypertext and even hypermedia capabilities opening up for the user of personal computers, through such devices as Apple Computer's Hypercard (Hallerman 1987), can be expected to accelerate this transition.

The ability to access various electronic information sources online has already had a significant impact on many libraries and these libraries are now adapting to the emergence of increasing numbers of databases on CD-ROM (Miller 1987; Silver 1988; Reitdyk 1988). Nevertheless, the impact on libraries so far has been limited by the fact that the electronic publications most widely available have been bibliographic databases that support only one library activity and are little more than print on paper displayed electronically.

It seems reasonable to assume that completely new types of electronic publications will emerge in the future, perhaps on media yet to be invented. Such publications may span the entire range of resources now

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*This article covers the exploitation of electronic capabilities by authors of various types but not the use of computers to create poetry, stories, and other forms of expression. This type of work has recently been reviewed by Hjerpe (1986).
handled by libraries—from textbooks to instructional manuals to novels to poetry to children's picture "books"—and they may be available in a wide variety of formats. This will create a formidable challenge for the profession.

REFERENCES

Optical Disc Applications in Libraries

PAMELA Q.J. ANDRE

INTRODUCTION

OPTICAL DISC STORAGE TECHNOLOGY is among the most recent computer technologies to enter the library community. Characterized by extremely high density data storage, optical discs offer storage capacities measured in millions of characters per square inch. These discs offer the potential for significant savings in shelf space in a library community where the cost of space is always increasing. The computer systems developed to utilize these discs offer improved search access to materials at high rates of speed.

There are a number of optical systems and services in production and available. In addition, there is continuous development of new products and services as well as improvements to the technology itself which could have significant impacts on the libraries of the future. Every aspect of library operations from acquisition of materials to technical processing and document delivery is being touched by optical technology.

This article will discuss various applications of optical technology found in libraries today. It will include research and development activities at the National Libraries as well as the use of existing products and services at a variety of public, state, and academic libraries.

For purposes of this discussion, the definition of optical disc will include any disc which is recorded or read using a laser. Distinctions relating to recording medium, recording process, or size of recording medium will not be discussed at length. This article is not meant to be a technical description of the variety of optical discs, but a discussion of their uses within various libraries.
National Libraries

The Library of Congress (LC), the National Library of Medicine (NLM), and the National Agricultural Library (NAL) each have projects underway which utilize various optical technologies as part of their mission to provide the world’s information resources to the American public.

Library of Congress

The Optical Disk Pilot Program, which began in 1982, is one of the most important experimental projects underway in terms of the potential for changing the future of libraries. The program is divided into a Print Project and a NonPrint Project, both of which will be discussed. The Print Project has an overall objective of evaluating the use of optical disc technology for information preservation and management. This project is exploring new opportunities for information storage and retrieval through storing high resolution digitized page images on optical disc.

Developed under contract by Integrated Automation, Berkeley, California, the optical disc system is capable of scanning and digitizing both printed pages and microfiche. Each printed page or microfiche frame is scanned at 300 dots per inch. Using sophisticated compression techniques, the digitized data are then compressed and stored on twelve-inch write-once-read-many (WORM) optical discs which are stored in a jukebox for subsequent retrieval, display, and printing.

The Input Subsystem for the Optical Disc (ISOD), which handles all scanning and quality control, was developed by staff of the Automated Systems Office of the Library of Congress to run on Data General minicomputers. Basic retrieval for the system is provided through the library's SCORPIO retrieval system which is resident on an IBM mainframe. An Optical Disc Interface System (ODIS) provides the linkage between the mainframe system and the optical disc system which allows users to search and display documents from the jukebox.

Six user workstations are located in various reading rooms of the Library of Congress for patron use. Users can search the bibliographic databases developed by the library and retrieve full text images of scanned documents. In addition, the Magazine Index, a product of Information Access Corporation, has been integrated into the system to provide an additional retrieval approach which includes article level access. Regardless of which retrieval approach is selected, users get a high resolution display of selected documents and the capability to print each page image.

There is a wide variety of material in the system ranging from several thousand articles and government documents from a public policy file to various popular and scientific journals, law materials, and manuscripts. Copyright clearance was provided by publishers before the materials were scanned into the system.
An evaluation of the Print Project was carried out by Sterling Software, Rockville, Maryland. A comprehensive evaluation report is to be issued by the Library of Congress at the completion of the Print Pilot Program in late 1988. The future use of the optical disc system as a continuing program of the Library of Congress is still under consideration.

The Nonprint Project of the Optical Disk Pilot Program has taken a slightly different approach to using optical technology. Rather than utilize the largely experimental WORM discs as in the Print Pilot Project, the Nonprint Project focuses on the use of analog videodiscs for storing graphic materials and digital audio discs for storing sound. The primary purpose of the project is to experiment with ways of providing greater research access to special materials.

Six laser videodiscs have been created during the project. These discs contain a variety of material from images in specific collections in the Prints and Photographs Division—such as the Farm Security Administration Collection and the American Cartoon Drawings Collection—to motion picture stills, television productions, and early films from the Paper Print Collection. Two compact digital audio discs containing a number of musical compositions have been completed and are also available for use.

Access to the discs is provided in a number of ways. A microcomputer linked to a videodisc player with two monitors is used to access still images. BRS/Search software from BRS Information Technologies is used to provide retrieval access to the material on the discs through a microcomputer database containing descriptive information for each picture. This database can be searched for specific subjects or pictures by a specific photographer, and once a descriptive record is found, a direct link to the videodisc player displays the graphic desired. A user can also browse the disc in a linear fashion using the videodisc player with a remote control. Once a picture is found, the caption information can be displayed. It is also possible to print a copy of any graphic on the discs.

The disc with motion picture stills is only accessible through a table of contents which is available on the disc and also as a printed list. The list is used to identify a frame number which is keyed to display the picture desired. There is no computer database available for this material. However, only a videodisc player and monitor are necessary to use the discs. Discs with motion picture material and digital audio discs with music will be accessed in basically the same way as the cans of film in the library's collection—i.e., through the catalog.

As with the Print Project, an evaluation mechanism has been used to determine the effectiveness of the videodisc and digital audio disc technologies for providing access to the various materials. The discs with still images were judged very successful at providing enhanced access while saving original materials from repeated use. However, because of the wealth of material to be processed, work is underway to
move the database from a microcomputer system to the Library of Congress mainframe system and to integrate it into the available retrieval approaches.

Another project at the Library of Congress is the use of Compact Disc Read Only Memory (CD-ROM) discs for the distribution of cataloging data. The Cataloging Distribution Service (CDS), which is responsible for the distribution of Library of Congress cataloging data to the library community, has an experimental project underway to develop CD-ROM versions of some of LC's most used materials—Subject Authorities, Name Authorities, and US MARC bibliographic records.

CDMARC Subjects, which includes the entire LC Subject Authority File on a single CD-ROM disc, underwent rigorous testing in early 1988. The disc was available at microcomputer workstations at the Library of Congress. It was also tested at the LC field office in New Delhi, India, and at sixteen test sites across the country including the National Agricultural Library, Yale University, Missouri State Library, Geac, and Baker and Taylor.

Developed under a contract with Online Computer Systems of Germantown, Maryland, all CDMARC products will be available with a user-friendly retrieval package using keyword searching, full Boolean logic, and the capability to display and print the full ALA Character Set. The system has been designed so that all records can be output in full MARC format for processing in various ways. As CDMARC Subjects is being tested, a second product, CDMARC Names, is under development. CDMARC Names will include all name and series authorities established by the Library of Congress. This product will be developed as a three-disc set. With three CD-ROM drives connected to a microcomputer, CDMARC Names can be used without swapping discs. However, the product can be used with only a single drive and the system will automatically direct the user to mount additional discs as required.

The third product to be developed is CDMARC Bibliographic. This will be an eight-disc set of nearly 3 million MARC records. All LC MARC records for books, serials, maps, music, and visual materials will be included. The product is being designed to operate on a microcomputer with as many as eight or as few as two CD-ROM drives.

The equipment necessary to use CDMARC discs includes an IBM PC, or selected compatible, with 640K RAM and a standard CD-ROM drive. A printer is optional. In addition, if support for the ALA Character Set is desired, a Hercules Plus or Hercules Incolor Card and a Hewlett-Packard Laserjet Plus printer are required. MS-DOS 3.1 or higher is necessary to use the CDMARC software.

This project has moved from the experimental stage to actual product offerings in only 2½ years. CDMARC Subjects became available for purchase in mid-1988. CDMARC Names will be tested in late 1988 and offered for sale in early 1989. A prototype for CDMARC Bibliographic should be available sometime in 1989.
The National Agricultural Library has a number of optical technology projects underway. The first project used digital videodisc technology for distributing textual information. This experimental project provided experience in converting printed text to machine form and in providing microcomputer access to full text.

The first videodisc contained the full text plus graphics for the *Pork Industry Handbook* and was evaluated at three test sites, including the National Pork Producers Council, Purdue University, and the National Agricultural Library. The twelve-inch digital videodisc is accessed using a microcomputer with videodisc player and controller plus a second monitor. This dual screen system enables a user to view both text and graphics simultaneously. The BRS/Search software from BRS Information Technologies is used for retrieval. A second expanded disc was developed during 1986 and 1987. Thirteen government publications were selected for inclusion on the second disc. The publications include such agriculturally related titles as *Soil Taxonomy*, the *National Corn Handbook*, and the *Fact Book of Agriculture*. Sixteen land grant libraries are participating in this project. Each participant will provide all hardware and software to use the disc at an estimated cost of $12,000. The second laser disc was distributed to participants in August 1988 and will be evaluated for a six-month period.

A second videodisc project focused on the storage and retrieval of visual material including photographs, slides, posters, and filmstrips. The Forest Service Photograph Collection, which is the largest photograph collection on forestry in the world, is part of the Special Collections program at NAL. This historic research collection was begun in the nineteenth century and currently contains over .5 million images. It was the basis for the development of a twelve-inch analog laser videodisc used to evaluate optical technology as a medium for storage and distribution of graphic materials.

With the assistance of the University of Maryland Library, images from the collection were processed for mastering onto a videodisc. The completed disc contains over 34,000 images along with 500 color slides, a number of illustrations, maps and posters, and portions of a filmstrip. This disc can be used in conjunction with a descriptive database to search and display any of the images on the disc. The descriptive database includes information for each image such as photographer, subject, location, and date.

One of the most important findings in this project was the high level of quality possible in transferring images to videodisc. Many of the photos in the Forest Service collection are very old and are deteriorating. It was possible to do image enhancement on many of these to the extent that the videodisc image is better than the original.

Compact Disc Read Only Memory is another medium being explored at the National Agricultural Library. Working with both
ANDRE/OPTICAL DISC APPLICATIONS

OCLC and SilverPlatter, NAL has developed CD-ROM databases for AGRICOLA, the bibliographic database for agricultural materials maintained at NAL. Working with SilverPlatter and capitalizing on the tremendous storage capacity of the CD-ROM, 2.5 million AGRICOLA records have been stored on a set of five discs which also have room for continuing quarterly updates. Working with OCLC, over 1.25 million AGRICOLA records and 30,000 records from the Cooperative Research Information System (CRIS) have been stored on a set of two discs. Both these products are available on a subscription basis from the vendors, including quarterly updates. Both sets of discs are searchable using proprietary software which allows field specific or full-text searching using Boolean operators. CD-ROM searching is done on an IBM PC compatible microcomputer with 512 KB memory and one floppy drive, plus a CD-ROM player and disc.

The experiences with both digital videodisc and CD-ROM technology only reinforced the idea that optical technology has tremendous potential in the libraries of the future in terms of both preservation of materials and enhanced access to those materials. These experiences, together with new technological advances in data conversion, led to another project for capturing and distributing machine-readable text materials for agriculture.

NAL and forty-two land grant libraries have entered into a three-phase cooperative project to test a new method of capturing full text and images in digital format for publication on CD-ROM discs. Known as the National Agricultural Text Digitizing Project, it will evaluate a turnkey optical scanning system to determine whether it is now possible to provide in-depth access to the literature of agriculture while at the same time preserving it from rapid deterioration.

Phase I of the project will test the scanning system and a variety of indexing/search software systems. Once the scanning system is installed at the National Agricultural Library and a significant testing period is completed, work will begin on scanning a significant amount of agricultural material. Four thousand pages of the most important, noncopyrighted, aquaculture material will be scanned and digitized. Both the page images and the ASCII text will be mastered onto a CD-ROM using TEXTWARE software by UNIBASE.

The material for a second disc will be the most important papers on international agricultural research as determined by the Consultative Group on International Agricultural Research (CGIAR). CGIAR is an association dedicated to supporting a system of agricultural research centers around the world with the purpose of improving the quantity and quality of food production in developing countries. It is supported by the World Bank and the United Nations. Access will be provided by the KAWARE retrieval package by Knowledge Access.

A third CD-ROM disc will be developed as part of Phase I using the retrieval package Personal Librarian by Personal Library Software and...
Phase I is to learn how to use the system, identify and correct any interface problems, and generally prepare for the remainder of the project. Part of Phase I activities will be to identify how best to scan different materials depending on age, condition of paper, type style, etc. The system is flexible in that each page can be scanned uniquely to ensure that the image of highest quality is captured.

Specifications for Phase 2 have been completed and the system will be installed in late 1988. In this phase more documents will be input and the workstations will be made available to researchers. The retrieval system, Personal Librarian by Personal Library Software, will enable researchers to select images via a variety of access points such as specific names, subject terms, or dates. Images can then be displayed at the high resolution terminals or stored for further use. System linkages will be established so the researcher can also access the campus mainframe computer, send images of particular documents to remote locations using telefacsimile capabilities, or print out documents of interest on site. In addition, the system will be linked to standard word processing software to enable researchers to use the system as a multipurpose workstation. Researchers will be able to make notes or commentary on the images they are working with by using a standard word processing package.

Phase III will be a further expansion of the system. This effort is scheduled to begin in 1989 and will include digitizing color images and sound recordings. Further retrieval enhancements will allow remote access to all aspects of the system.

University of Vermont

The establishment of the Automated Reference Center (ARC) is the University of Vermont Bailey/Howe Library's creative approach to utilizing optical technology. Established in 1986, the Automated Reference Center was designed as an end-user search facility and is located in the reference area at the Bailey/Howe Library.

The ARC offers access to WILSONDISC indexes on CD-ROM (Readers Guide, Humanities Index, Social Sciences Index, General Science Index, Applied Science and Technology Index, and Business Periodicals Index); SilverPlatter databases on CD-ROM (ERIC, Psyclit, and AGRICOLA); online services (BRS/AfterDark, Dialog's Knowledge Index, and the Dow Jones News Service); as well as access to LUIS, the University of Vermont's online catalog. Initially, INFO-TRAC, which utilizes digital videodisc for storage, was offered instead of WILSONDISC. However, this was dropped in mid-1987 because of the need for a more comprehensive set of databases. Additional optical products will be added to the ARC as appropriate subject databases become available.

The ARC searching center contains IBM PCs, AT&T 6300s, and Hitachi CD-ROM players and printers. There are three WILSONDISC
drives and an optical disc subsystem with two Optimem 1000 optical
disc drives which handle twelve-inch write-once-read-many optical
discs. Approximately 4000 compressed images can be stored on the
system. The scanned images are selected and displayed using a high
resolution CRT from Terminal Data Corporation. A high resolution
Xerox Printer is part of the display system. A page scanner and a book
scanner are also part of the system configuration.

The document capture subsystem scans and digitizes printed docu-
ments at a density of 200 DPI. The subsystem can handle both looseleaf
pages and bound books. The looseleaf scanner, which is commercially
available, scans at the rate of one page per second and will capture
material on both sides of a page automatically. The book scanner,
which was designed at the Lister Hill Center, is a very exciting part of
the project. This innovation at NLM has great potential for increasing
the effectiveness of scanning technology for capturing library materials.
One of the drawbacks of current scanning technology is the inability to
handle bound material.

The book scanner was designed around a split tray book holder
which allows the book to be placed face up for scanning. A glass cover
flattens the pages and holds them in place. After both pages are scanned
at 200 DPI, the glass cover is lifted and the page turned and flattened for
the next scanning operation.

Once captured, the page image is sent to the image handling
subsystem for quality control. A variety of techniques have been devel-
oped by project staff to enhance image quality. These include gray scale
processing, image centering, and removal of image “noise.” Rescan-
ing is performed as necessary. When image enhancement is completed,
the images are copied onto optical disc for long-term storage.

The display subsystem is a hybrid. It offers stand-alone access
directly to the images through a unique identification number. In
addition, there is an automatic link between the NLM Medline and
Catline databases using the Grateful Med, a user-friendly front end
interface, so that a bibliographic search can result in an image display
from optical disc. The searching workstation is an IBM PC/AT com-
patible microcomputer with a high resolution monitor. Users can browse
through images on the terminal screen or print high resolution copies.

At this time no conclusions have been drawn as to the effectiveness
of optical discs as long-term archival storage. However, much has been
learned about the operation of such a system and the hardware and
software enhancements necessary to develop a production version of the
prototype system.

The National Library of Medicine has also been working with CD-
ROM technology as a means of distributing parts of the Medline data-
base. In 1986, NLM signed experimental nonexclusive licensing agree-
ments with several commercial firms including Disclosure, Silver-
Platter, DIALOG, and ARIES to develop CD-ROM products for medical
information. Because of concern over the quality of the data and the effectiveness of presentation, NLM retained the right to review all products prior to release by the vendors. NLM has organized the evaluation of these products at a variety of test sites around the country including the New York Academy of Medicine, Meharry Medical College, and the University of Texas at Dallas. The experimental phase is due to end during 1988, although many vendor agreements will be converted to paid licenses to ensure the continuation of product availability. The results of the study were made available during a Medline CD-ROM Conference at NLM on 23 September 1988. Both CD-ROM vendors and staff from participating libraries were represented at the conference.

**Library Networks**

Both national and regional networks are becoming involved in the use of optical technology. Some are actively developing optical disc products based on their online databases while others are acting as distribution agents for various optical products developed by the vendor community.

**OCLC**

OCLC is very active in the application of optical technology to library products. Foremost among a variety of projects is the CD-ROM retrieval system, Search CD450. What began as a research project has progressed to the point where a variety of CD-ROM products are now available to users.

Search CD450 is a microcomputer-based retrieval system for bibliographic data on CD-ROM. Currently, three broad categories of bibliographic data are available for purchase in multiple disc sets: education, agriculture, and science and technology. Each of these subject sets includes a reference database with both current and retrospective citations and a special subject-oriented selection of records from the OCLC Union Catalog. Each set of databases is updated on a regular basis.

The Search CD450 software was developed specifically for use with CD-ROM technology. It has a sophisticated searching capability which allows users to search a variety of fields of a record including author, title, and subject. Boolean operators can be used for complex searches as well as positional operators such as adjacency, truncation, and range searching on fixed fields. Search results can be displayed in a number of formats and printed as required. Additional capabilities include a search history function which enables a user to save previous searches for later use as well as the ability to download selected records for subsequent manipulation on a microcomputer. This system will run on a variety of equipment including IBM PC-XT or AT or compatibles and OCLC M-300 XT and M-310 workstations with 512K RAM, a hard disk drive, and CD-ROM player. A printer can be attached to the system. It is
also possible to attach up to four Hitachi CD-ROM drives to the system simultaneously. This will greatly facilitate access to multiple disc databases. With the variety of CD-ROM products under development, OCLC has become a leader in the development and distribution of CD-ROM products for the library community.

In addition to developing subject oriented products on CD-ROM, OCLC has also announced a cataloging system on CD-ROM which became available in mid-1988. This cataloging system, known as CAT CD450, contains two collections of the most frequently used bibliographic records from the OCLC database and a collection of name and subject authority records. The Current Cataloging Collection includes approximately 1.4 million book records published from 1980 forward and 1.4 million nonbook records plus book records with pre-1980 imprint dates. The Authority Collection includes approximately 1.8 million LC name and subject authority records. Plans call for updating the bibliographic collections quarterly and the authority collection semiannually.

CAT CD450 was designed to work on an OCLC M-300 or M-300 XT workstation with a 20 megabyte hard drive and a CD-ROM reader. In addition, there is a communication capability to enable the system to look into the OCLC online system when necessary. When a desired record is not found on the CAT CD450, disc users can automatically search the online system. The system also has the capability to download records for local card production.

Western Library Network

The Western Library Network (WLN), using a grant from the Fred Meyer Charitable Trust, has developed a CD-ROM product based on their online bibliographic database. This product, known as LaserCat, consists of three CD-ROM discs containing over 2 million bibliographic records from the WLN database as well as the most current two years worth of records from the Library of Congress. Holdings information for WLN members is also included. All records are in full MARC format, and the set is updated quarterly throughout the year.

The equipment required to use LaserCat is an IBM PC, XT, AT, or compatibles with 512 RAM memory and two floppy disk drives. Two CD-ROM players are required. The system supports Hitachi CDR-2500 or CDR-1503S, or Sony CDU-100 drives. An IBM compatible printer can also be used with LaserCat. The software required is DOS 3.1 or higher and a Meridian device driver. The software used to access the CD-ROM was developed by WLN, but can be licensed for use in developing other CD-ROM products. The retrieval software is very user friendly with easy to follow menu screens. Access points include author, subject, and title, and Boolean operators can be used to link up to two search terms per search. It is also possible to limit searches based on language, date, material type, specific library, etc. All aspects of the
system, including the software, are fully described through extensive use of help screens.

In addition to being used as a public access catalog, LaserCat also includes the capability to print products for use at local sites. These include card labels and bibliographies. In addition, records can be downloaded for use in local systems. A special feature of the system allows for retrospective conversion by member libraries. Local users can add their locations to the database by recording the information on a floppy disk and forwarding it to WLN for inclusion on the database and, hence, for the next update of LaserCat.

LaserCat distribution started with approximately 100 of the 350 WLN libraries and is now up to over 250 subscriptions. LaserCat has been found to be so effective that it will be made available to high school libraries as well as public and academic institutions. A second grant from the Fred Meyer Charitable Trust is making possible an evaluation of LaserCat in the high school environment. Nine high schools in four states will be installing the CD-ROM database for evaluation purposes.

**ACADEMIC AND PUBLIC LIBRARIES**

There are numerous optical disc application activities underway in the academic and public library communities. They range from installation of end-user CD-ROM workstations to the evaluation of write once optical discs for full-text retrieval. The applications described here show the variety of approaches being taken to the application of optical technology and are by no means the only ones underway.

**Syracuse University**

The Department of Media Services at Syracuse University has a project underway using optical disc technology to enhance access to their collection of adult education materials. Called the Kellogg Project after its funding agency, the Kellogg Foundation, Syracuse has defined a three-phase project utilizing a computer system developed by Plexus Computers, Inc. This information system will give researchers electronic access to all materials held in the Adult and Continuing Education Research Collection at Syracuse.

The Plexus System was selected after an extensive effort to develop system specifications and carefully evaluate vendor systems. The system consists of a P95 supermicrocomputer with an optical disc player linked to four workstations, two scanners, and two printers. The system will scan and digitize printed material in the collection and store a compressed version of the digitized page images on a twelve-inch write-once-read-many optical disc. As pages are scanned, indexers will input records of descriptive information for each image using the workstations. These records will be used to provide access to the page images.

Phase I of the project is well underway. The equipment was installed in November 1987 and is being tested. The primary focus of
Phase I is to learn how to use the system, identify and correct any interface problems, and generally prepare for the remainder of the project. Part of Phase I activities will be to identify how best to scan different materials depending on age, condition of paper, type style, etc. The system is flexible in that each page can be scanned uniquely to ensure that the image of highest quality is captured.

Specifications for Phase 2 have been completed and the system will be installed in late 1988. In this phase more documents will be input and the workstations will be made available to researchers. The retrieval system, Personal Librarian by Personal Library Software, will enable researchers to select images via a variety of access points such as specific names, subject terms, or dates. Images can then be displayed at the high resolution terminals or stored for further use. System linkages will be established so the researcher can also access the campus mainframe computer, send images of particular documents to remote locations using telefacsimile capabilities, or print out documents of interest on site. In addition, the system will be linked to standard word processing software to enable researchers to use the system as a multipurpose workstation. Researchers will be able to make notes or commentary on the images they are working with by using a standard word processing package.

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stations including microcomputers and CD-ROM players and printers for use with the WILSONDISC indexes. There are four microcomputer stations with printers for the three online services—BRS/AfterDark, Dialog’s Knowledge Index, and Dow Jones News Retrieval Service. In addition, each of the SilverPlatter CD-ROM databases has its own workstation, and a final CD-ROM workstation with a printer is reserved for testing new products.

One of the most interesting aspects of the Automated Reference Center is the approach to training. Patrons are expected to complete a training program in database searching before using any of the ARC resources except WILSONDISC or Dow Jones. This is primarily because of the complexities of database searching and lack of effective system tutorials as well as the expense of inefficient online searching. The patron has the choice of completing a training workshop taught in-house or completing a computer-aided-instruction (CAI) program and a workbook. The training room contains five microcomputers—four AT&T 6300s plus a COMPAQ—and a computer projection system.

After one and one-half years in operation, the ARC is judged to be a success. It is very popular with both faculty and students. The total number of ARC searches done for fiscal year 1987 was approximately 3000. In addition, mediated searching has decreased and there has been a substantial increase in interlibrary loan requests based on computer searches. Preliminary analysis has shown that the fixed cost of CD-ROM products results in a low per unit cost when the product is heavily used. The result is better library service for less cost.

**Cornell University**

The Mann Library at Cornell University is taking a slightly different approach to the use of optical technology in that it will be integrated with the centralized computer center. With the increasing use of microcomputers on the campus plus the variety of databases available in electronic form, Cornell is concerned about getting appropriate information to the researcher in electronic form. The university computer center and the campus network will be the focal points of this four-phase project to assess the potential of write-once-read-many optical technology to deliver both bibliographic and textual information to the researcher.

Phase I of the project, which began in 1987, was identification of funding and the establishment of a hardware and software system to support networking as well as a database management system to provide a database structure and indexing capabilities to facilitate access to large text files. The system chosen was a Microvax Minicomputer with the BRS/Search software package by BRS Information Technologies used for database maintenance and searching.

In Phase II, which began in March 1988, the full AGRICOLA database was loaded onto magnetic discs using the BRS software pack-
and the Microvax Minicomputer. AGRICOLA is the bibliographic database developed and maintained at the National Agricultural Library. This database has been made available to a limited number of Cornell faculty for testing through the campus network. Plans are underway to make additional bibliographic databases of scientific information available in late 1989.

Beginning in late 1989, Phase III of the project will begin to provide full text through the system. Material from selected journals cited in AGRICOLA will be stored on WORM discs and indexed for full-text searching. BRS/Search will continue to be used for the full-text retrieval and users will be able to search, display, and print full-text information as well as high-resolution page images. These materials will be delivered through the campus network to a high resolution terminal at the researcher's disk. At the completion of this project, Cornell expects to have determined how best to provide library service for electronic databases to the scholarly community in a campus environment.

One of the most exciting approaches taken to the use of optical products in libraries is the various statewide programs which aim to provide a basic automation capability to libraries by utilizing CD-ROM technology.

Missouri

The Missouri State Library has utilized Library Services and Construction Act (LSCA) funds to provide any public library in the state with funds to purchase automation equipment. By meeting a set of specific requirements, including voted tax support, completion of an annual report to the state library, and agreeing to purchase specific equipment, over 180 libraries will be acquiring equipment in 1988.

Specific equipment is required to ensure compatibility among libraries. The equipment includes the Epson Equity microcomputer, the Hitachi 1503-S CD-ROM player, a Hayes 2400 baud modem, and Smartcom software as well as a Hercules Graphics Card. The State Library is coordinating the distribution of equipment and special training sessions which will be held at various locations around the state.

The State Library is also supporting the conversion of local bibliographic records to electronic form. This will be done using Bibliofile, a product of The Library Corporation, and the purchase will be supported by state funds. Bibliofile is a CD-ROM product which supports retrospective conversion by enabling users to select, modify, and output MARC records from the CD-ROM database. Bibliofile was selected because of its strong reputation and the fact that many Missouri libraries already owned the package. Using local records, the State Library has plans to create a statewide database on CD-ROM. It is scheduled for completion by October 1988.

This is by no means the end of the project, however. Other software and CD-ROM products will be identified for use by participating libraries over the next few years and purchased as appropriate.
ACCESS PENNSYLVANIA is another statewide project utilizing CD-ROM. Unlike the Missouri project, which involves public libraries, the Pennsylvania project focuses on school libraries. This project is the joint effort of the Pennsylvania State Library, the Pennsylvania Department of Education, and the BroDart Company. The purpose of the project is to create a Pennsylvania Union Catalog utilizing microcomputer and CD-ROM technologies. Funding for the project is a combination of state, local, and federal funds used to support database development, retrospective conversion, and mastering and copying of CD-ROM discs.

While the primary focus is on school libraries, other libraries are also included if they form a consortium with a school library. There are a number of requirements for participation, but primarily a participant must purchase the microcomputer and related hardware and software needed to use the CD-ROM Union Catalog. In addition, they must implement an automated library management system for inventory and circulation control. Participating libraries must also agree to support the cost of updating and remastering the database for a five-year period as well as supporting the cost of interlibrary loan activities from their collections.

The equipment used for ACCESS PENNSYLVANIA is basically the BroDart Le Pac System. The hardware includes a Tandy 1000SX microcomputer with two Hitachi 2500s CD-ROM drives. The Le Pac software supports a public access catalog with full MARC records and provides a variety of access points including author, title, and subject headings. A special search capability for the location field was added for the project in order to facilitate interlibrary loan activities.

As with the Missouri project, retrospective conversion of cataloging records was a large part of the effort. Over 150 participating libraries provided unique cataloging records to the Union Catalog database. For cataloging records not already in electronic form, a contract was made with BroDart for retrospective conversion, a process which will result in a database with full MARC records. The first CD-ROM database was delivered to participating libraries in September 1986. A new database with approximately 1.4 million records from over 200 libraries was delivered in September 1987. This latest version required two CD-ROM discs and some software enhancement for facilitating access to the two-disc set. The database will continue to be updated annually.

Support services such as software testing, coordination of retrospective conversion, contract negotiation, and training for participants are all coordinated by the State Library. The State Library is also involved in planning and coordinating ongoing efforts to improve and enhance the overall project.

Although a formal study of the project is underway, a number of positive project results can be seen. Circulation has increased in a
number of participating libraries due to the user-friendliness of the CD-ROM catalog. Some libraries have indicated that their image has been enhanced in the eyes of users as a result of their participation. Others indicate that expanded interlibrary loan activities are providing outreach services which will bring future benefits, and, most important, students are having positive library experiences.

*Maine*

Another approach to statewide library service using optical technology is underway in Maine. While Missouri focused on public libraries and Pennsylvania focused on school libraries, the Maine state project, MAINECAT, anticipates participants from public, school, special, and academic libraries.

The Maine State Library Bureau took a legislative approach to statewide library automation. Legislative Document No. 321 entitled "An Act to Open Maine Libraries to Modern Information Technology" was introduced into the Maine House of Representatives in February 1987 and soon passed into law.

The purpose of the MAINECAT Project is to improve library service within the state of Maine through the use of microcomputers and CD-ROM technology. The project is directed by the Ad Hoc State-wide Library Automation Committee. Fifty libraries will be selected on a competitive basis to participate in the first year of the project. Selection criteria include such things as readiness to undertake automation projects, financial ability to acquire compatible microcomputer equipment, willingness to convert local collections, and willingness to provide access to collections. Each participating library will receive a CD-ROM drive and a $500 grant to be used to purchase a microcomputer system.

The equipment to be used for the project has yet to be identified. A Request for Proposal (RFP) detailing the requirements for MAINECAT has been completed and made available to the vendor community. Appropriate equipment will be identified in the winning proposal.

MAINECAT will be a Maine Union Catalog of full MARC records including more than 1.5 million existing records in electronic form. Each record will include local call number and location information. Once the project is underway, new records will be added to the MAINECAT database on a regular basis, and a new CD-ROM will be issued semiannually. In addition to its use as a Maine Union Catalog, MAINECAT can also be used as a "scoped catalog." By "scoping" or limiting, the database can be used as a local library catalog.

The State Library will provide coordination for the MAINECAT project in terms of database development, training, and general educational programs. In addition, the state will support the cost of CD-ROM readers for participants, processing of existing records to create the initial MAINECAT database, and the CD-ROM mastering and
duplicating. Ongoing database maintenance costs will also be supported by state funds.

With a three-year planning effort completed, the first MAINECAT disc will be distributed to participants in March 1988 with full software implementation expected in fall 1988. It is expected that fifty additional libraries will be added during the second year of the project and additional libraries thereafter.

**Summary**

CD-ROM, digital videodisc, and WORM are the three types of optical media being used today in the nation's libraries. Much of the present use is to provide existing products in an alternative format. Hence, online databases or printed indexes become available on CD-ROM discs. However, a number of vendors are starting to experiment with new products which do not exist in other formats. There is a new focus on text products as distinct from bibliographic products, thus helping to direct the library community toward alternatives for the delivery of information.

Considering the relatively short time-frame since the introduction of optical technology, the number and scope of activities—both operational and experimental—in the nation's libraries is indeed astounding. It is clearly a technology whose time has come and with a little help and direction from the library community it can become a major factor in the way libraries do business in the twenty-first century.
Telefacsimile in Libraries:
New Deal in the 1980s

STEVEN ALLAN BROWN

At first examination, telefacsimile seems an ideal technology for any library: a device that instantly sends a replica of a printed page—complete with text and graphics—to any other facsimile machine that can be reached by conventional telephone service. Unfortunately, as with many technologies, further examination reveals mechanical limitations and financial burdens that limit its universal appeal. Nonetheless, the potential advantages are so alluring that libraries have conducted studies for decades. The 1980s have seen a striking increase in studies, trials, and installations of telefacsimile in library settings. Those unfamiliar with the technology or those who remember it as slow, clumsy, and terribly expensive well may wonder why telefacsimile has become prominent in the literature.

Three major changes have stimulated the library world's interest. Following 1980, a new generation of telefacsimile machines—designated as Group III—became available. These machines adhere to a common international communication standard, unlike the two earlier generations—Groups I and II—which were hampered by compatibility problems between units built by different manufacturers (McQueen & Boss 1983). Group III units can communicate with each other regardless of brand, although slightly faster transmission or enhanced resolution often is possible between two machines from the same manufacturer. Some can even "talk down" to machines of the two earlier groups. This change makes it possible for networks to evolve without coordination. Just as installing a telephone makes a library part of the nation's telephone network, installing a Group III machine makes a library part of the telefacsimile network. A second change occurred in speed of
scanning and transmission. Group III machines are much faster, scanning a page in less than a minute, as opposed to two minutes with Group II and six minutes with Group I. This decreases long-distance telephone charges, making transmission more economical. The third change is also economic in nature. Like pocket calculators and personal computers, the price of facsimile units has decreased throughout the decade.

**The Technology**

At the heart of telefacsimile is an operation somewhat akin to dot matrix printing. A telefacsimile machine views a page of text being scanned as a grid of tiny points. It assesses whether each point is dark or light and transmits its assessment over telephone lines to the receiving unit. The receiving unit recreates the grid of light and dark points, producing a dot matrix facsimile of the original page. Unlike computers, telefacsimile never recognizes a character: it only codes, transmits, and decodes patterns of light and dark that configure a shape that we recognize as a letter.

Such a gross oversimplification will be of little use to librarians evaluating machinery, and they will want to turn to several valuable articles. William Saffady (1984) has provided a detailed, yet brief, overview of the central technology of telefacsimile units. Lawrence Robinson (1986), in his book *The Facts on Fax*, surveys the many automatic features available and argues for telefacsimile from a business perspective. Similar information, in more concise form and considered from a library perspective, can be found in *Library Technology Reports* telefacsimile overview (“Survey of Telefacsimile Equipment” 1985). These sources provide reviews of specific telefacsimile units available at the time. While this information demonstrates how features have been incorporated into actual machines, it rapidly becomes outdated as models change. Less detailed, but more current, information is available, for example, in *The Office* which publishes a table of currently available units in its September issue (“Buyers' Guide to Facsimile Systems” 1987, pp. 108, 112, 114).

**Library Applications**

Most articles advising libraries on telefacsimile stress assessment of need as vital to the success of an installation. Telefacsimile is neither technologically perfect nor insignificant in cost. If the library's users really have no need for the technology's advantages, they may ignore the service and the library may regret its investment. Fortunately, results of many studies are now being published in the literature, allowing libraries to survey applications and profit by the experiences of others.

In most studies, telefacsimile has been applied to interlibrary loan situations. Programs of national scope have been coordinated by the National Library of Canada and the Research Libraries Group, Inc.
(Anand 1987a; Anand 1987b; Smith 1984). Within a region, notable studies have been conducted in the Pacific Northwest (DeJohn 1984). Statewide studies include those conducted by medical libraries in Texas and networks of public, special, and academic libraries in Illinois and in Montana (Algermissen et al. 1982; Mak 1988; Wainer 1986; Brander 1987). A network’s service focus can be as small as one city as in the case of a group of major law libraries in New York City (Boss & Espo 1987).

In a similar application, telefacsimile is used for moving documents from large supplying libraries to smaller units. This pattern of service has been much explored in medical settings where information must flow as rapidly as possible from large research collections to hospitals or other medical facilities. Such situations have been reported by the College of Physicians of Philadelphia, the Health Science Library at the Texas College of Osteopathic Medicine, and the Montana Health Sciences Information Network (Aguirre 1988; “Libraries Begin to ‘Think Digital Facsimile’” 1983; Kaya et al. 1987). A similar situation, but with generally less urgent speed requirements, was explored in a trial conducted by the National Agricultural Library. In this study, documents moved from the National Agricultural Library and a network of Land Grant University collections to smaller regional libraries of the USDA’s Agricultural Research Service (Brown 1986). An extreme example of one-directional document flow occurs at DePaul University. DePaul’s O’Hare branch campus has no permanent collection so rapid access to journal articles is offered by means of a telefacsimile link to the main campus (Brown 1985).

Telefacsimile also is used outside of document delivery. When the Denver Public Library was forced to cut back on reference staffing, it installed telefacsimile units to move reference queries and answers swiftly between the central library and the branch libraries. Denver also reports that the system has proved to be an excellent internal communication option (“Libraries Begin to ‘Think Digital Facsimile’” 1983).

These and other studies provide information about the needs that libraries have addressed with telefacsimile. Many of the articles also provide information about the questions that should be asked in considering implementation: can telefacsimile speed up operations significantly, is it too expensive, will the user be satisfied with the document supplied, and will the impact on the library operation be positive or negative?

**Speed Improvement**

There is no question that telefacsimile can move text immediately from one location to another which is performance only electronic mail can match. Indeed, Lawrence Robinson (1986) argues that telefacsimile should be viewed as a type of electronic mail, one which can often eliminate the time needed to rekey a message in conventional electronic mail systems (pp. 5-8). The technology, when applied to conventional
document delivery situations, only eliminates the time needed to send requests and documents through the mail. Studies indicate that such time savings are noted by users although they do not always feel that the savings are important to their work. When users can be satisfied with delivery by mail, telefacsimile is an unnecessary expense.

When next-day delivery is adequate, there is the possibility of using courier delivery services. This may be a cost-effective alternative for libraries with only occasional need for rapid delivery; however, such services are costly and are not available in all areas. If courier services are frequently used by a library, it should seriously consider the speed and cost advantages of telefacsimile. Where delivery speed is of the greatest importance—as in medical settings—policies may be set to give priority treatment to requests. In 1987, for example, the National Library of Medicine initiated a program whereby requests designated as needed for "clinical emergencies" will be processed, if possible, within two hours ("NLM Begins Telefax for ILL" 1987). Such handling realizes the full potential of telefacsimile but demands a huge investment of staff time.

Cost of Service

Cost has been the central focus of many telefacsimile studies. Cost estimates are usually expressed in terms of cost per page transmitted, but not all libraries have calculated this figure in the same way. Several factors may or may not be involved in such a calculation—i.e., telefacsimile purchase price or rental fee, maintenance plan cost, telephone line cost, long-distance telephone charges, supply costs, and labor costs. Calculations can be greatly influenced by fixed costs if they are figured into the cost per page. Because fixed costs are constant, regardless of how much use is made of the machinery, these costs greatly increase the per page figure in a low-volume operation. The fewer pages sent during a month, the greater the share of the fixed cost burden each transmitted page must bear. Fixed costs include telephone line charges and telefacsimile machine costs. Most libraries will want to have their telefacsimile unit ready to receive and transmit at all times; thus they will have to pay a monthly charge for a dedicated telephone line. Some libraries lease their telefacsimile machinery, incurring rental fees. This leaves them free to upgrade machinery if the technology improves. With falling purchase costs bringing high quality units into the $2000-$5000 price range, however, machine purchase appears increasingly attractive. The purchase price of a machine, amortized over its life, certainly has much less fixed cost impact than monthly rental charges. If a library has carefully estimated its needs and has found a machine that will give adequate service for some years to come, it should seriously consider the purchase option.

Purchase does add the fixed cost of a maintenance agreement. Considering that telefacsimile units are generally reported to be quite reliable, the price of such agreements seems high. Richard Boss and Hal
Espo (1987) report that these contracts can cost between $200 and $1100 annually (p. 39).

The remaining cost factors all vary with amount of use. Of the variable expenses, long-distance telephone charges have the greatest impact on cost except in cases where the bulk of a network's telefacsimile activity takes place in the same local call zone. Long-distance charges are also one of the most elusive charges to predict. Like voice calls, the total cost will depend on the location to which the call is placed, the length of time spent on the line, and the time of day. Since the first minute of a long-distance call is the most expensive, there is a cost advantage if transmissions contain large numbers of pages. Considerable savings also can be realized if transmissions are made at night when discounts are offered on long-distance calls (Brown 1986, p. 51). Unfortunately, delaying transmissions to achieve these savings may undercut the rapid delivery which makes telefacsimile attractive in the first place. Charges can be much diminished if a special long-distance arrangement—such as a WATS line—is available.

Much of the long-distance cost will depend on how quickly a unit can scan a page. In general, manufacturers quote figures based on office correspondence rather than on dense text involving complex illustrations. Nonetheless, transmission time of less than a minute seems to be the rule in library studies. Although a page may be transmitted in far less than a minute, it is necessary to realize that there will be a pause of several seconds between each page scanned as the machine reassesses the quality of the connection. Also, if a Group III unit is communicating with a Group I or II unit, the transmission will occur at the older machine's rate.

Many machines feature two or three scanning resolution settings. If the material being transmitted is very detailed or if the telephone connection is poor it may be necessary for the machine to scan at a higher resolution, creating its electronic picture of the page with a much finer grid containing many more points. A higher resolution scan thus contains more data and will take longer to transmit. Some machines will automatically adjust to finer scan levels if a telephone connection deteriorates.

One unexpected telephone factor found in the National Agricultural Library study was the cost of broken connections. Because of telephone service problems or mechanical problems with one of the telefacsimile units, connections would often be broken. This would necessitate making an extra telephone call to complete a transmission, incurring a second premium charge for the first minute.

Supply costs for telefacsimile machines are very moderate compared to telephone costs. With many machines the only supply required, besides electricity, is paper. In the National Agricultural Library study, the cost of the thermal paper used in the telefacsimile machines was found to be less per sheet than the cost of photocopies.
Because the machines offered the optional capability to copy documents, money was saved by copying transaction records on the telefacsimile unit. Paper costs will differ from manufacturer to manufacturer and users are warned that maintenance problems may arise if unauthorized paper is used (Pocius 1986). Thus a library may be locked into one paper supply price when a machine is chosen. It should be noted that some machines use a system that requires both toner and paper.

Labor costs are difficult to calculate in a telefacsimile study because the work is usually integrated into regular operations. Telefacsimile machines are not difficult to operate and can be enhanced with a variety of time-saving automatic options. Because telefacsimile machines only accept single sheets of text, the laborious work of photocopying and proofing requested articles is still necessary even if the photocopies are thrown away following transmission. Malcolm Smith (1984), in his Research Libraries Group study, concludes that attending to the telefacsimile machine and dealing with transmission problems takes more time than is saved by not having to package and mail the photocopies (p. 145). In some studies, recipients of telefacsimile copies have wanted to have the photocopies mailed to them for their permanent files, which of course cancels out any savings of postage or processing time.

In spite of the different ways that costs can be determined, most of the studies cited earlier found that per page costs averaged under $1 and were well under $1 if there were no large fixed costs for equipment. Richard Boss and Hal Espo (1987) calculate that libraries should be able to transmit for less than $1 per page, even with equipment costs included if they transmit over 200 pages per month. They further estimate that sending more than 350 pages per month will bring costs down to $.75 per page and that transmitting over 1000 pages per month can bring the cost down to $.50 (p. 41).

**User Satisfaction**

Copy recipients in most studies are well satisfied with the time savings that can be realized with telefacsimile; but recipients are not always so satisfied with the quality of the copies received. Under the best transmission conditions, the telefacsimile process will distort the type very slightly. Text, nonetheless, is usually judged quite acceptable and legible by the recipient. If the article's type is small, however, there may be legibility problems. Even if the text is legible, the slight blurring may become irritating if many pages must be read.

Nonalphabetical elements, such as numbers or mathematical and chemical symbols, can provide legibility problems especially if they are printed in smaller type. Such symbols can constitute the most important part of a science article, being especially vital if the text is written in a language the requester cannot readily understand. Graphic materials such as drawings, graphs, and photographs, are particularly vulnerable to distortion. The fact that they often do not photocopy well com-
pounds the problem, although there are rare cases where the telefacsimile process will enhance a poor copy.

Telefacsimile units that can accept pages of unusual width usually transmit them with text reduced in size. This allows them to be printed on standard width paper on the receiving machine, but it can also mean that the facsimile received is unreadable.

Whether or not users will accept the quality of telefacsimile copies is hard to predict. Most studies report that users are pleased with the quality, despite occasional legibility problems. Even in medical settings, where science-oriented materials filled with symbols are used, users seem satisfied. This is perhaps because of the vital importance of speed in their work. In the National Agricultural Library study, users were found to be more critical of copy quality, perhaps because they generally were reading large numbers of telefaxed science articles and were accustomed to fairly rapid service from local research libraries. Even though critical of the quality of copies, most of the recipients in that study wanted telefacsimile to be available for transmitting materials in rush situations and for sending requests for documents.

Copy quality can deteriorate because of bad telephone connections. Although some machines automatically or manually adjust to higher resolution scanning to compensate for a poor signal, the compensation can be inadequate. Distortion can range from moderate blurring to total disintegration into streaks. Such problems are not common over a good line, but some lines simply cannot support transmissions during certain hours. In the National Agricultural Library study, transmissions to Berkeley, California, almost always were impossible during daytime hours.

With such distortion occurring, sensitive proofreading is necessary at the receiving end. This creates a burden for the receiving library that does not occur with mailed photocopies. The receiving library must be willing to request that pages be retransmitted, but this can be done quickly with a note transmitted back to the supplier.

Although it is a minor factor in studies, some recipients dislike the paper on which their facsimiles are printed. Thermal paper, used in many units, strikes some as unpleasant to the touch, discolors if exposed to intense sunlight or heat, darkens if colored with a highlighting marker, and may not be as permanent as regular photocopy paper. It should be noted, however, that copies made on thermal paper three years ago and stored in a filing cabinet are perfectly legible today.

**IMPACT ON LIBRARY OPERATIONS**

Need, cost, speed, and user satisfaction are the factors which a library will examine to determine whether or not to implement telefacsimile. If it is to be implemented, the library must consider the impact upon library operations in order to choose the right features and assure the smooth integration of the technology.
At the beginning, the location of the machine should be carefully chosen for convenient access. Manufacturers' brochures, based on office use, can create the impression that the machines require very little attention. This impression rapidly dissipates in a high-volume operation where transmission problems can disrupt the workflow with surprising frequency. In such a situation, easy access becomes vital to staff acceptance of the technology. Telefacsimile machines vary in size; thus the location for the machine must be considered in choosing a unit.

Once location and machine are selected, getting a unit into operation can be simple if your vendor meets promised deadlines. Telefacsimile is turnkey technology—once connected it is ready for business. Libraries seem to have more problems with the installation of the dedicated telephone line than with the installation of the telefacsimile machine itself.

Telefacsimile machines are easy to operate and their use requires little training. Several of the automatic features, alluded to earlier, can greatly ease the operation of a unit. An option of major importance in library applications is automatic receiving. This feature allows the receipt of a transmission without any action on the receiver's part beyond keeping the machine supplied with paper. With automatic receiving, documents can arrive during late hours when long-distance tolls are low, even if the staff has gone home for the night.

Automatic document feed is necessary for a document delivery operation of any considerable volume. With this feature, an entire document is placed in a hopper on the machine. Once the telephone connection is made, each page is pulled through the scanner and transmitted, saving the time and trouble of hand feeding. This feature, though very valuable, can be a source of trouble. Pages can jam, causing the telephone connection to be broken; or two pages can feed into the scanner at the same time, with only the page on top being scanned. Staff will need be watchful for such developments, and it is probably best to have someone working in the area during transmission. Library users have speculated that jamming could result from the chemical coating on photocopies or static electrical charges on text pages. Others have felt that there was a relationship to humidity.

Unfortunately for libraries, automatic feed systems are made to hold only twenty to fifty sheets of text. Many users report that machines jam when they try to use the feed hopper at the manufacturer's stated capacity. This may be because libraries usually are scanning photocopies, while manufacturer's claims may be based on common paper. Even the manufacturers' claimed capacity is too limited for many document delivery applications. In some cases extra pages can be added to the hopper after several pages have fed through, but this can lead to a paper jam and a broken connection unless done delicately.

Programmable dialing systems are available that will store frequently called numbers, automatically redial a busy line at a later time,
and permit advanced programming of calls so that the machine will make a transmission unattended. Combined with automatic feed, the dialing option allows a properly prepared machine in a deserted library to transmit text to a machine with automatic receiving in an equally deserted library.

Although night transmission is very desirable from a cost standpoint, it is hampered by the limitations of automatic feed systems. Some telefacsimile machines overcome these limitations by offering an electronic memory capacity. With such a machine—known as a store and forward unit—staff members can scan hundreds of pages of text into the memory during daytime hours and then use programmable dialing to cause the machine to transmit the stored data at night. Since the scanning is not being done during transmission, there is no need to worry about paper jams breaking telephone connections. The one possible drawback to the system, besides the extra cost added to the unit, is that the machine cannot switch automatically to higher resolution scanning if a connection deteriorates. Such a problem, however, would be unlikely to occur during night transmission; during the day it would result in requests for resupply of pages. When library-based studies of these systems appear, they probably will reveal that the store and forward unit's ability to solve problems of large-scale transmission outweighs any quality adjustment limitations.

Staff members transmitting documents should be aware of the legibility difficulties that can be encountered. It is hoped that they will be able to spot potential problems and judge whether or not to shift to a finer resolution. Some machines can produce copies of a page, as well as transmit its image. Since these copies are made by the same scanning process that is used for transmission, a copy will give some idea of how the facsimile will appear at the other end. Making such assessment copies can help new users develop an ability to judge when articles will require higher resolution transmission.

If libraries use telefacsimile to transmit interlibrary loan requests, loss of legibility will restrict the number of times the facsimile of the same request can be referred from library to library. As mentioned elsewhere, even an excellent telefacsimile copy will suffer some trace of distortion in its characters. When a request received by telefacsimile is transmitted on to another location, the second transmission's distortion compounds that of the first. Deterioration continues with each transmission. In the National Agricultural Library study, typical requests were illegible after the third transmission.

A library implementing telefacsimile will need to consider its impact on service policies and work flow, both to avoid confusion and to maximize the technology's speed advantages. For requests received from other locations, libraries will have to consider what speed of processing will be offered for "rush" requests. Will premium service require premium supply fees? One of the complications of telefacsimile
is that the supplying library will be charged for the long-distance charges. Will these telephone costs be recovered and, if so, how will charges be calculated when the precise cost may not be known until the telephone bill arrives? Can some sort of standard equitable charge for service be made? Can the library wait to take advantage of late-night telephone rates without counteracting too much of the speed benefit of using telefacsimile?

Libraries will have to decide what charges, if any, should be passed on to users requesting telefacsimile delivery of materials. In many studies users pay, or have expressed a willingness to pay, a small fee. Library users may request that the library transmit or receive personal messages for them. The library must decide whether to allow such access and how to charge for it if they do. The recent appearance of public telefacsimile machines at locations such as public photocopying centers may decrease such requests.

**RECENT TECHNOLOGICAL DEVELOPMENTS**

While libraries try to juggle all of the factors involved in the consideration of telefacsimile, the situation is complicated by the fact that the technology is constantly changing. Given the business community's enormous interest in the technology, it is not surprising that a great deal of energy is going into new developments. Some may have applications to library situations.

Much of the current interest in the business community revolves around interfacing personal computers and telefacsimile units. Some years ago, telefacsimile machines were introduced with ports allowing them to be connected to personal computers. The computers in these systems work as control and data storage mechanisms, duplicating the automatic dialing and store and forward features available on the most sophisticated telefacsimile units. In addition, software makes it possible for characters in the computer's memory to be converted into images that can be transmitted to other telefacsimile machines, allowing them to function as remote printers.

As the graphics capabilities of the personal computer have been explored, the technology has developed to eliminate the separate telefacsimile machine altogether. Recently, expansion boards have appeared that can be added to a personal computer allowing it to duplicate telefacsimile operations. To do this it must be connected to one of the scanners marketed for use in storing graphics and a dot matrix printer. Those who work with computer graphics are excited by this development because Group III telefacsimile machines' communication standards can serve as a gateway for graphics communications between computers. Previously, computer graphics have lacked standards to allow easy communication. These enhanced computers are viewed as having great potential in desktop publishing where there is a great desire to manipulate and transmit graphics. Winn L. Rosch (1987) has
provided a comprehensive overview of these developments, along with reviews of products.

Although writers in the computer literature are clearly excited about these developments, it is not clear how much impact they will have in libraries. Bruce Morton (1987) has reported on a current study among Land Grant libraries in the Pacific Northwest which will examine the use of scanners and computers in lieu of telefacsimile units. This study was set up before the telefacsimile imitation hardware was available, but it may provide useful insights into transmission without telefacsimile units. Morton stresses the need for technical support in operating such a system, a point that should concern libraries. Privately assembled systems using components from multiple manufacturers may remove much of the turnkey simplicity from telefacsimile operation. If manufactured telefacsimile units offer adequate capabilities for control and storage, it may not be worthwhile to fabricate a unit from a personal computer. A criticism voiced in the business literature is that assembled units require the use of a personal computer while operating (Voros 1987). Libraries would probably regret sacrificing the use of a personal computer in order to keep the lines of telefacsimile communication open. Unless a system can be assembled that offers all of the features and the simple operation of a sophisticated telefacsimile unit at a much lower price, it is doubtful that libraries will turn to such assemblies.

An interesting use of telefacsimile as a peripheral device is reported by David Hessler. He reviews a system developed by Kirsch Technologies Inc. that combines a microcomputer, a videotape recorder, and a telefacsimile machine. This combination allows an enormous number of images scanned by the telefacsimile machine to be stored on the videotape recorder for later transmission. The system offers other data storage advantages not related to telefacsimile, but it is far more expensive than telefacsimile units with store and forward capability (Hessler 1987).

One of the most common complaints about telefacsimile is its inability to scan anything but single sheets of text. Most libraries regret the cost and effort that goes into producing photocopies of articles to be run through the scanner and then discarded. The British Library has promoted the development of machinery that can scan directly from bound volumes. Such a machine was reviewed in 1984, but at the time it could only produce copies of pages. The review stated that an interface unit was being developed that would allow its scanned information to be sent to telefacsimile machines. Unfortunately, its purchase price would prohibit use by most libraries (Williams 1984).

As the library world examines Group III technology, the next generation, Group IV, is being introduced. This new technology offers high resolution and much higher transmission speeds. Common telephone lines cannot support these improvements; so Group IV technology can only be implemented where there are dedicated high-speed data
lines. This eliminates the economical universal access capability that makes telefacsimile valuable in library networking. Corporate libraries, in settings where such lines are available, may implement Group IV for internal communication (Finlay 1986).

Optical character recognition developments offer the most interesting competition to existing telefacsimile technology. A computer can transmit the ASCII character a far more efficiently than a telefacsimile unit can transmit the bits of information needed to create a facsimile of the letter a. If scanners that recognize letters and encode them as such in a computer's memory are developed to the point where they are highly accurate with a wide variety of type styles, these scanners will provide strong competition for telefacsimile systems. Even when such systems are developed, however, telefacsimile technology will still be needed for transmitting graphic materials or articles written in non-Roman characters.

At this stage, with Group IV technology out of the reach of most libraries in the near future, Group III technology seems fairly stable. This makes purchase of a versatile Group III machine a logical step for a library interested in telefacsimile.

THE GROWING NETWORK

One of the limiting factors in telefacsimile's adoption has been the absence of other telefacsimile machines. Equipment that was not installed as part of a specific network could stand unused for lack of other units with which to communicate. This situation has changed rapidly in the 1980s for both libraries and the business community. The current library network is documented in the Directory of Telefacsimile Sites in Libraries in the United States and Canada, a geographically organized listing of telefacsimile machine telephone numbers, contact people, and equipment in public, academic, corporate, and medical libraries (Jones 1987). Libraries are included in the Official Facsimile Users' Directory which also includes machines in many nonlibrary applications (Greenfield & Maenike 1987).

Regions still exist where library-based telefacsimile machines are rare and where an individual library may hesitate to install the first equipment. In the past, grants from foundations interested in improving information services have been instrumental in setting up networks. Libraries can also take the initiative to develop networks in their areas. For example, the Montana Faxonet Project plans an involved marketing campaign to popularize telefacsimile use within the state (Brander 1987, pp. 73-74). Outside of libraries, telefacsimile equipment is widely used in the business community. Several libraries report that local businesses have been delighted with the possibility of telefacsimile contact with their local library.

Library networks are now complemented by supply services that offer telefacsimile delivery. Chemical Abstracts, the Institute for Scien-
tific Information, and University Microfilms International all offer optional telefacsimile delivery as part of their article supply services. Such optional delivery is expensive, but when budget and need are compatible, it can prove to be a valuable resource.

Network growth testifies to the potential value of telefacsimile to libraries and, at the same time, makes the technology look more attractive to libraries that lack it. As networks and services grow, more libraries will be considering telefacsimile as a communication option. As prices decrease, more libraries will be able to experiment with the technology. And as long as researchers need very rapid access to materials that exist only in print form, telefacsimile will retain its attraction.

REFERENCES


Electronic Mail in the Library: A Perspective

BECKI WHITAKER

Electronic mail has been available for over a decade in various forms. How is it used in libraries? To what extent is it used? Is it still viable for library applications? Are there other competing technologies which have surpassed the promise of electronic mail? These are some of the issues which this article will address.

The concept of electronic mail is fairly straightforward. Electronic mail systems allow creation and transmission of messages which can be addressed to an individual or select groups of individuals. The recipient can then read the message, answer it, store it electronically, forward it to another individual, print a paper copy, or delete it. However, the technology and variety of types and levels of electronic messaging is much more complex. For background information, consider Trudell et al. (1984) who present historical and technical aspects of electronic mail.

Trudell et al. also identify speed of delivery, reliability of delivery, and security and privacy of messages as three beneficial characteristics of electronic mail. Universal delivery and flexibility continue to present problems in the use of electronic mail (Trudell et al. 1984, pp. 21-23). Additional benefits of electronic communication include the extension of the potential work day since electronic mail can virtually be sent and received any hour of the day; the use of more succinct, written communications which take advantage of the fact that people read about six times faster than they can talk; and the decrease in interruptions by incoming telephone calls (Howitt & Weinberger 1984, pp. 89-90). The classic benefit of electronic mail, however, is the elimination of “telephone tag” and the frustration of not being able to reach the person you need to talk to.
A search of the current literature reveals a substantial body of works on electronic mail applications in libraries. Many of these applications deal with the use of an electronic bulletin board system. Bulletin boards allow users to post messages and receive answers from other users. Libraries are beginning to develop and support bulletin boards for communication with their patrons. The partnership of electronic messaging—particularly bulletin boards—with local online systems is also an area of recent growth and development. Local online systems which contain an electronic mail component or which can connect with a campus computer center are also emerging as a means for electronic communication between libraries and patrons especially in academic communities. The focus of this article, however, will be on the use of nationally available, externally hosted electronic mail services which can be accessed and used by a broad spectrum of libraries. Therefore, extensive, well-developed local library electronic mail and bulletin boards such as Maggie III (Dowlin et al. 1986, pp. 7-21) or the Delaware County Library System in Pennsylvania (Belanger 1988, pp. 24-27) will not be discussed.

Electronic mail has always been a major feature of information utilities such as CompuServe and The Source. The Cooperative Library Agency for Systems and Services (CLASS) has been offering OnTyme II services to libraries and other similar organizations since 1980. CLASS's OnTyme II is probably the first electronic mail system designed and marketed to the library community. More recently, other library-oriented electronic mail services have been introduced—e.g., ALANET from the American Library Association, DIALMAIL from DIALOG Information Services, Inc., and the BRS Information Technologies and ALANET partnership/gateway. The short-lived OCLC LINK service was also conceived as an electronic mail and online vendor gateway service for libraries. It seems that most librarians who wish to communicate with other librarians choose one or more of these systems developed specifically for the library and information community rather than one of the information utilities.

The potential uses of electronic mail in libraries can be divided into two categories: general office or business applications, and library specific applications. Since electronic mail allows the sender to relay a message in his/her own words regardless of the length or complexity and also get a receipt from the system when the message has been read by the recipient, "telephone tag" is greatly restricted. If a telephone conversation is needed, an appointment can be set up via electronic mail.

General correspondence, committee work, draft and final documents for electronic and/or print publishing, announcements, consultation and training, teleconferencing, and calendars are all candidates for electronic mail. Most full function electronic mail systems will allow carbon and blind copies, mass mailing lists, and uploading of lengthy documents prepared on a microcomputer or computer worksta-
tion before signing onto the system. In addition, on some systems the sender can request an immediate reply or have a receipt automatically sent by the system when the recipient reads the message. With these features the sender can track the progress of a message.

Interlibrary loan probably represents the greatest use of electronic mail by librarians. The OCLC ILL subsystem is a dedicated electronic mail system with the potential of connecting some 7000 libraries. OnTyme II and ALANET have developed specific forms and routines to facilitate ILL procedures through their systems.

Electronic acquisition and claims systems are other versions of dedicated electronic mail services. Baker & Taylor, Ingram, and Faxon are examples of book and serial jobbers that now offer their own electronic ordering systems. Some jobbers and publishers also maintain mailboxes on electronic mail systems such as ALANET and DIALMAIL and accept orders and/or claims inquiries through these mailboxes. This allows any user of ALANET or DIALMAIL to contact these jobbers without having to subscribe to special dedicated services or to purchase software.

Document delivery is another application for electronic mail in libraries. Orders for reprints from document delivery alternatives such as the University Microfilm International Article Clearinghouse (UMIAC) can be accomplished through electronic means. UMIAC offers at least nine electronic ordering avenues giving the user flexibility and choice of method. Since many requests for reprints and other documents are now generated as a result of online searches, online search services such as Pergamon's ORBIT, BRS, and DIALOG provide that capability as part of their search protocols. Depending on the service, documents can be ordered from database producers or document delivery suppliers like UMIAC or the British Lending Library. Again, these systems can be viewed as dedicated electronic mail services with a specific purpose and user clientele.

Another aspect of electronic document delivery involves the advent of complete text databases, especially complete text journal databases. The growing number of these databases means that the increasing requests for journal articles can be met without going through ILL or other third party document delivery options. An online searcher can identify and download pertinent documents immediately, eliminating any waiting period for delivery. The downloaded document can then be sent electronically to the requester's mailbox on any electronic mail system. The introduction of DIALOG's DIALMAIL has reduced the steps in this procedure since the results of any search can be printed via DIALMAIL and then forwarded to any DIALMAIL mailbox. It is anticipated that the BRS/ALANET venture will also allow forwarding of search results to any ALANET user.

The transmission of reference requests and answers is a fourth electronic mail application for libraries. Much of the activity in this area
is on local library systems and bulletin boards. However, ALANET is one system which maintains a public bulletin board for hard to answer reference questions received by ALA. The nine Area Library Service Areas (ALSAs) in Indiana have referrals of reference questions from their member libraries as part of their mission. An ALSA can receive and transmit reference questions from its member libraries, other ALSAs, the Indiana State Library, and other research libraries in the state and nationally over ALANET. Librarians are also able to send specific requests for reference help to a distant subject specialist or library which could help with a reference question.

As noted earlier, I.L.I. is probably the most recognized and used application of electronic mail in libraries. Other applications seem to be used as needed by groups of users with special needs. For example, committees within ALA's Reference and Adult Services Division, in particular the Machine-Assisted Reference Section (MARS) and the Library and Technology Association of ALA, have made extensive use of ALANET. Project INSITE, a partnership grant from the National Science Foundation involving eight Indiana school districts, the Indiana Cooperative Library Services Authority, the Indianapolis Children's Museum, Purdue University, Ball State University, Eli Lilly and Company, and Merrell Dow Research Facilities and DIALOG's CLASSMATE Program, will use DIALMAIL to share results of scientific experiments, conduct surveys, consult scientists in the field, and communicate with other CLASSMATE users. (The grant proposal was prepared and submitted to the National Science Foundation by Mike Rush and Peggy Buchanan, Project INSITE, Eagle-Union School District, Zionsville, IN. A copy of the proposal is available from the author.)

In addition to these functional uses of electronic mail, Buckland (1987) identifies four groups which could be reached via electronic mail in the library. The groups are librarian to librarian, librarian to patron, patron to librarian, and patron to patron (p. 267). In externally hosted electronic mail systems, the first three groups can still exist and interact within the framework of the library. However, the fourth group, patron to patron, could operate independently of the library. One benefit of local system bulletin boards and electronic mail systems is the inclusion of patron to patron communication within the realm and focus of the library. It becomes another public service of the library.

Other examples of electronic mail use can be identified, in particular, individual librarians who, because of their job responsibilities or apparent personal desire and dedication, use electronic mail as a routine communication method. This group includes bulletin board operators, authors and/or editors, network consultants, information brokers, and other librarians who have become enthusiasts of electronic mail. However, the typical librarian seems not to employ electronic communication in his/her daily work. What barriers exist which seem to prevent the general routine use of electronic mail?
Cisler did an informal survey of five librarians who are known users of electronic mail systems. In fact the survey was conducted via electronic mail systems. His question about the obstacles to electronic mail usage got the following responses:

- lack of equipment and lack of easy access to existing equipment;
- lack of understanding of electronic mail applications as compared to the telephone and regular mail;
- lack of time to overcome the initial learning curve required to use a system;
- lack of time, understanding, or interest to integrate electronic mail as a daily activity;
- cost is perceived as high;
- people are not accustomed to paying to receive regular mail so do not understand costs of electronic mail;
- availability of telefacsimile;
- first-time experience was bad;
- local telephone problems and costs;
- lack of other electronic mail users to communicate with;
- old habits are hard to break;
- and they “don’t communicate with anybody anyway” (“Electronic Mail Survey” 1987, pp. 4-6).

This extensive list can be rephrased into several basic reasons for the nonuse of electronic mail by libraries and librarians.

Connectivity is a current buzzword in the computer industry. It refers to how various computer systems can interact with each other. Connectivity is important in electronic mail since each service runs on its own host computer system and serves those who have access to that computer. Therefore, to gain access to ALANET, OnTyme II, and DIALMAIL, a user would need to contract with each system separately. Some enterprising users have, therefore, learned to download messages from one system and then upload them on a different system in order to share information among all their correspondents. This is at best a cumbersome and a time-consuming method.

In addition to effectively separating users into groups by system used, signing multiple contracts leads to the obvious disadvantage of having to check multiple mailboxes on multiple systems. Connecting or linking systems seems to be the obvious answer. Services like ALANET and OCLC’s I-MAIL, which is available for communication between OCLC and the regional networks which support OCLC services, are subsystems of DIALCOM, Inc. Users of these subsystems have built in connectivity since all DIALCOM computers link to each other. Linking local systems to one another or to a national external electronic mail system is desirable for greater convenience. BITNET and ARPANET, which permit the forwarding of electronic mail from one local system to another, are also examples of linking systems (Buckland 1987, p. 268).
Second, use of electronic mail seems to require a critical mass—i.e., a large enough number of existing users to convince new ones to use electronic mail. ILL users, on the other hand, apparently have that necessary critical mass. Both the OCLC ILL subset and other electronic mail systems such as ALANET and OnTyme II are well-established ILL conduits. The use of ALANET and OnTyme II by medical libraries for ILL has only strengthened their position in the ILL arena. For individual librarians wishing to use electronic mail for applications such as correspondence, committee work, or reference referral, the task becomes one of identifying other librarians who use or would like to use electronic mail. Fortunately, most electronic mail systems offer at least an online directory of users if not a printed list. A printed directory of users can be useful in selecting an electronic mail system.

A companion to critical mass is need. Librarians must have a purpose or reason to log on to an electronic mail service. ILL librarians and groups such as the MARS committees noted earlier have a need and purpose built into their missions. Some novice users are disappointed when they log on to an electronic mail service and have no mail waiting, not realizing that the way to receive mail is to send mail and create a user base. Unfortunately, education about what electronic mail is and what needs it can meet and how is usually not provided except as part of marketing efforts.

Critical mass apparently cannot be assumed. BRS’s joint venture with MCI in 1984 gave access to MCI mail to all BRS users. The joint venture was not continued past the first year. The OCLC LINK service allowed OCLC users to not only communicate electronically but to gateway to online search services. The OCLC LINK service was discontinued in April 1988 due in part evidently to the lack of use. Both BRS and OCLC seemingly had built in critical masses of users.

The lack of use of BRS/MCI and the OCLC LINK service may also be attributed to complexity of the system and the degree of difficulty to manipulate the system. Just as most electronic mail systems are billed as “user friendly” and easy to learn and use, so were BRS/MCI and the OCLC LINK service. However, perhaps these systems contained too many levels of menus for straightforward use. (The author had the opportunity to use and evaluate both the BRS/MCI and the OCLC LINK service while they were available.)

Even with “user friendly” systems, there is still a learning curve involved as the respondents to Cisler’s survey noted. The ease of use of the systems varies. For example, OnTyme II can be particularly disconcerting to novice users since it has no user prompt. The cursor simply rests in the far left position until the user types a command. Once learned, however, OnTyme II’s commands can be simple to use. Training on systems is occasional at best. ALANET, DIALMAIL, and CLASS, on behalf of OnTyme II, do offer some training sessions, usually at regional sites or attached to national conferences. There is
usually a cost for these sessions. Online help and tutorials are also available on many systems, but the user usually must pay the regular online connect rate to use this kind of training.

Costs are a major factor in the nonuse of electronic mail and involve not only the ongoing costs incurred each time an electronic mail service is used but also equipment and service overhead costs. The current BRS messages (MSGS) system and DIALOG's DIALMAIL service are available to all BRS and DIALOG password users respectively. Therefore, it seems reasonable that all BRS and DIALOG users would be using electronic mail. However, online searchers who often have the need and desire to use electronic mail may not have the budgetary authority to do so. Libraries which currently offer online searching on a fee basis may not have "permission" to use electronic mail services unless a fee can be assessed. Even libraries which support online search services may not have a budget to cover electronic mail. Since most online searchers in libraries are still in the reference department, this condition will effectively limit the use of electronic mail for reference applications. ILL budgets usually include online access, again supporting that application for electronic mail.

Online searchers will have the needed equipment even if they cannot access electronic mail. Such is not necessarily the case in other library departments including the library administration. Librarians with budget authority—administrators and middle managers—may not have the equipment or password to access electronic mail systems. They may also not be aware of the opportunities of electronic mail.

Some libraries are still equipment poor, with modems operating at 300 baud when 1200 or 2400 baud is now considered standard. Other libraries still lack modems for their microcomputers or have other dial-up access equipment. Therefore the cost of upgrading or obtaining equipment remains a roadblock for some libraries.

Start-up costs for electronic mail services can include training, documentation, and monthly minimums of usage. More importantly, the perceived costs of future electronic mail use may hinder initiation or extension of the service. Telecommunications costs are often seen as much higher than other forms of communications such as the postage stamp. However, perceptions of electronic mail costs can be countered by the real costs of time and processing added to the postage fees. That cost has been placed at $12 for a business letter. The Bibliographic Center for Research (BCR) has projected that if 50 percent of the current paper communication was on electronic mail, they could pay for the total electronic mail use of its member libraries (Zuck 1988, p. 10).

Another related cost of electronic mail is telecommunications to the host system. Most of the electronic mail services are available through at least one national telecommunication value added network (VAN) such as TELNET or TYMNET. While VANs can provide a less expensive alternative to access remote computer systems, local access to a VAN is
not universal. Rural and other more isolated libraries will still incur long-distance telephone charges to connect with a VAN. In some cases these long-distance telephone charges might more than double the cost of using electronic mail. As Zuck (1988) observes, "the use of resources drops dramatically when distance and availability become factors" (p. 10).

Finally, there is the factor of the technology used in electronic mail systems. Since some electronic mail systems predate widespread use of the microcomputer, many systems still maintain editing and file storage features. These features can still be useful but will make the cost of using electronic mail more expensive. Recent technological advances have also been reflected by some of the electronic mail systems—i.e., the availability of 2400 baud access; multiple protocols such as XMODEM which can be used to verify character transmission when uploading a file; and ALANET's recent announcement of their DOWNLOAD and UPLOAD commands which are designed to facilitate transmission of files to and from a microcomputer.

There are, however, at least two other technologies which might have an impact on the current and future use of electronic mail in libraries—voice mail and telefacsimile. Voice mail technology translates verbal messages received over the telephone into digital form and stores them in a computer. The recipient can then retrieve messages at a subsequent time, precluding the need for "telephone tag." Voice mail typically provides some features similar to electronic mail in that messages can be annotated or edited and forwarded to other voice mail users, stored for future use, and sent to several users at one time. Since voice mail systems are usually purchased, they need to be integrated into daily work flow to be productive and cost efficient for libraries (Koelker 1988, p. 50). Also, since voice mail is usually considered an in-house system, electronic transmission of information is one way. The caller into the system uses a telephone. To send a response to a message, the voice mail recipient must still use the telephone, conventional mail, or other electronic means.

Telefacsimile (FAX) is a technology that has recently gone through a resurgence. Advancements in the quality, cost reduction, and standardization of equipment and transmission protocols, and relative ease of use account for part of this resurgence. FAX also couples electronic transmission with paper communication, producing an immediate paper end product which does not need further manipulation into a final form. In addition, FAX can faithfully reproduce graphics, signatures, and illustrations. FAX has been used in libraries for document delivery and ILL, as a means of distributing surveys and their answers, to transmit draft documents for comments, and to send signed contracts and agreements. Some librarians feel more comfortable with FAX's seemingly easier technology which can be programmed to automatically send and receive documents. FAX does require that the sender and the receiver have compatible equipment which is ready to send or
receive as appropriate for the situation. This can require some telephone communication between the two parties. In addition, FAX can only send to one receiver at a time. Given that electronic mail, voice mail, and FAX all have advantages and disadvantages, all three technologies can easily coexist and give librarians choices for electronic communication.

Electronic mail is growing, albeit slowly. OnTyme II reports that they have 759 subscriptions (Champany 1988, p. 16). A quick scan of ALANET's printed directory indicates that about 2,000 ID numbers are in current use. This represents about 600 subscriptions since many subscriptions have multiple IDs. Likewise, an investigation of DIALMAIL's online registration procedure showed that more than 31,000 mailboxes were registered on DIALMAIL. A realistic estimate of the number of electronic mail users among INCOLSA's 200 members is probably 20 percent. This estimate ignores users of OCLC's ILL subsystem and in-house electronic mail systems. BCR also estimates that less than 20 percent of their 350 members are electronic mail users. However, it must be remembered that "the availability of use is not a measure of the extent of use" of electronic mail systems (Zuck 1988, p. 10).

However, effective and efficient use of electronic mail and continued growth may be contingent upon the degree to which librarians are willing to invest in education, planning, and training. Planning should be based on education about the capabilities of electronic mail, existing types of systems and their connectivity, and the role of local library systems in electronic mail. Training is needed as with any other automated service. Librarians need to be encouraged to explore the possibilities of electronic mail in order to introduce its capabilities into library routines. The future of electronic mail in libraries may rest in the way it is perceived by librarians. Electronic mail should not be viewed as an added option but should be treated as a routine option for library communications.

REFERENCES

New Bibliographic Instruction for New Technology: "Library Connections" Seminar at the Rochester Institute of Technology

LORETTA CAREN

Access to a variety of electronic information systems and services in academic libraries has been reported as confusing and mystifying to patrons, detracting from effective and efficient use of such technologies (Garfinkel 1988, pp. 27-29). Exposure and instruction is important for integrating electronic resources into traditional library use patterns and habits. A new bibliographic instruction program at the Rochester Institute of Technology (RIT) in Rochester, New York, was designed to familiarize faculty with the full array of electronic information retrieval services available to them and their students through the library.

Called "Library Connections," the seminar covers local connections (online catalog and remote access to it and electronic mail reference services), bibliographic connections (online databases, CD-ROM, access to regional networks), document delivery connections (ILL systems, online ordering through commercial vendors), and future connections—planned or imagined. The program is flexible and can be tailored to the specific needs of an academic discipline or institute department. It is also easily expanded to incorporate new services or technologies as they are added.

RATIONALE

Academic libraries have traditionally designed bibliographic instruction programs for students in the use of library resources. However, as reported by Shill (1987) "the instructional mission of the academic library must be reassessed as we advance into the electronic environment" (p. 435). Instruction in using library reference sources and finding tools is inadequate to meet the needs of an increasingly
technological environment. The new technologies must be incorpo-
rated into any state-of-the-art instruction program.

Traditional methods have always worked best when faculty corrob-
orated by understanding library resources and incorporating them into
coursework and assignments. This corroboration has been somewhat
lacking with respect to new technologies simply because faculty have
been unaware of the new resources or have used them only for special
purposes (e.g., in-depth research justifying the cost of expensive compu-
terized literature searches). With the advent of comparatively low-cost
online services and optical media, libraries are now able to make elec-
tronic information available to the student body as a whole without cost
being a major deterrent. Faculty are often unaware of the rapid and
comprehensive impact that electronic information systems are having
on the use of the library including bibliographic searching, reference
services, access to external databases, and document delivery, not to
mention consumer utilities, nonbibliographic databases, electronic
publishing, and network capabilities. With the recent proliferation of
online services, optical discs, and the marriage of libraries and campus
computing networks, academic libraries are being pressed into provid-
ing appropriate instruction to increase faculty and administrator
awareness of the full range of resources and services available to them
and their students.

There is, for example, a clear indication of the need for such
instruction in user reaction to CD-ROM products being introduced in
many academic libraries. Although marketed and designed to be “user
friendly,” CD-ROM discs have yet to achieve the “self-serve” status
aspired to by their producers. At Columbia University, CD-ROM pro-
ducts were acquired and installed in workstations at eleven libraries as a
result of a Pew Memorial Trust Grant. Although presented in walk-up
stations, Garfinkel (1988) reported user frustration caused by a variety of
user interfaces, a lack of awareness of search capabilities or manipula-
tion such as downloading, and a lack of satisfactory help screens or
patience among patrons to use them (p. 28). Many users do not under-
stand the difference between the library’s own online catalog, online
searching, CD-ROM searching, or the OCLC database terminals often
available for patron use.

At the Rochester Institute of Technology, where online catalog and
online search services have existed for nearly a decade, the introduction
of CD-ROM workstations resulted in similar reactions, necessitating
the location of these stations close to the reference desk and requiring a
considerable amount of one-on-one instruction and assistance.
Although the student population is largely “computer literate,” there is
often confusion between floppy disks and optical discs and where to
insert them. Index or “browse” search modes are often used without
further investigation into combination searches or modifying capabili-
ties. Some users are mystified by the notion that there is a corollary
between the online media and the printed index. Few faculty are fully aware of the potential revolution in student research methods because of the introduction of the optical disc.

All of this is occurring despite the fact that the new technologies are gaining rapidly in popularity. Without adequate instruction, there is increased pressure on reference desk staff to provide extensive assistance. Otherwise, ineffective or inefficient use of the media may occur with less than satisfactory search results, or search results not reflecting the full potential of the search software. Yet students seem to be unaware of, or unconcerned with, these limitations (Bristow 1988, p. 27). A need for bibliographic instruction for both students and faculty is clearly apparent. "With the growing use of new technologies, librarians need to know the uses of these technologies and educate campus administrators and faculty on their potential" (Shill 1987, p. 445). Then they can turn to students and provide instruction with traditional faculty reinforcement.

BACKGROUND
At the Rochester Institute of Technology the library has quickly espoused the capabilities of new information retrieval technologies. A pioneer in microfiche catalogs, the online catalog, and online search services, the library will convert to a second generation online catalog in 1988. It is also incorporating optical disc technology and utilizing the campus VAX network to extend remote access to library systems and electronic reference services. Recognizing the need for parallel bibliographic instruction in successful promotion and utilization of such facilities, a bold new approach to bibliographic instruction has been taken, targeted at faculty and staff and designed to expand in many directions.

THE PROGRAM
The theme of RIT's program is "connections" including: (1) a historical review, (2) local connections, (3) bibliographic connections, and (4) document delivery connections and future connections. The seminars are planned for one and one-half to two hours each. In line with the institute's dual self-concept in arts and technology, these seminars are designed to be multimedia presentations. The initial site for the seminars was the bibliographic instruction laboratory equipped with a slide projector, an overhead projector, and a phone line. A modem and a PC workstation with CD-ROM drive were moved from the reference area for each instructional session. Also used was an LCD (i.e., liquid crystal display) instructional projection unit. An LCD projector is a device which connects to a PC and is placed on an overhead projector as a light source. It has proved indispensable in online instruction, being superior to monitors or other projectors in clarity and representation of the online interaction. A good review of state-of-the-art projection systems including LCD projectors is provided by Davis and Miller (1988).
Ultimately the seminar was moved to a larger lecture room since the bibliographic laboratory capacity was only twenty and the response rate was growing, necessitating successive repetitions of the same seminar. The choice of rooms was limited by course scheduling and physical requirements. The room had to be equipped with a phone line to access external databases and also be conducive to using a variety of visual aids.

The first segment of the seminar on “history” is a ten to fifteen minute slide presentation and narrative done by the assistant director for information services, a former art/photography librarian with a talent for turning a slide show into an entertaining, stimulating, and imaginative tour. Historical photos of the library’s successive generations of catalogs and services are intermingled with humorous, artistic, or graphic slides to depict otherwise abstract or subtle ideas. This introduction sets the stage for the seminar as a lively and exciting journey and puts the forthcoming “connections” into perspective.

The second module of the seminar describes local connections—those at the library and on the campus network. The general instruction librarian gives a quick explanation and illustration of the MARC record format, its evolution from catalog cards, and its relationship to the in-house online catalog. References to the universal format and shared cataloging utilities (another “connection”) are made. Utilizing the remote access capacity of the online system, we demonstrate dialing into the catalog through the campus VAX network as could be done from any VAX terminal or compatible terminal equipped with a modem, phone line, and communications software in an office or home. Once connected, search capabilities and procedures are demonstrated as well as use of the electronic reference service (twenty-four hour maximum turnaround time on straightforward reference questions via electronic mail).

The next “connection” demonstrated is access to a regional linkage project in which four local colleges and one public library have provided remote dial-up access to searching each others’ catalogs. To facilitate and expedite demonstrations, auto-logons are constructed and stored on disk. Still, there can be telecommunications problems or any of the systems can be “down.” To cope with the possibility of such failures, backups of all searches are prepared on floppy disks. These “canned” searches can be displayed as a last resort if necessary, precluding a complete halt to the demonstration due to technical problems. One staff member is also “at the keyboard” while another is speaking, a separation of labor that works well to keep the demonstration running smoothly both visually and orally.

The third module of the seminar presents both online searching and CD-ROM searching. One of the objectives here is to differentiate between the two and compare them with respect to content, format, advantages, disadvantages, costs, mode of access, and end-user involvement. One or two librarians participate including the online services coordinator and either the head of reference or a subject bibliographer.
appropriate to the nature of the audience. Again, one of them is at the keyboard while the other speaks. The online portion of the search is also executed via auto logon and the search is previously done and saved to disk as a backup should the database service be unavailable. This is a major module of the seminar and the first two modules are kept brief to make sure that this segment gets a full share of time. A variety of searches and databases are illustrated including bibliographic and nonbibliographic databases, biographical and general databases, and citation or other specialized databases. Since the CD-ROM collection has grown over the year, we are able to demonstrate more of a variety of products in that format.

The last module presents an overview of document delivery connections—e.g., interlibrary loan subsystems, online ordering from commercial vendors—and a look at future connections. This module is done by either the head of reference or the director of the library. Future connections include selection and conversion to a new online catalog in 1989, new networking (i.e., the recent transition from Utlas to OCLC and the upcoming availability of public access to the OCLC database at the reference desk), and expansion or adoption of new technologies and services. In the latter category, CD-ROM services are addressed—adding more products, exploring multiple-servers, and considerations of a CD-ROM catalog as a backup to the online catalog. Also discussed are end-user searching of external databases through the campus network (the Dow Jones Information Retrieval system has been made available to faculty in this way by the institute’s computing center) and by other possibilities such as onsite loading of general or heavily used databases. Future improvements in document delivery services are envisioned such as telefacsimile transmission. Improvements in current awareness services are suggested, such as electronic Table of Contents service or downloading of stored SDI searches to individual workstations. This module encourages faculty input—suggestions and reactions which form an important dialogue—and builds bridges of communication for future interaction.

The modular structure of the seminar has proved effective in several ways. Each module can be handled by a different person distributing the burden of such a major presentation into manageable slots. Each module has a “script” written for it to serve as a guide for the presentation so that staff members can be interchanged without having to reinvent the wheel in preparing remarks. This has encouraged other staff to become involved. It is a team effort with a lot of esprit de corps, a road show with roles to be filled. The roles can change depending on the nature of the audience.

The modular nature of the seminar also permits a great deal of flexibility in focus. Initially the seminar presented a generic overview with no specific subject orientation. Some attendees, finding the seminar very useful, requested specialized seminars for their depart-
ments or divisions with a focus on an area such as business, or a special orientation, as in the case of the Office of Cooperation and Placement. These special requests can easily be filled by keeping the format of the modules the same but changing the examples of searches and databases. In the case of subject specialization, the librarian with that bibliographic responsibility is asked to participate in the online/CD-ROM module of the seminar. These librarians select the databases and sample searches to be done but usually follow the format and comprehensiveness of the standard "script."

The modular approach also offers additions in the future for new technologies or services. If, for example, we wanted to feature a module on accessing consumer utilities or to meet other needs of patrons (e.g., electronic publishing) it could easily be incorporated with or without deleting other modules.

Other supporting materials include a variety of handouts. A brochure entitled "Electronic Retrieval Services" was developed and includes a short description of all major services—e.g., public access catalog, remote access, network access to external databases, online search services, CD-ROM services, electronic reference service, interlibrary loan subsystem and document delivery services. It also contains a list of librarians and their subject specialties and phone numbers. Additional handouts include lists of databases available on CD-ROM or through online vendors, brief instructions for remote use of the online catalog and electronic reference service, an online search request form and policy statement, and general instructions for CD-ROM use.

**EVALUATION**

The idea of a faculty seminar was well received. A session for approximately twenty participants was originally planned. After a campus mailing of flyers announcing it, an overwhelming response necessitated adding four additional seminars, reaching over seventy faculty. It was obvious that interest and/or a need for such a seminar did exist. Comments and reactions to the seminar by attendees were very positive. The most telling evidence, however, was the resulting incidence of requests for additional general seminars and for specialized versions. This led to developing seminars specifically for business and finance, the social sciences, education, and for the placement office. In the near future there will be one for science and engineering.

Perhaps the most valuable aspect of the seminar is the opportunity to build channels of communication between the library and the faculty and to provide a mechanism for input from patrons for current and future library services. It is more than an instructional vehicle in that it promotes liaison and communication.

**FUTURE**

The success of the program has motivated enhancement and expansion of it. We are encouraged to expand the target audience, the
scope of the seminar, and the participation of library staff. Having moved the location of the seminar to a larger room will permit promotion of the seminar among students with the support and encouragement of faculty. As mentioned earlier, the focus will be on specific subject areas in the future or on selected topics. Recently there were requests to do a seminar on CD-ROMs in education. We simply used the "CD module" of the seminar but included a more in-depth demonstration of ERIC than would normally have been done.

Another area of expansion is staff participation. The modular nature of the seminar permits gradual introduction of staff into the program, generally for their own subject specialties. The "script" format has made staff more inclined to participate. A written version of each module is available. Staff are free to change the script if they wish, but may use it as a guide or literally "recite" it. This eliminates much of the anxiety some staff feel when doing bibliographic instruction, especially to faculty. Refinements to the script, the delivery, and the pace of the presentation have resulted from both the experience of repetition and input from new staff participants. One of the initial presentations was to the library staff who were encouraged to sit in on other seminars to familiarize themselves with the content, to provide critical remarks and suggestions, and to learn how to cope with questions and audience reactions.

Other future enhancements will be determined by the technologies themselves as they are incorporated into the library's repertoire of services. Implementation of a new online catalog may require spending more time on that portion of the seminar. Soon to be installed teletype equipment will generate new services that can be incorporated into the seminar. The overall organization of the seminar is flexible enough to meet new requirements without having to start from scratch.

Perhaps the most pressing need, at the moment, concerns logistics. A permanent equipment set-up would greatly simplify the preliminary activities required prior to doing a seminar. Moving a workstation from the reference area for each presentation is a nuisance and hard on the equipment. It also removes one of four heavily used stations in the library for about a day. However, unless we can use the instructional workstation for other purposes, we currently cannot justify dedicating it to the sole purpose of the seminars. A planned building expansion with a proposed microcomputer lab may solve the problem and even permit hands-on activities during the seminar.

Another problem being discussed is the apparent incompatibility of some LCD projectors with CD-ROM display technology. Some menus and messages, especially highlighted ones, are not reproducible on the current equipment. More sophisticated projectors are available which presumably will not swallow up lines of text or even whole screens.
CONCLUSION

From experience it seems clear that bibliographic instruction designed to feature new electronic library services is needed and can be highly successful. The model described here works well as a structured, yet flexible, approach. It is hoped that it will serve as a mainframe for diversity in the future. It takes maximum advantage of staff expertise while minimizing the burden on them for presentation preparation. It has served to generate and encourage dialogue between faculty and the library. Finally, it gives the bibliographic instruction program for new technologies cohesiveness and direction. Meeting the demands of a new and complex technological approach to information storage and retrieval has caused revamping of the approach to instruction in a dynamic and responsive manner and has raised the visibility and peer recognition of librarians within the campus community.

REFERENCES


Library Management and Emerging Technology: The Immovable Force and the Irresistible Object

SUSAN K. MARTIN

SCENARIO:  Professor B., a member of the History Department faculty, sits at his PC, located in his departmental office and linked to the campuswide Local Area Network (LAN), to consult the library catalog by scanning the holdings for definitive works in his area of interest. He finds that three items are on the shelf and then he sends a computer message to the library requesting that they be charged out and delivered to his office. Finding that a fourth item is already charged out to another user, he places a hold on it. He is disturbed to find that two desired books are not in the collection so he files an order request with the acquisitions department. Another book is not in the local catalog, but he is able to switch his request to a national database where he locates the item at Princeton. He then places an interlibrary loan request. He also finds an article in a journal held by the University of Michigan and requests telefacsimile transmission of the article.

Without setting foot in the library building, Professor B. has thus perused the holdings of dozens of libraries, has made arrangements to secure desired material, and has received a copy of a pertinent article, all in a matter of minutes. Indeed, he continues by using the library's online system as a gateway to external full-text databases of interest to him.

Libraries and librarians have been involved with automation for decades; the concepts are no longer new, and people now coming into the library profession cannot imagine cataloging books without OCLC or relying only on hardcopy indexes for a reference search. The technologies discussed here are, for the most part, commonplace in medium-sized and large libraries. Technology, once the special preserve of the
catalogers and information retrieval specialists, has moved throughout
the library and has become familiar to both staff and users of libraries.

A key question relates to the rate of change of the tools and pro-
cesses of the library and to the need to restructure the library's organiza-
tion to accommodate these emerging technologies. There are those who
believe that wherever appropriate, libraries and computer centers will
merge (Neff 1985, pp. 8-12, 16). These people believe that the fundamen-
tal nature of library use and research will alter so radically in the coming
years that the only logical step is to combine computing and libraries,
otherwise libraries as we now know them will disappear or become
museums. Others believe that only the walls of the library will disap-
ppear, and that the traditional library function will become less and less
relevant (Lancaster 1985, pp. 553-55). Holders of this point of view
believe that electronic data will soon supplant the printed word. I
suggest that neither of these views is completely accurate nor is the view
that states that the library's traditional role will be retained. In fact,
since no two institutions are alike, no two libraries will cope with
information technologies in the same way: some will move rapidly to
adopt an aggressive posture, and others will remain as traditional as
possible for as long as they can.

Now, in the late 1980s, implementation of innovative technologies
in the library as well as in other institutions within society is wide-
spread. About a decade ago, we had already heard of optical disc (but not
of CD-ROM), telefacsimile, and microcomputers. Optimistically we
thought that the full use of these innovations would take only a few
years—perhaps two or three at the most. We were wrong; and it was the
entertainment industry with the compact disk which really led the way
to the practical application of optical disc for information support. As is
often the case, it takes much longer than anticipated for new technolo-
gies to reach the market and then to enter our homes and workplaces.
The reaction of the library as a social institution does not need to be
dramatic, and often librarians overreact to society's expectations of
them. However, the steady change of libraries in response to technologi-
cal innovations is obvious and cannot be ignored.

Libraries are in the process of absorbing a variety of these
technologies—into the budget, into the organizational structure, and
into the behaviors of both users and staff. No really new information
technology is on the drawingboard for implementation in the next five
years or so; therefore, we will now have the opportunity to become
fully acquainted with today's innovations before moving on to to-
morrow's.

There is a focal point for the innovations. Specifically, libraries of
all sizes are beginning to use local online catalogs (Walton & Bridge
1988). With these catalogs, they are experimenting increasingly with
telefacsimile, optical disc, end-user searching, and microcomputers for
patrons. The opening scenario described earlier is by no means science
fiction; all aspects of the professor's system are technically feasible, and each is already in place in one library or another in some form.

A Tool or a Revolution

A recent report issued by the Boston Library Consortium (BLC) (1986) points out an interesting dichotomy which has significance in the way that emerging technologies affect libraries and librarians. On the one hand there are those who regard information technologies only as a tool to assist in providing more information more rapidly and successfully to library users. These people undoubtedly look back to the invention of the typewriter and the electric light and perceive an evolution of library and information services over a period of time with the library embracing each new technology as it becomes available. Hugh Kenner (1986), scholar of Irish literature at Johns Hopkins, has said:

People nervous about the future are by their own definition open to lessons from the past; and one lesson the past has to teach is that every new technology, when it applies for admission to a citadel of the intellect, has invariably received its first welcome from the librarian. Nearly a century ago, libraries were the first buildings to be getting incandescent lights; a half-century ago they were among the first buildings to be air-conditioned. When copying machines escaped from corporate offices, the first place they became accessible to the public was the library. (pp. 1-3)

His point is well taken; in an almost haphazard way libraries have incorporated the new into their buildings and procedures. CD-ROM, for example, has become a tool in the reference area with little fanfare and no organizational change.

On the other hand, there are those who, as the BLC report says, see the advent of information technologies as an opportunity to totally restructure the work environment. Some view a blurring of the distinction between technical and public services as a necessary part of this organizational change, although studies to date have shown that alteration of organization charts along these lines simply has not happened (Busch 1986).

Probably more critical, for all types of libraries, are the changes which are taking place within the institution as a whole which in turn put pressure on the library to evolve to serve new structures. Many institutions are extending their services to adult learners and have determined that the establishment of remote sites or campuses is a positive way to reach this population. As a result, the library must identify the appropriate way to deliver information services to these remote sites; new information technologies such as telefacsimile, microwave, and satellite links can be used to achieve this objective. Often, new organizational structures within the library may be the only way to cope successfully with the change.

Who is right—the advocates of evolution or those of revolution? The answer cannot be framed as a simple response to such a dichotomy. Too many factors intrude in each circumstance to allow anyone to
dictate either that technology is a tool, to be viewed precisely as such, or
that it provides opportunity for full organizational review and restructure. Of course, both are true. Information technology is a tool. In
addition, it provides opportunity for full organizational restructure.
Rather than presenting a dichotomy for selection by the library man-
ager, these two views represent the two ends of a continuum where, for
every library, technology is at least a tool. The degree of movement
toward one end of the continuum or the other depends on a variety of
factors, including the nature of the institution, the characteristics of the
library staff, the leanings of library management, reactions of the users,
timing, and the resources available, to name only some. Experience
shows that most libraries remain fairly close to the conservative end of
the continuum; a few libraries have reorganized radically, among them
the University of Illinois, Columbia University (about fourteen years
ago), and the Library of Congress in the sense that it has deployed a
matrix management structure.

**Window of Opportunity**

The introduction of technology into the operations of a library has
the potential to provide a window of opportunity—a series of activities
and decision points which can, if desired, frame organizational and
functional plans and changes which might otherwise be politically,
financially, or administratively extremely difficult to contemplate. For
example, changes in staffing patterns in the technical services depart-
ments are common adjuncts to the introduction of computerized sys-
tems. Moving the bulk of copy cataloging to paraprofessional staff is an
obvious step which can ultimately alter the personnel requirements for
the library and allow it to reallocate funds. Another case for change,
minor though it may be, is the circumstance in which the interlibrary
loan staff is overburdened because of the success of its resource sharing
with other institutions. An argument can thus be made for adding to the
staff of that unit.

But this author believes that there is another, more fundamental,
level of planning needed for libraries, whether or not they are heavily
involved with information technologies. This level is the planning
which identifies the direction of the library—i.e., what kind of institu-
tion it wishes to be in the future; how its users will relate to it; what
strengths will be needed; and what level of funding will be required.
Accomplishing this exercise will give the library administration—and
the institutional administration—a strong sense of the role of the library
within the institution and the resources needed to move from here to
there.

The formulation of this kind of organizational concept need not
have anything at all to do with automation and technology, while at the
same time being fully responsive to the question of the future of the
library. However, most would incorporate information technologies as
a rather important part of the institution's future, but that is because enough is known about the information marketplace to recognize its own future relationship to technology. Basic to this premise is the belief that technology is a tool; that it is a means to an end and not an end in itself.

In 1984 a program of the Association of Research Libraries (ARL) focused on the characteristics of libraries of the future and the resources and staff development required to become particular kinds of organizations. Several types of libraries were described; the suggested models ranged from the traditional library, with relatively little automation, to an organization which is highly automated and relies very little on human intellect to serve the needs of the users. This exercise was brought back to the author's library and administrative staff were asked to discuss the several models as they related to the library. A model was developed for the future which was a composite of two of the models used at ARL; the library will need more staff who are expert bibliographers and reference librarians, but also needed will be the technical capacity to provide access to many machine-readable databases which will serve as a link between the campus and remote computer-stored information.

**Delivery of Information and New Technologies**

Naturally, the goal of scrutinizing new technologies in the library environment is ultimately to improve the delivery of information to the user. The extent to which full text in computer-readable form will permeate the library is a controversial issue. Butler (1986) says: "It is important not to generalize about primary publishing from developments in the publishing of information databases. To do so creates an unrealistic expectation of the speed with which electronic publishing will become common among primary publishers" (p. 49). He believes that optical disc will be used for long runs of periodicals, but that these products will not generally cover the retrospective volumes. In other words, the economic impact of scanning and mastering will be perceived as excessive by publishers as well as by librarians.

Of course, more information will be made available online or on optical disc. However, the process of assimilating this technology into document delivery services is much slower than most expected. Librarians began talking about the potential of optical disc in the mid to late 1970s. Now it is the late 1980s, and very few products are yet available either on 12 inch optical disc or CD-ROM. Most of the products currently on the marketplace are information-locating tools—i.e., indexes to periodicals and other literature.

Why hasn't the technology moved more rapidly? There are several obvious reasons:

1. Cost. The impact of cost upon libraries and publishers has recently received much publicity; we must not disregard the impact upon
users who may now be asked to pay in order to access an online database or to search an optical disc file and print out abstracts.

2. Lack of standards. Until recently the hardware manufacturers used differing standards. Now the High Sierra standard seems to be making it easier for software publishers to deal with CD-ROM equipment, but standards remain to be developed in other areas such as telefacsimile.

3. Lack of perceived market. Publishers do not perceive a library market for new products based upon new technologies. As an example, relatively few libraries and hardly any individuals own optical disc or CD-ROM drives for their PCs. The originators of Bibliofile sold the product with the drives, and this technique of selling hardware as well as software now has several imitators. It is still not a large market.

4. Content of disc. Even a 5 inch CD-ROM contains more than 500 megabytes. That is a lot of information, and publishers are having some difficulty determining logical groupings of information to assemble on a disc.

5. Graphics and color are only now beginning to be widely available.

6. Users are not yet ready to move from the printed page exclusively to electronic data.

7. Articles solely in electronic form are not yet perceived as valid contributions in the publish-or-perish cycle; these may not receive the same stringent scholarly review, and electronic articles are not yet trusted by scholars.

8. Copyright. The 1976 copyright law did not address emerging information technologies, and the library and publishing communities are attempting, with only some degree of success, to effect a compromise between the interests of the two groups. The copyright issue will become even more intense as full-text documents become increasingly available in electronic form.

Colbert has outlined some of the difficulties of relying exclusively on online full-text information retrieval; that is, of going through a broker such as Dialog to gain access to full text. She cites the lack of ability to reproduce graphs, pictures, charts, and color; the need to have access to many different online services with the attendant subscription fees; the need to have the user keep up to date with the changes in search strategies in order to perform a competent search; and the limitations of using electronic databases to follow up page citations (Colbert 1988).

In a superb paper, Govan (1987) projects an expanded information base which will indeed incorporate increasing amounts of electronic data. He suggests that, as in years past, libraries and librarians will accommodate these new information technologies side by side with all the information-bearing technologies which are already supported to provide users with the documents they need (pp. 15-25). Together with other wise and experienced administrators such as Vartan Gregorian
and Daniel Boorstin, he believes that libraries will gradually increase their access to electronic publications but not to the exclusion of print. They postulate that print collections will continue to grow but perhaps at a less rapid rate than has been the case in the past three decades.

**Technology and People**

The BLC report showed that most people believe that the implementation of technologies in the library requires widespread staff participation. The role of library staff in planning and managing automation has been emphasized. Clearly, people would not only like to know what is going to happen to them and their jobs; they would also like to have a voice in the way that technology is adopted by the library.

Three groups of parameters are essential for the manager and leader of a library wishing to introduce innovative technologies:

1. First, it is not wise for the library to pull too far ahead of its parent institution’s culture and tendencies. Libraries could install many interesting technologies, databases, technical devices, but if the users are not ready to accept them, the library will not succeed with those innovations. In many universities the culture is mixed. Some segments of the community cannot wait for the advent of higher technology than is currently available, while others cling to 3 x 5 cards. The resulting approach for the library is likely to depend on the strength of feeling of both sides. A compromise is possible: to the extent feasible, keep the traditional means of access while implementing new technological tools. Some universities such as Carnegie-Mellon or M.I.T. are steeped in technology; in these cases, on the other hand, the library must strive to keep current before it is left behind as a museum. The library manager has to gauge the parent organization and plan library developments accordingly.

2. A second area relates to fairness to the library staff. Although managers cannot promise a stable environment—technological change is making most libraries seem chaotic at times—the staff needs to know what is happening, to participate to varying degrees in the decision-making process, and to retain a position with the library if they so choose (and if the library finds their performance sufficient to warrant keeping). With or without technology, the role of the professional is gradually being redefined so that an increasing number of formerly professional tasks are being assigned to paraprofessionals and library assistants. With technological developments, librarians can now be trained or retrained to specialize in methods of accessing or using information, thereby becoming vital links between the user and the information.

The BLC report is optimistic about the relationship of library staff to technological advances—the vast majority of staff are prepared for, if not actually excited by, the changes that they perceive in the library of the future. Increasingly, librarians are graduating from library
schools with sufficient knowledge of information technologies to be able to be productive relatively quickly, and certainly to be able to continue to learn on the job what they began learning as graduate students. However, the changes which took place in library school curricula fifteen or twenty years ago are insufficient to allow today’s and tomorrow’s graduates to enter the job market fully prepared. Library schools need to update their courses; these will become obsolete almost as rapidly as hardware. And they need to pay additional attention to the role and relationship of the library within the parent organization.

3. A final set of parameters revolves around the management of the library. What is the characteristic driving force behind any particular library director or management team? The answer to this question will guide the way in which the library approaches information technologies. Is the management team conservative or daring? The first library to use any particular commercial system is likely to be led by a daring management; an excellent example is New York University’s use of the Geac system. Does the director want to be a pioneer? The reader may be familiar with the saying that pioneers are likely to be shot in the back; however, someone has to be first, and many pioneers are successful.

The level of participation in the decision-making process in the library is important. Usually a library with a strong leader and few committees will be bold in its actions because that institution does not need to take time to send potential recommendations through all the committees which require a voice in the decision. On the other hand, in those organizations where much of the decision-making process rests heavily upon recommendations from advisory groups, the decisions which are made tend to be more conservative just by virtue of the group action.

DIRECTIONS FOR THE FUTURE LIBRARY

The library of the future is at once a fascinating and large topic. Let us conclude with several projections:

1. There will be printed books for the foreseeable future, but our problem will be the management of traditional and innovative information formats simultaneously. We will need to staff and finance ourselves appropriately to handle a transition period which may be lengthy.

2. Users will not stop coming to the library unless the library is allowed to become a dull and inactive place. Normally this will not occur, and even though much information will be available remotely, people will still come to the library for books, for human interaction, and for consultation with librarians and colleagues. At the same time, librarians and administrators must learn how to support remote sites better than at present.
3. In most cases, the library and the computing center will not merge. Once again, there are some institutions and circumstances where this merger is logical, and these places are now receiving much publicity. But to generalize from these few instances to say that this organizational structure is the wave of the future is to ignore many human, institutional, political, and technical factors which militate against such a merger.

4. The library of the future will have a different organizational structure only if the introduction of technology matches the administration's desire to make a particular change; technological activities will not in themselves require reorganization in the immediate future. After all, thus far, only those applications are being discussed which are direct translations of functions which take place in a traditional structure.

5. However, information technologies may make it necessary for people in different parts of the library to communicate with each other somewhat more frequently. If the catalog department is given responsibility for a database which everyone can access and perhaps modify, the department will need to make its procedures and policies well known and understood throughout the library.

**CONCLUSION**

Information technologies are already a firm part of daily life. Rather than trying to assess how technologies will change our lives, we should accept these technologies as another set of tools and proceed to make the best use of them for the library and all of its users. We must, however, seize the initiative to ensure that we control, and are not controlled by, the technologies of the future.

**REFERENCES**


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