In spring 1985, the University of Illinois Library at Urbana-Champaign received a grant of more than $83,000 in Library Services and Construction Act (LSCA) funds through the Illinois State Library to create and distribute its online catalog on optical disc. The grant had several objectives. The first was to determine whether optical disc technology and industry production capabilities had advanced sufficiently to make it feasible to produce a database of more than 900,000 bibliographic records on laserdisc which could be searched by microcomputer.

The database used in the demonstration was the university's online catalog database created in 1980 as the result of an earlier LSCA grant. The objective of the earlier grant had been to mount the software of the Western Library Network (WLN) to demonstrate how that software could be used as the basis for a statewide online union catalog for Illinois libraries. The result was the creation of a joint online catalog of the holdings of the University of Illinois Library and those of the River Bend Library System (one of the state's eighteen regional library systems). This joint catalog, which became operational in summer 1984, serves as the prototype for a statewide online union catalog. Additional funding has since been obtained to expand this catalog into a union catalog by including the holdings of all libraries participating in ILLINET, the state's library resource sharing network. The projected statewide database, to be called IO (ILLINET Online), will contain, at the outset, 3 million to 4 million titles reflecting over 10 million holdings and will be accessible at locations throughout the state and through dial-up access. Like the existing joint UIUC/River Bend online catalog, the ILLINET Online will provide
sophisticated access to bibliographic information, including subject, keyword, and Boolean searching as well as the ability to limit searches, for example, by library or by geographic region.

The optical disc project described in this article had the second objective of evaluating the feasibility of distributing the statewide union catalog database on optical disc and testing the expectation that distribution in this format to certain libraries would enhance resource sharing. Ultimate distribution would be to libraries which did not want or could not afford online access through the mainframe system or which would not be satisfied with dial-up access. Small libraries in the state were viewed as the most likely potential beneficiaries of the proposed optical catalog. As matters developed, technical considerations made it simpler to place only the University of Illinois portion of the joint catalog on optical disc. According to the terms of the grant, data retrieval from the laserdisc version of the catalog was to be at least as effective as in the online mode. Therefore, the optical database was to be searchable by keyword anywhere in the bibliographic record or at least where keyword searching is now possible online. This requirement necessitated high capacity storage to accommodate indexes and bibliographic data and the use of full-text search software. An additional aim of the grant project was to familiarize staff at the University of Illinois Library with emerging information technology. In the end, this educational role became quite important since the evolution of the technology and other factors necessitated several significant changes to the original grant plan (for additional information on the project see Watson [1982, 1987a, 1987b] and Watson & Golden [1987]).

The original proposal was written just as optical disc products were beginning to appear in the library marketplace. Discs were still mastered abroad and turnaround time was uncertain. It was unclear whether updates could be issued in a timely fashion to satisfy the demands of public catalog use. The capacities of digital optical media were still being tested. The original proposal therefore stressed the realism of a one-year time frame to create the desired product. It also called for the use of a 12-inch videodisc as the storage medium. By the end of the experiment, it was clear that the issue was no longer whether a 900,000 record database could be put on optical disc, but rather how useful it was to do so in light of the retrieval capabilities of available software and the response time possible with optical drives searched by means of a microcomputer. The other more or less unanticipated issue raised by the demonstration was the determination of the precise value of optical catalogs as resource sharing devices in a highly articulated library network environment such as that which exists in Illinois.

THE ORIGINAL TECHNICAL PLAN

As indicated earlier, the LSCA grant was obtained in spring 1985 when promotion of optical disc products for libraries had only just begun.
A few systems made their debut at the American Library Association meeting in January 1985. Carrollton Press demonstrated three 12-inch videotape systems: DISCON (a retrospective conversion aid), DISCAT (a cataloging product), and MARVLS (part of the Library of Congress shelf-list which was searchable in limited ways for reference purposes). None of these products ever reached the market. InfoTrac, an index to 1,000 general interest and business periodicals on 12-inch disc, was also on display in January 1985. This product was the most successful optical disc reference system available for some time, and it is only recently that it has competitors in CD-ROM products which have been developed in the last two years.

At the time the Illinois grant was written, however, there was no public access catalog product on the market either on 12-inch disc or on CD-ROM which satisfied grant specifications for search capabilities. There was a company, however, which had worked successfully on two library projects and had developed a workable configuration employing a 12-inch videotape, a system which might be used for a catalog. The company was LaserData of Cambridge, Massachusetts. They had collaborated with the Information Access Company to create InfoTrac and had also worked with the National Agricultural Library (NAL) on an agricultural information system mounted on a 12-inch disc. The goal of the NAL project was to test the feasibility of using laserdiscs in conjunction with microcomputers for storage and retrieval of agriculture related full-text databases, including graphics.

The initial NAL database was the *Pork Industry Handbook*, a text containing illustrations. To fill up the disc, a selection from the AGRICOLA database was also converted to optical format. The search software is BRS/SEARCH modified by LaserData to retrieve graphics. NAL set out to test full-text retrieval from a print source with illustrations as well as from a set of bibliographic citations. The hardware for the NAL system consisted of an IBM XT with a memory of 512K, a Pioneer LD-V1000 videotape player, a LaserData TRI0 110 controller with an interface card, and a Panasonic TR 124 monochrome video display monitor for graphics. LaserData played a key role in developing the NAL system by providing the interface controller that connects a standard videotape player to the personal computer allowing the retrieval of the multimedia information stored on the videotape. The unit controls the videotape player, retrieves the analog information from the disc, and recreates the digitally encoded material. LaserData also used proprietary encoding techniques to premaster the NAL database and the company took essential responsibility for integrating the system. (For a complete description of the project, see Andre, 1985.)

According to the original plan, Illinois was to work with LaserData in exactly the same manner as NAL had done, relying on the company for
premastering, for system hardware and software, and for final integration of the system. There was one major reservation concerning the NAL system, however, which was reinforced by conversations with NAL staff. BRS/SEARCH is powerful and flexible software but, at that time, it could be run on only the PCIX operating system. We wanted BRS/SEARCH search capabilities but were uncertain about PCIX as an operating system, particularly for a public access catalog which was ultimately to be used in small public libraries by presumably fairly unsophisticated end users. NAL staff reported that they were not comfortable with PCIX. It was difficult to learn, the documentation was unclear, and they experienced frequent system crashes due to improper shutdown procedures, power irregularities, too rapid advancement of the video screens, and for other reasons. An ordinary user could normally not rebuild the system without the help of an expert librarian. Another quite important objection NAL staff brought out was that searching was surprisingly slow on the bibliographic portion of the database (J. Zidar, personal communication, Fall 1986).

The PCIX problem was raised during initial contacts with LaserData. The project technical consultant seemed to recognize that an MS DOS-based system would be an improvement and reported that attempts were being made to identify or design DOS compatible software. LaserData never made good on assurances on this point and the project could therefore not proceed. Three months into the grant year found the library without a systems integrator. (For details of the breakdown of Illinois' relationship with LaserData see Watson & Golden [1987].)

NEW VENDOR: NEW PLAN

Conversations with cooperative individuals in the industry (J. Schwerin and D. Corney, personal communications, 1986) led us to Brodart. Brodart is a well established and broadly-based library company with experience in the online public access and COM catalog markets. They had experimented for some time with a CD-ROM-based public access catalog product to market to larger libraries and library systems which were already customers for their COM catalog. They called the new product LePac. (For a complete description see Schaub, 1985.) In its earliest stage of development, LePac functioned mainly as a browsing search system. This capability still exists in the novice mode in which the user may search by either author, title, or subject using a specially designed ten-key pad and proceeding through a simple menu. Segments of the menu appear on each screen to help the user narrow the search to progressively smaller sections
in the alphabetic hierarchy and finally to the desired individual item or items. The total number of phrases viewed by the user in each pass is dependent on the total number of titles in the catalog. The lists of phrases run continuously through the alphabet and are selected so that they are spaced evenly throughout the title, author, or subject parts of the database. With authors and subjects, authority control can be provided. Were LePac to have remained with only these capabilities, we would have been unable to meet grant specifications for retrieval by relying on it as our system. Brodart’s development of the product was continuous, however, and by the time the database was ready to be mastered there was a somewhat more sophisticated system to work with. Version 4.0 of the software allows for search in an “expert” mode which employs a full keyboard and permits keyword searching of authors, titles, and subjects out of context along with Boolean combinations. It also provides a search field called “Anyword” which allows searching for a known term anywhere in the record and also permits a search by Library of Congress card number and International Standard Book Number. The expert system is not menu driven and relies only on the natural prompt provided by the screen format to indicate to the user what an initial search strategy should be.

Because of Brodart’s experience in the library marketplace, the infrastructure for marketing, pricing, and technical support of a CD-ROM product was already in place within the company. One of the conclusions reached by Watson and Golden (1987) is that libraries experimenting with technological development will find it easier and more productive, for a variety of reasons, to deal with a company whose business is libraries (p. 70). The University of Guelph—the only university library known to the author to be relying on a CD-ROM catalog for local public access—was successful in working from first principles with Reteco, a company which had no previous experience with bibliographic records. To avoid embarking on an entrepreneurial technological development project independently with neither adequate skills nor time and because LePac seemed a reasonably sound product, the decision was made to continue the project by signing a contract with Brodart in January 1986.

Development of the American optical information industry had progressed sufficiently by early 1986 so that it was at last possible to master optical discs in this country and thus substantially reduce production time. Since Brodart already had an integrated system and since delays due to mastering abroad were about to be eliminated, creation of the Illinois catalog within the timeframe of the grant ceased to be very much in doubt.

During the first week in April 1986, a LePac unit and sample discs were delivered to test. Changes to the screen could be suggested so that the menu would make more sense to Illinois users and clear answers could be obtained to the questions about the system. In late spring the UIUC online
catalog database was loaded from the mainframe onto eight 6250 bpi tapes. The tapes were shipped to Brodart in late June. In mid-July a set of formal specifications for the content of the database, indexing, and display of records was received. The completed optical database was received from Brodart in September 1986. The disc held 700,000 of the 900,000 records to be mastered and the indexes to the database: mid-1986 state-of-the-art storage capacity for a single side of a CD-ROM.

The first industry connections were made with LaserData, a company on the leading edge of development in selected aspects of videodisc technology. Seemingly, the library's interests were not a good match with the long term business interests of that company. Good advice from concerned experts led to a company whose experience and goals gave them a natural reason to work on the project even though it might well turn out to be a pilot which would never be implemented on a large scale. The lesson to be learned from this appears to be that best results with application of a volatile technology in a library setting are likely to be gained by collaboration with a company which is in the business of serving libraries. There are exceptions, of course, to every apparent rule. NAL found LaserData cooperative and supportive. They have gone on to a second project with the company to mount thirteen full-text sources on 12-inch discs. Also, Reteaco, the company with which the University of Guelph Library worked to develop its CD-ROM local public access catalog, specializes in business applications such as the storage and retrieval of catalog and inventory data.

IMPLEMENTATION

The system was tested at four Illinois sites: Champaign Public Library and Information Center (280,000 volumes), Decatur Public Library (220,000 volumes), Lincoln Public Library in Springfield, Illinois (40,000 volumes), and Parkland College Library in Champaign, Illinois (80,000 volumes). The regional public library system headquarters for two of the public libraries (the Rolling Prairies Library System for Springfield and Decatur) and the University of Illinois at Urbana-Champaign also participated in the test.

The two test sites originally named in the grant—the UIUC Library and the Rolling Prairies Library System headquarters—used off-the-shelf equipment specifically purchased for the project. Brodart agreed to lend preconfigured equipment to the additional test sites. Duplicate discs were also made for all participating libraries and each received a copy of the LePac system software. Initial contact with the cooperating libraries was made in early October 1986 at a general planning meeting. Contact librar-
ians named by each institution received a brief overview of the project and its relationship to state online union catalog development. Equipment, security, and maintenance issues were addressed as well as plans to involve other members of each library's staff in the evaluation. Realistic means for obtaining feedback from users were assessed and the preconditions for making the systems available for public use were discussed. In all but one of the libraries it would be necessary to distinguish this computer-based system from an online system already available in house. Signs and handouts would be required. A general evaluation plan and timetable were agreed to. Contact librarians were to orient staff at their library to the use of LePac, to motivate them concerning the project as they saw fit, and to choose a site for the equipment.

Owing to the newness of the product, Brodart's technical documentation for LePac was informal and really quite inadequate. Librarians practicing on the system discovered features of the software and peculiarities of the database which had to be verified with the company. Brodart made revisions to the existing users' manual at the suggestion of the principal investigator which were passed on to the project participants. Before public testing, it was necessary to develop concise user aids addressing system features which were not explained in Brodart's documentation.

EVALUATION METHODOLOGY

A consultant assisted in the development of the evaluation plan and took the lead role in evaluation activities. (The consultant on the evaluation phase of the project was Dale Brandenburg, associate head, Division of Measurement and Evaluation, Office of Instructional Management Services, University of Illinois at Urbana-Champaign. He was assisted by Ping Der Wang, a graduate student at the university.) In his view, the issues to be examined in the evaluation included: ease of use or improvements needed to the technology, utility of the technology in relation to present methods of access, and, in general, its perceived value. The data collection instruments were designed expressly for this project, although concepts and questions employed in the National Online Catalog Use study formed the development of some of the tools used. Librarians at the various sites were the primary target of the evaluation since it would be their opinion which would be most important in determining the usefulness of the system (see Appendix A). The views of users were also obtained by means of a concise reaction card concentrating on a few central questions. Also, a class in the UIUC Graduate School of Library and Information Science (GSLIS) was asked to evaluate the system by means of a detailed questionnaire focusing on software and retrieval capabilities (see Appendix B). An
expert was called upon (F. Wilfrid Lancaster of the GSLIS) to assist in defining indexes of perceived value. Because the original duration of the grant was to be only one year and an extension was required due to the problems encountered in the initial identification of a vendor, only three months were available for evaluation and testing. Methods used reflect this shortness of time and also what could reasonably be expected of librarians volunteering to evaluate a new product not likely to have an immediate impact on their work and of users interacting with a test system which was available in their libraries for only a few weeks.

Librarian reaction was captured during site visits by the evaluation team. After staff members had sufficient time to become acquainted with LePac, a group interview was scheduled at each library. These interviews centered around the use of three checklists—two pertaining to the operation of the system and one pertaining to its use. Librarians were asked to respond quickly either positively or negatively to features listed on the checklists. Each checklist was tallied immediately and any areas of disagreement were explored. A set of predetermined questions were also asked of all site librarians. The checklists and the rearranged questions appear in Appendix A. During the site visits, the evaluation team was also able to observe the placement of the terminal. This choice of location was crucial to the acceptance of the system by users. Three test libraries placed it in highly visible, high traffic locations close to library staff who could explain its capabilities. One located the system in a carrel behind the reference desk where it remained largely invisible to users unless they were specifically referred to it. Enthusiasm for the project and the system were lowest among librarians at this site and this was quite naturally reflected in user response.

Members of the GSLIS class answered a thirty-seven item questionnaire (see Appendix B) which addressed system effectiveness, overall value, documentation, display design, system feedback to the user, search records, and cost of the user’s time. There were also two open-ended questions.

RESULTS

Operation of the System

General Assessment

The following discussion of the effectiveness of LePac as a system should of course be understood in terms of the hardware and software which were standard at the time of the study. Brodart is continually refining the system, hardware improvements have occurred and continue
to occur, and optical technology is being driven continually forward by the desire to develop better products. As is indicated, several of the problems mentioned in this section have already been addressed by Brodart or are likely to be dealt with soon. For the test, an IBM or IBM-compatible PC with 512K RAM was used along with a Hitachi 1502s CD-ROM drive. The software employed at most of the sites was version 4.0.

Most librarians were quite positive about the general operation of the LePac system. They stressed its user friendliness and simplicity in particular. The overall reaction to the technology on the part of patrons was definitely skewed to the positive side at four out of the five sites. Despite the fact that the database is limited to UIUC holdings since 1976, 73 percent of patrons who filled out the reaction card said they found what they were looking for.

The "expert" and "novice" search modes for LePac were described earlier. Librarians' response to the novice mode was less positive than to the expert mode. Significant criticisms included the time required to arrive at a match and the tedium of searching through long alphabetic displays. Of the users surveyed, 63 percent went beyond the novice mode to the expert mode. Librarians generally thought the term expert was misleading and acted as a barrier to the use of what is a quite straightforward search system. The novice mode was the first stage of development of the product and grew out of Brodart's original idea for replacing the COM catalog with a faster and more efficient product. Feedback regarding the novice mode has caused Brodart to consider an enhancement which would include the ability to block its use.

**Improvements Needed**

There was consensus on certain necessary improvements. One change noted as critical by librarians was the addition of a mechanism for exiting long searches which were in fact quite common on the system. A search interruption feature was incorporated by Brodart into version 5.0 of the software. Librarians did not see it as critical, but they did suggest the need for a mechanism for predicting search results. LaserGuide, a competing product on the market, for example, had this feature as long ago as July 1986. Brodart's recently released version 5.0 of the LePac software produces a display for the number of matches obtained in author and subject searches and also provides continuous reporting of the percentage of the database searched as the search progresses.

On the test disc, there was a particular problem with foreign words containing diacritic marks. Most were essentially irretrievable due to programming and processing problems which had not been resolved when the disc was mastered. These difficulties were not unique to the Illinois project, and Brodart expected a solution in future releases. It has been reported
that the retrieval problem was solved, but diacritic marks still do not appear in the display.

As mentioned earlier, the user aid available at the time of the project was seen by librarians as completely inadequate both as a tool for the public and as an explanation of the system for professionals. Since the system is under continuous development, Brodart's reluctance to invest a great deal of time and money in documentation is understandable. On the other hand, at the time of the study, there was a strong inclination on the part of company representatives to avoid excessively complicated explanations, seemingly without the realization that librarians need a complete understanding of system operation in order to facilitate its use by the public. For example, a user who has been unable to bring up anything on the system on Apple II computers should be able to find out from a librarian that the software will not search a term with three characters or less and to receive advice on alternate search techniques. Brodart had developed a new LePac Reference Manual package as of fall 1987 which includes a tutorial database with software that coordinates with sample searches. (Information on recent LePac enhancements in the foregoing paragraphs is based either on a telephone conversation with Russ Thompson, senior technical specialist, Brodart Automation, Williamsport, Pennsylvania on January 28, 1988 or on reporting in the company newsletter, Interaction.)

Response Time

The issue of response time on a CD-ROM public access catalog assumes particular importance when the catalog database to be searched contains more than 100,000 to 300,000 records. The views on LePac response time collected as part of this study were quite dependent on the expectations and previous experience with online systems of both users and librarians. There were certainly some users who were quite dissatisfied with LePac response time, but most did not find this a significant problem. Most librarians tended to use the online system currently available in their institutions as a point of reference and found LePac performance acceptable in this context. On the other hand, UIUC users who tested the system were comparing it with a highly sophisticated and responsive mainframe system, and their reaction was, predictably, markedly different from that of other users.

To provide some objective data on speed of response, we timed eighty-seven sample searches at the UIUC Library. The searches were based on actual questions collected at the UIUC Information Desk, a general service point which handles numerous catalog inquiries. The first aim was to explore the amount of time needed for LePac to provide its first response to a query, whether this response was a complete answer, a positive indica-
tion leading onward toward a complete answer, or a negative answer ending the search without result. The time needed for initial response ranged from one second or less to several minutes if very common terms were necessarily part of the search. The average for all types of searches was twenty-nine seconds. It is, incidentally, interesting that far more informal experimentation at the community college test site produced a similar result. For the sake of comparison, three to four seconds is considered an acceptable initial response time on a mainframe online catalog system. One of the sample searches turned out to be for a common one-word title and was abandoned by the searcher after nineteen minutes. Such a search would cause problems on any system, but there were other queries involving common subject or title terms which required unacceptable intervals for an initial response. The absence of an escape mechanism and the persistence of the message "Please Wait" on the screen may have caused high frustration levels for some test site users. As a means for comparison and to test the state of the art, the same searches were run on WLN’s LaserCat. Evidently owing to major differences in software capability and to the layout of data on the discs, by and large the searches ran significantly faster on LaserCat than on LePac. (Copies of the search forms were sent to Jerry Maioli of WLN who arranged to have them replicated on LaserCat.) Again, a caveat must be introduced in relation to interpretation of the time test results especially with regard to those which made a fairly casual comparison between the two CD-ROM systems. There are obviously factors which may have influenced the results including the exact hardware and software in use on the system at the moment, the search strategy employed, the skill of the searcher, and the searcher’s experience on the system.

Brodart was clearly aware that searching could be painfully slow under certain circumstances with the then-standard hardware configuration and version 4.0 of the LePac software. With the implementation of version 4.9 and its optimization of search logic, company representatives expect that search will be five times faster. However, speed of response is a well-known limitation of CD-ROM technology due to the high seek time required by the drive to locate data on discs as they were normally arrayed at the time of this project. In an early study of the technology written for the Council on Library Resources, McQueen and Boss (1986) observe that: “Advocates of the technologies suggest that these speeds can be significantly improved by attention to the layout of the data on the disks and by development of specialized software” (p. 64). Brodart representatives predict further improvement in response time beyond the 500 percent they have already achieved. They expect these advances to be accomplished largely through software enhancements since the hardware still places inescapable limits on response time.
CD-ROM CATALOGS & RESOURCE SHARING IN ILLINOIS

One of the conclusions drawn from this study was that CD-ROM technology had not advanced quite to the point that it was entirely feasible to mount a database as large as the Illinois Statewide Union Catalog on CD-ROM. When the study was completed in February 1987 it was certainly possible from a purely technical standpoint to store bibliographic data for 3 to 4 million items on CD-ROM. However, with data storage techniques in use at that time, four separate discs would have been required. The Western Library Network had developed software to search 2.1 million records on three discs in two separate drives, and such software was also under development at Brodart. A four-disc configuration had not yet been attempted, however, and, besides, the Illinois database was expected to grow at the rate of 15 percent each year. Furthermore, firsthand searching experience, together with the time tests done on LePac as part of the project, suggested that response time on a 3 to 4 million-record database might be problematic.

During the year since the Illinois project was completed, developers have pushed back the earlier limitations of the technology, and prospects for further progress seem bright. As of January 1988 Brodart had succeeded in mastering a database of 3.2 million records reflecting 17 million holdings on two discs and a small part of a third to be used by Wisconsin as a statewide union catalog. As of August 1989 this database was under distribution to 150 of the 700 libraries whose holdings it represents.

Greater storage has been achieved through triple density data compression in which full MARC records can be reduced for storage purposes to less than 180 characters per record. With standard indexes, 3 million records may now be put on one disc when it was only possible previously to store 1 million. Additional space was required on the Wisconsin disc for the large number of holdings records in a statewide system and because detailed indexing (of notes fields, for example) was thought to be desirable. To increase disc storage, proprietary methods are used to encode and decode bibliographic records at the field and subfield level. Data density is further increased through word, character, and bit level techniques. Decompression is performed by the LePac display software and this reformating of the data retrieved adds slightly to the response time. Brodart technical experts expect a degradation in response time due to decompression of no more than one second (information on data compression was provided by L. Anderson, marketing manager, Brodart, personal communication, February 1988). Wisconsin libraries will use the system first at the reference desk for answering queries and for interlibrary loan. No assessment of the system's success seems likely before spring 1988. Given these advances, the purely technical feasibility of creating an optical disc
version of the Illinois Statewide Union Catalog is less in doubt than it was at the close of the study. Since the technical obstacles are rapidly being overcome—with the possibly very important exception of response time—other issues assume a more important place in considering the usefulness of a CD-ROM version of the Illinois statewide union catalog. The most important of these is an understanding of where such a service would fit in to the already highly developed state network for resource sharing.

**Potential Applications of CD-ROM Catalogs**

Resource sharing and library cooperation have historically had a high priority in Illinois. The Illinois Library and Information Network (ILLINET) has been in existence in some form since 1965. It consists of about 2,900 academic, public, special, and school libraries whose cooperative efforts are coordinated by the Illinois State Library through eighteen regional library systems, four research and reference centers, and two special information centers. Automation plays a key role in enabling libraries of all sizes and types to share their resources and to make materials at all libraries available to all citizens.

Experimentation with the distribution of the projected online union catalog database in optical disc format was wholly in keeping with the direction of library development and cooperation in Illinois. The long-range plan calls for the expanded use of technology in Illinois libraries and for development of appropriate linkages between the system, network, and local libraries. Specific goals in the long-range plan to which the Illinois optical disc catalog project was related include: expanding interlibrary cooperation, assessing means for making data communications between libraries more cost effective, expanding the use of the statewide database, and promoting personal computer access by citizens to library bibliographic databases. In funding projects for the increased use of technology, state granting agencies also take into account the recommendations of a May 1983 conference of Illinois public library leadership. Recommendations from this conference relevant to the funding of the optical disc catalog project include: providing direct off-site access using appropriate technology to the information resources of the public library and coordinating collection development between all libraries to ensure that user needs are met.

To make an assessment regarding the second goal of the project, that is, to assert that the availability of a CD-ROM version of the statewide union catalog would enhance resource sharing, requires an examination of exactly where and how such a system would fit into the array of cooperative mechanisms, and correct access to the bibliographic utilities available in a state in which networking has received priority attention for
decades. The ILLINET system is a highly developed and efficient network relied upon by libraries of all sizes for interlibrary loan and reference service.

The LCS system, which links more than twenty academic and special libraries in the state and which can be accessed by the system libraries, already provides direct user access to a very large number of holdings. Some non-LCS libraries can easily dial up LCS and use it fairly routinely to identify loan material.

The statewide network itself, to be implemented in fall 1987, will provide an additional 300 libraries with bibliographic access to each other’s holdings. Even with this giant step forward, however, close to 90 percent of the state’s libraries will still lack this access.

Since the database made available to test libraries was not the union catalog but rather the catalog of one of the largest research libraries in the country, only suggestive inferences may be drawn from the results of this study as to whether or not the availability of the statewide union catalog in optical format would significantly enhance resource sharing in the state. The reaction of the participants in the study was of course conditioned by the current means available to them to satisfy their interlibrary loan needs. As was mentioned earlier, more than twenty-five libraries and the regional system network nodes in the state have direct access to LCS, the state online circulation system. Many non-LCS libraries (three of the sites where the CD-ROM catalog was tested, for example) can easily search LCS through dial up and routinely use it to identify material for loan. Larger libraries in the state may also have direct access to OCLC and may use it for verification purposes, even if they rely on the regional system library to obtain the item for them.

Smaller libraries in each region are under no obligation to fully identify or locate items their patrons wish to borrow. Responsibility for this may be borne entirely by the regional system library. The system director who participated in the grant project estimated that approximately 80 percent of the interlibrary loan requests received by system headquarters are from public and school libraries, many of which are without even the most basic bibliographic tools. About 40 percent of loan requests come without any verification whatever. Although the test librarians implied that they do not view the need as compelling, they did generally agree that the smaller libraries, though least able to pay for it, had the most to gain from access to a stand-alone system on CD-ROM which could be used to identify materials of interest to their users beyond their own collections. Librarians from small public and school libraries who saw a demonstration of LePac were clearly concerned about costs, but they were also highly enthusiastic about the possibilities of radically expanded access for their users. Although the broad array of options for
cooperation that already exists in Illinois for the larger libraries dampened enthusiasm for the creation of a CD-ROM-based union catalog among the test librarians, they did identify various potential benefits. For example, rising telecommunications costs might make it more appealing in the future to resort to a stand-alone system than to dial up what may be a distant node in the LCS network or a bibliographic utility. Difficulty of access and slow response time were cited as frequent problems with OCLC.

In order to provide an index of the perceived potential value of a CD-ROM union catalog, librarians were asked to estimate how much use would justify purchase and also what cost they thought would be reasonable. Purchase was judged to be worthwhile if patron/staff use was to be five searches each day (at three sites) or fifteen to twenty searches each day (at one site). The site at which librarians were least enthusiastic about the project, surprisingly enough, were willing to pay $2,000 annually. The other test libraries were willing to pay $500 per year for the service.

In terms of workload, the test libraries saw little gain to themselves. All felt, because of the large number of unverified requests received by the systems libraries, that real work savings could be effected at that particular point in the interlibrary loan process.

A slightly surprising result of the study was the observation that even in Illinois, where resource sharing has been emphasized for a quarter of a century, not all librarians in the test were entirely positive about the potential of LePac for increasing direct user access to information about library materials. Two sites placed little value on and did little to promote the system as a means for users to identify items of interest completely on their own in a very comprehensive collection. Librarians at one site could see the CD-ROM catalog as valuable only to a small class of users—i.e., researchers and business people. At a second site, the staff saw the work of interlibrary loan being passed back to the patron. The staff also displayed a definite resistance to direct charging out of books by users were this to be a future possibility.

On the other hand, at a third public library site, librarians encouraged individual public use by strategic and highly visible placement and by frequent referrals of users to the system with an explanation of its capabilities. This promotional effort resulted in a measurable increase in interlibrary loans during the test period: a 15 percent increase over the normal lending rate for a like time period. At the community college library, librarians also viewed the system as a significant way to broaden the information horizons of their users.

The lack of appreciation for direct user access to information about distant library materials is reminiscent of the consistent views expressed by Thomas Ballard on the value of networks to public libraries. According to Ballard (1985), "patrons are unwilling to accept a definition of access to
books that requires them to go somewhere else or await future delivery” (p. 257). He argues that browsing is the most desirable or at least the most pleasurable means to identify needed materials and that users will not be prompted by a mere bibliographic citation to want something they have not laid hands on. Networks are expensive luxuries because they “tantalize patrons with bibliographic records instead of books” (Ballard, 1985, p. 258). What is more, patrons do not want everything on a subject and librarians are foolish, he asserts, if they tie their professional status to their ability to provide information. William Gray Potter, writing from his experience in resource sharing in Illinois, turns aside Ballard’s arguments with some telling statistics and an eloquent statement of the philosophy that has informed recent library development in the state. He points out that at the University of Illinois interlibrary borrowing as a percentage of circulation rose from approximately 3 percent to approximately 8 percent in just two years largely due to direct patron charges on the LCS network. The lesson to be learned from the UIUC experience, Potter (1986) believes, is that librarians “must find ways to make access to library networks as easy, direct, and painless as possible,” meeting the untapped demand for resource sharing “graciously and with devices that emphasize our willingness to serve” (p. 246).

Potter’s view, obviously, is that the possibilities for sharing are endless and are unrelated to the size of the library. While librarians in the test libraries recognized the value of a CD-ROM union catalog to small libraries as borrowers, they failed to recognize the potential of such libraries as lenders. As was indicated earlier, even though ILLINET Online, the Illinois statewide online union catalog, is quite an extensive database, it nevertheless falls far short of providing direct access to all the library holdings in the state. There are more than 2,000 libraries of various types and sizes whose holdings are not included. The eighteen regional systems serve many of these libraries, and these services might be improved by the availability of union catalogs of regional holdings. CD-ROM cataloging systems (offered by Brodart and a number of other vendors) might be a cost effective way of converting the records of these libraries to machine-readable form, and CD-ROM public access catalogs might be an economical way of distributing these union catalogs around the region and the state. Were their holdings known, the smaller libraries in the state might be changed from only borrowers to lenders. It is well known that even the smallest rural library may hold something unique and, taken as a group, these libraries contain a sizable and perhaps seriously underrutilized share of the state’s library resources. For example, Illinois school libraries are frequently not served by the regional systems. Other states are moving to bring school libraries into the resource sharing network, both to allow cooperation among the schools and to make more comprehensive holdings
available to students. It is interesting to note in this context that a study
done in 1985 to lay the groundwork for the Access Pennsylvania program
described later found that the average high school library in Pennsylvania
contains 20,000 items including materials of all types. The investigators
estimated that the total number of items in all high schools, public and
nonpublic, if placed in a union catalog, could be as many as 17 million and
that 50 to 60 percent of these items are probably unique. This information
was contained in processed material obtained by the author from Richard
Cassell, consultant on the Access Pennsylvania project.

A good example of this kind of development is the Access Pennsylva-
nia project which has used LePac in the establishment of a resource
sharing network. The ultimate goal of this project, which is part of the
Governor's Agenda for Knowledge and Information Through Libraries
and has been funded by the legislature, is to ensure that all citizens of
Pennsylvania have access to the holdings of the 4,000 publicly supported
school, academic, public, and special libraries in the commonwealth.
Initially, Pennsylvania used LSCA funds and state funds to convert 700,000
records in thirty public and school library catalogs into machine-readable
format. The databases thus created are being used for resource sharing
purposes on a local basis through CD-ROM, microform, and online
catalogs. Ultimately, development will continue through the creation of
both regional and statewide databases.

Brodart has shown that a CD-ROM catalog can be made to interact
efficiently with existing systems and can be an effective tool for resource
sharing. The company has developed interface capabilities for LePac with
several standard circulation systems making it possible for the system to
provide status as well as location and holdings information. A communi-
cations package now allows LePac terminals to dial other terminals in a
given network. Interlibrary loan requests may be transmitted in this
manner. Brodart has also developed an interlibrary loan “director” for
more complex networks. The director is a message-switching system that
functions automatically to gather and route interlibrary loan requests,
acknowledgments, and related messages throughout the network.

In Illinois, another potential use for CD-ROM catalogs is in individ-
ual libraries which want their own local public access catalog. These
libraries may not be satisfied for one reason or another with the alternatives
provided in the region or they may not want or be able to avail themselves
of the existing alternatives. They may regard available systems as too
expensive or too limiting in terms of local control. Staff of the community
college library which tested LePac, for example, became highly interested
in a CD-ROM catalog as an alternative to the online system currently
available to them. The use of that system results from their participation in
the regional network, but they do not find it satisfactory for their needs, do
not use it even for circulation, and do not encourage its use by patrons as a partial substitute for an online public access catalog. There are many benefits to a CD-ROM catalog for a community college library. Total local control is possible, the system is cost effective, and elaborate technical expertise is not required to maintain it. Quite sophisticated search capabilities may be presented to users in an understandable way. In addition, for a smaller library (the community college has 80,000 volumes), reasonable response time is possible.

CONCLUSION

This summary has presented the results of a pilot project to assess the effectiveness of distributing catalog records on CD-ROM to facilitate resource sharing and reference work. In addition, it has attempted to provide an analysis of the capabilities of optical technology for use in libraries at an early stage of the development of that technology. Where possible, the findings of the study were reviewed in light of the current state of the art. Much progress has been made in the year since the study was completed. Although its permanent viability has not yet been entirely established, the infant optical information industry has begun to gain a firmer foothold in the marketplace. While libraries represent only a small piece of the market base for the industry, the number of players in the library field has increased, competition has brought product improvement, and vendors are solidifying their positions. The disc mastered by Brodart for the Illinois project was only the third the company had ever produced. Now, within a year, Brodart has installed 400 workstations at more than 200 sites and is expected to ship 1,000 more for installation by the end of 1987 (Brodart, 1987). Several states, including Washington, Maine, Pennsylvania, Wisconsin, and Louisiana, have already created, or are in the process of creating, union catalogs on CD-ROM. This proliferation has even begun to be regarded as a threat to existing bibliographic networks by proponents of large scale interlibrary cooperation. An article in American Libraries (1987) "20 Years of Networking: New Life—or Dead Dinosaurs" for example, reported the observations of speakers at the Public Library Association, Technology in Public Libraries Committee meeting at the ALA annual conference in July 1987. In it Henriette Avram of the Library of Congress is quoted as urging that libraries look beyond the shortsighted goals of self-sufficiency toward the longer term benefits of networking. The article "Will Optical Discs be the End of Online Networks?" (1987) asks experts to comment on the impact of the technology on various types of online services. Most who commented shared the view that there is a place for optical tools in certain circumstances and that libraries
must understand the tradeoffs in using one technology or another for internal library functions or for the provision of services.

The study has been in no way definitive concerning the future place, if any, for CD-ROM catalogs in Illinois. Their potential for bringing a larger number of libraries in the state into active cooperation is certainly in line with the traditions of library development in Illinois. Still, further investigation is required before the state can commit to any broad-based employment of CD-ROM catalogs to provide access to holdings which are not recorded in currently available online systems. It would be useful to create a CD-ROM union catalog containing the holdings of all libraries within one of the regional systems and to evaluate the reciprocal borrowing which takes place among member libraries of different sizes. A plan for increasing system resource sharing in an Illinois region was written by McMorran (1987). His idea was to use one of three available CD-ROM based cataloging systems (most probably General Research Corporation’s Laser Quest) to add full MARC records to the system’s existing catalog database. The headquarters library and the nine out of one hundred member libraries whose holdings were in the database already were to participate directly. Smaller libraries were to submit holdings for addition to the database and have cards produced for them. Only the ten direct participants would have online access to the regional union catalog. The catalog would contain only current holdings since retrospective conversion was viewed as being prohibitively expensive. If the database created was large enough to make storage in optical format appropriate, such a plan could be carried one step further by distributing CD-ROM versions of the database to libraries other than the ten online participants. Users in the smaller libraries, as well as the larger libraries, could then have direct access to the information on the holdings in the regional database. Such an experiment should be designed to measure the extent to which smaller libraries can assume some of the interlibrary lending burden from larger libraries. It should also address the true magnitude of the unmet need for library materials among the populations served by smaller libraries. Cost benefit issues would certainly have to be addressed. It would of course be difficult to place a quantitative value on the benefit to users of direct access to remote library materials. The idea that such access does have significant value, however, is central to the philosophy which has informed library development in Illinois for at least the last ten years.
APPENDIX A
Checklists and Questions Used at Sites During Group Interviews

Operation
Please check one response per mode for each of the following features of this information retrieval system.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Novice Mode</th>
<th>Expert Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Subject searching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Boolean searching capability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. &quot;Anyword&quot; searching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Response time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Searching through alphabetical lists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. General ease of search</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Following directions on screen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Use of keyboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Amount of training needed to operate well</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. System reliability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Purpose/Use/Application
How is this system useful or potentially useful to you?

<table>
<thead>
<tr>
<th>Purpose</th>
<th>YES</th>
<th>NO</th>
<th>DON'T KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Verification of information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Identify location for interlibrary loans</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4. Stimulate demand for follow-up services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Efficiency over any present method</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Would some patrons prefer this over any present method?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. How much time have you spent using the system?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

     minutes (estimate)
CATALOG ON CD-ROM

Improvements/Limitations

If this system was improved, which of the following elements are important?

<table>
<thead>
<tr>
<th>CRITICAL</th>
<th>NICE TO HAVE</th>
<th>NOT IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Printer access</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Clear, more concise user manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Single-sheet user search aid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Add user-truncation feature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Delete automatic truncation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Improve response time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Add escape mechanism for long searches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Provide estimate of size of search results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Present more than one match at a time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Charge-out feature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Larger or more targeted database</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Need for more than one terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Call number availability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Call number searching</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interview Questions

1. Did you find the 'NOVICE' mode useful?
2. Did you find the 'EXPERT' mode useful?
3. What would be the ideal database to use this system on in your library (discuss various databases)?
4. How much of your present workload would be eliminated if the system was permanently installed in your library?
5. Discuss results from checklists. Arrive at consensus.
APPENDIX B

Questionnaire Used with University of Illinois Graduate School of Library and Information Science Class

LePac Software Evaluation

I. In answering the questions below, make reference to your experience using the Expert mode.

EASE OF USE

A search by (1-4)
1. title
2. author
3. subject
4. combining authors or titles or subjects
5. Finding the correct subject term
6. Scanning through a long display (forward or backward)
7. Increasing the result when too little is retrieved
8. Reducing the result when too much is retrieved
9. Using "or" logic
10. Use of the "anyword" search

EFFECTIVENESS

11. Taking into account the dates of coverage of the database, I found what I wanted
12. Sequence or order of search steps

OVERALL SATISFACTION

13. Most of my trial searches

DOCUMENTATION

14. LePac user manual
AIDS (Signs and Search Guides)

15. Accuracy
16. Sufficiency
17. Usefulness

SATISFACTION LOW HIGH

EASY DIFFICULT 1 2 3 4 5
DISPLAY DESIGN
18. Capability of interrupting or stopping the display of information
19. The order in which items are displayed
20. The rate at which items are displayed
21. Understanding the display for a single book, journal, or magazine
22. Understanding the display that shows more than a single book, journal, or magazine

SYSTEM FEEDBACK TO THE USER
23. Usefulness of the screen format as a prompt
24. Adequacy of on-screen instruction explanations
25. Conciseness of the wording of the screen instructions

RECORDS OF SEARCH
26. Cumulative records of searches being informative to the user

TECHNICAL DESIGN
27. Length of response time
28. Clarity of keyboard design
29. Ease of identification of function keys

USER'S TIME COST
30. Selecting from a list of choices
31. Learning to use the Expert mode
32. Searching by author on the Expert mode
33. Searching by title on the Expert mode
34. Searching by subject on the Expert mode
35. Searching combined authors and titles
36. Combinations which include subjects or terms entered in Anyword
37. Searching using the "OR" operator
REFERENCES


