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ABSTRACT

The use, history, and role of machine-readable data base technology is discussed. First the development of data base technology is traced from its beginnings as a special resource for science and technology to its broader use in universities, with descriptions of some specific services. Next the current status of mechanized information services in academic settings is considered, along with the organization of such centers and the role of data bases in information dissemination. Differences between university and industrial information centers are discussed, and the operations of six university information services funded by the National Science Foundation are described. Finally, there is a review of the literature concerning the reference or information service librarian's role in the interface between user and data base. Special emphasis is placed on query formulation, question negotiation, and educating the user. A list of acronyms and a bibliography are included. (LS)

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The Role of Mechanized Services in the Provision of Information With Special Reference to the University Environment

by

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Introduction

The librarian involved in the provision of information services is today confronted with the new challenge of making available to users the wealth of information recorded in machine readable data bases. As these bases proliferate in number and complexity the librarian is faced with a dual problem: 1) current awareness of the state of the art of these resources, and 2) a re-evaluation of question analysis and formulation of user requests so that these are compatable with the requirements of the data base.

Traditionally, machine readable data bases have been the province of researchers in science and technology and have been funded by industry or the federal government. As a result most research into the needs of the user has addressed this rather sophisticated group of users and their special problems. However, there is a growing body of literature concerned with the problems of the less mission oriented user (e.g., the pure scientist or the university student) and it will be the main purpose of this paper to discuss the studies relevant to the user of information services in the university setting.

The scope of this paper is threefold: 1) a brief overview of the development of machine readable data bases, 2) the role of machine readable data bases in information dissemination and the organization of mechanized information centers with special reference to their use in a university situation, and 3) the role of the reference/information services librarian at the user/data interface and the accomodations that must be made by practicing librarians in order to adequately deploy such resources.

Part I: State of the Art of Machine Readable Data Bases

For the purposes of this paper a data base is considered to be an organized set of machine readable records containing document-related or bibliographic data. The use of these machine readable data bases for information retrieval takes the form of Current Awareness (CA) or Selective Dissemination of Information (SDI) and retrospective searching. Output has been traditionally in a batch mode, but current technology is increasing the systems using on-line response.

The rationale for such services has often been described but it is important here to emphasize the initial impetus behind the "information explosion" concept. In the field of chemisty, alone, over 300,000 papers are produced each year and the cost of indexing and retrieving these materials is impossible for the working scientist. CA and SDI services make it possible for the bench scientist to have access to the information base of his or her science covering the references really needed, as well as fringe areas, and without irrelevant references.

The deployment of these services first came from information dissemination centers subsidized by the federal government and were therefore strongly mission oriented. The National Library of Medicine and NASA were the first government agencies to produce machine readable data bases. In 1962 Chemical Abstracts Service first made its data base commercially available in machine readable form. User groups worked closely with these pioneer processing centers to discuss problems such as debugging programs, refining search techniques and preparing profiles.

The need for mechanized information services to move from single mission centers dedicated to special data bases to centers processing a number of data bases has developed from a recognition that searching of a single data base

may provide high recall from that base but will not provide high recall from the 35,000 current periodicals and 900,000 significant papers published every year. Recall based on a small data base only tests the efficiency of searching within small confines leaving the great majority of information inaccessible.

P. S. Davison of the Scientific Documentation Centre of Dunfermline has carried out a comparison of information services for a single field (mass spectrometry related to computers) and found that single data bases only retrieved a small percentage of the potential articles. He notes that "none of the indexes searched, including our own files, could find more than about half of the known references...a chilling reminder to all of us working in information retrieval of the magnitude of the problems which still remain with us".[1] Davison's contention that more than one data base must be searched in order to give adequate coverage of a field has been born out by the gradual move of information processing from single mission centers to multi-purpose centers.

In less than a decade processing of machine readable data bases has moved from single locations to centers. Data base producers are converting their operations to integrated computer-based operations. These centers operate in a variety of environments with support from federal and local government, universities, industry, professional societies and trade associations. They operate as brokers, retailers or middlemen between the data base producers and the end user.

At these centers search programs are no longer confined to single data bases but are now capable of handling multiple data bases with varying content and format with many processing operations under user or intermediary control. The move has been from experimental services serving parochial users to an organization of established centers, such as Lockheed, Systems Development Corporation, or the Illinois Institute of Technology's Computer Search Center,

which operate multiple data bases and serve a nation-wide community.

Before we go on to describe the information center in greater detail it will be benificial to note the extent to which needs for such services exists. At a non-specialized level (e.g., not for industry or university based research per se) a sense of the needs of the average citizen is exemplified in the recent declaration of the Chicago metropolitan area's Illinois Regional Library Council (IRLC) to begin application for a grant to establish such a center. The IRLC Task Force on a Council Area Information Center recommended:

> a model for a data base center which would provide unlimited access to some 35 major data bases through the Lockheed Dialog Information Retrieval System, the SDC (System Development Corporation) Search Service, and the New York Times Information Bank. .... the libraries and librarians represented in the Council form a uniquely qualified group of users for the major data bases, a group that will eventually do most of its information work and biliographi searching through data bases.[2]

The IRLC's proposal enforces the goal of the National Commission on Libraries and Information Science (NCLIS) of "equal access to information" for all citizens and seems an outgrowth of the "Information Utility" concept discussed at the 1974 meeting of the ASIS.

The concept of the "information utility" is to treat information as a commodity--a service to be provided by an enterprise modeled on other public utilities intended to serve the public interest.[2a] The proposed IRLC project and the goals of the NCLIS seem to indicate that the idea of provision of machine readable information to citizens(not involved with industry able to support it privately or universities)is becoming a commonplace. A noteof caution about all this optimism was sounded in a recent issue of Library Journal, however, which comments that while the NCLIS was supposed to consider the nation's inability to "provide library service of excellence to all Americans the Commission itself...was thinking all the time about a vision of a nationwide

electronic network for the transmission of data."[3] Because of the visionary aspects of the information utility concept it does not seem yet appropriate to examine the machine readable data base in the context of the public sector, but mor pertinent to discuss the state of the art as it exists in the university setting where such services are rapidly being implemented.

This grand vision of a publically supported information utility is yet far from reality. The activities of the IRLC, however, underscore the fact that the concept of such is very much a part of the current thinking of planners for library service. Because such centers are operating primarily in the setting of universities and government at present, we turn now to examine briefly the structure of the association of information centers and to describe a particular instance of a highly developed center in order to see the university centers in perspective.

ASIDIC

The Association of Scientific Information Dissemination Centers (ASIDIC) is an association of information dissemination organizations or centers that fulfill the following criteria: "operations are computer-based and either SDI searches are made on two or more data bases with a minimum of 100 profiles processed on a continuing basis or retrospective searches are performed on a demand basis against two or more distinct data bases with a minimum number of 1000 questions processed within a one-year period."[4] Associate members are those with an interest not meeting the above criteria. The need for such centers is a manifestation of the proliferation of machine readable data-bases.

The second edition of the Encyclopedia of Information Systems and Service[5] published in 1974 describes and analyzes 1750 organizations concerned with service based on the storage and representation of structured information with output on a recurring or demand basis. Mechanized information centers eliminate

the need to contact each data base producer for service by channeling in all requests and processing them on data bases already purchased or leased. The proliferation of data bases and the many available services compel the librarian to be alert to the potential of this expanding resource. The increasing problem of bibliographic control of data bases will be discussed later in this section. But first it will be useful to examine in some detail one center which, since 1972, has been self-supporting and whose operation may serve as a model for the activities of many such centers.

IITRI - CSC

The Illinois Institute of Technology Research Institute (IITRI) Computer Search Center (CSC) provides information from computer-readable data bases to users in industry, governments and universities. The CSC was designed to provide a variety of services from multiple data bases using a modular machine-independent PL/1 software system able to handle any bibliographic data base. Users submit profiles which include full free form Boolean logic with any degree of nesting, full truncation capabilities, search terms of single words, multi-word terms, phrases or term fragments, optional sort by author, citation number, or weight and optional printing on 5 x 8 cards. Services include SDI and retrospective searches.[6] The CSC searches in the areas listed below:

Abstacted Business Information (ABI)	INFORM
American Geological Institute	GEO-REF
Biological Abstacts	BIOSIS
Chemical Abstacts Service (CAS)	CONDENSATES
Educational Resources Information Center	ERIC
Engineering Index	COMPENDEX
Food Science and Technology Abstracts	FSTA
Funk and Scott	F&S INDEX
Index Medicus (NLM)	MEDLINE
Library of Congress	LIBCON
Life Sciences Citation Index (ISI)	SCISEARCH
National Agricultural Library	CAIN
National Technical Information Service	NTIS
ORBA Information Limited	MATRIX
Pollution Abstacts	POLLUTION
Polymer Science and Technology (CAS)	POST
Psychological Abstacts (APA)	PSYCHOLOGICAL ABSTRACTS
Science Abstracts (IEEE)	INSPEC
Social Sciences Citation Index (ISI)	SOCIAL SCISEARCH[7]

In addition IITRI - CSC has established a "private libraries" service which allows users to create, store, edit, rearrange and perform operations on personal files. Citations received from CSC searches are stored on magnetic tapes and disks and the user's own information can be merged with the data obtained therein to provide a specially tailored, personalized data base generated from a variety of inputs.

The CSC/user interface is usually facilitated by conferences with the with the user either in person or via telephone. Profile development is executed from a KLIC (Key Letter in Context)Index prepared from a recent volume of Chemical Abstracts, which is especially useful for left truncation and retrospective searches. Search output is available on 5 x 8 card stock (See samples on page 7a) which can be sorted in any manner the user chooses.

The promotion of CSC services has been aimed mainly at industrial users since they are more receptive to the fee-for-use basis on which the CSC operates (NSF funding and government contracts supported the CSC start-up, but the CSC is currently self-supporting). Marketing techniques have included IITRI workshops, talks to researchers, and mass mailings (though these last have been the least productive).

Searching of multiple data bases such as that at CSC offers many advantages over manual searches or searches of single data bases. In an article defining the CSC experience, Martha Williams cites eleven reasons for using SDI services:

1) coverage
2) thoroughness of search
3) consistency of search
4) high recall
5) interdisciplinariness
6) cost effectiveness
7) speed and regularity
8) timeliness
9) multiplicity of data bases
10) automatic preparation of files in standardized form.
11) cost of data base preparation and operation of SDI system vs. subscriptions[8]

These reasons are similar for all disciplines making use of mechanized information services. As these services become evident to librarians involved in the pro-

vision of information it is likely that librarians as well as information scientists will become more insistent about access to such services.

Data Bases in the Disciplines

In the main the literature on mechanized information services deals with these services as an adjunct to the hard sciences. The summary matrix (page 17a) of information services in universities is heavily weighted toward the scientific. The reasons for this are simple. The hard sciences have had the support of federal money in the development of information systems whose need was justified interms of the national defense, and the support as well of industrial money justified by profit. The Encyclopedia of Information Systems and Services lists hundreds of commercially available data bases, most of which service the hard sciences.[9] The types of bibliographic services for the social sciences are increasing. The Social Science Citation Index, providing access to over 1,000 social science jounals, and ERIC are the two most widely used data bases. Since 1970 the storage of the U. S. Census on magnetic tapes has provided service for sociological interests, allowing access to the material from diverse viewpoints. Other social science services include PASAR (using the Psychological Abstracts data base) and Sociological Abstracts. The New York Times data base will provide interdisciplinary material, but will probably be most heavily used by social scientists.

The humanities are not as direct in their use of computerized information services. Calculi and Computers and the Humanities list projects in the humanities using computers but these are largely projects involving textual analysis for purposes of concordances or definitive texts, rather than bibliographic study. Seven humanities oriented services were documented in 1971 and will give us an idea of the types of services available:

1) Playbill Information Retrieval System (PIRS)

2) Incunabula Project - designed to produce a dictionary catalogue and multiple access to incunabula
3) Hand-Printed Books Project
4) Art Category of Computerized Slide Classification
5) Computerized Fogg Slide Classification System - able to print out hard copy indexes
6) National Information Center for Educational Media (NICEM)
7) America: History and Life[10]

None of these humanities services provides the type of bibliographic citations available in the data bases of the sciences and social sciences. It is conceivable that some of the large humanities bibliographies such as PMLA will become computerized in the future and that these will make their claim on librarians for acquisition; however it is difficult to see where the funding for such a project will come from.

Bibliographic Control of Data Bases

As we have observed, the growth and proliferation of the number of data bases itself is an "information information" explosion. How do we keep track of the data bases? At present the only comprehnsive access is through directories such as Kruzas[11] or through updating services such as Information Hotline,[12] a monthly news service reporting information activities in all fields

John D. Byrum, Jr. considers the problem in a 1972 article from Library Resources and Technical Services:

> Data archives of all types are proliferating everywhere, but data librarians are finding themselves floundering in their attempts to organize and document their data holdings. No rules exist; no generally accepted plan appears in the literature. Elaborate information retrieval systems have been implemented at a number of institutions, but even these require a system for documenting and referencing the material which support and relate to the data set itself.[13]

It is imperative that the existence of data sets be made widely known in the relevant user communities. Standards and new procedures will have to be established for recording information about data collections.

Byrum goes on to note possible methods of bibliographic control for

machine readable material: 1) standard catalogue entries--filed in the main catalogue with suject headings in the same manner as other library materials, (There is an ALA committee --ALA/RTSD/CCS/DCC Subcommittee on Rules for Cataloging Machine Readable Data Files--concerned with this method of control.); 2) Data abstracts or data description form --a one page summary that would be entered into a loose leaf binder or in machine readable form; 3) content documentation codebooks --description of variables within each data base; 4) records of physical and logical characteristics of the data bases.[14]

From standard bibliographic treatment of machine readable data will come union lists and greater facilitation of information networking. There already exists an agreement between the University of California and the University of Georgia to share expensive data bases. Greater control of specialized bases will certainly encourage greater cooperation in the interest of economy between libraries.

Conclusion

This brief overview has attmpted to describe the breadth of current activity in the provision of information services from machine readable data. The practicing information librarian will be pressured in the next decade to have a close understanding of machine readable data as the facilities for using them proliferate and their use becomes the perrogative of all citizens.

Part II: Mechanized Information Services in the University Setting

The history of the machine readable data base as a service to industry and scientific research is a history of attempts to create more efficient research routines on a cost/recovery basis. The need to cut the costs of replicative searches and inefficient research has motivated the private and governmental sectors to produce a startling array of services. At the university level the influx of money from such agencies as the National Science Foundation and NASA has made it possible to institute processing centers for data bases in an academic environment. In relation to the millions of dollars spent, however, information about these efforts has been surpisingly minimal. In this section, we will consider the current status of mechanized information services in academic settings and attempt to locate such services within the general provision of information for the academic community.

We have already discussed at some length the services and scope of coverage available to the user from a mechanized information center. The rapid evolution of service from single to multiple data base provision has been noted. We have examined in some depth the services of one of the most successful private sector centers (IITRI) and found that industry is so willing to maintain such a center that IITRI is self-supporting. At the university level a number of experimental uses of information dissemenation form machine readable bases have been implemented in the past ten years with varying degrees of coverage and services offered. The types of centers available in the academic environment vary from access to a single data base to full scale institutional information centers to a broadly conceived network of cooperative access to information in the Northeast Academic Science Information Center (NASIC).

The experience of university based centers differs greatly from that of centers serving private industry or federal projects and provides an arena

from which to study mechanized information services in a context somewhat (though not entirely) removed from the need to earn a profit. That is, in their initial stages most university based systems provided free services in an effort to create a constituency. Usually the university computer center is affiliated with either a library school or a highly developed library information department interested in service to users from which will develop serious consideration of the provision of such services comparable to the discussions which developed the traditional information services.[15]

Variations between University Based Mechanized Information Centers and those Serving Industry

The needs of a commercial organization for computerized information may be characterized as homogeneous and largely satisfiable by access to comparatively few files. This service may be viewed as analogous to the special library function where the structure of the library is clearly defined by the aims, objectives and profit motive of the parent organization and whose existence depends upon its cost effectiveness. This contrasts with a university system where the range of interests are greatly diversified, and demand, while continuous, shows sizable peaks and troughs reflecting examinations and vacations. There is a wide spectrum of information need, ranging from the humanities to the hard sciences. The library facilities in the university have been developed to meet this demand; mechanized information service must be developed towards the same end. On coming into the era of large-scale reliance on the computer for information storage and retrieval, the university must discover the best methods of responding to the huge challenge that this represents and must be prepared to face a wide and only minimally predictable range of demands.

The formula-packaging of data bases for industry is not tenable for the university environment. While the university is a natural habitat for the

mechanized information center, the center must be able to extend the scope of data bases in order to expand the services that the library has traditionally offered into the realm of SDI, retrospective searches of bibliographic files, automatic literary or statistical analysis, and on-line interogation of a personal file. The holdings of such a center would have to mirror the universities' active interest in the whole spectrum of knowledge. An internal host system would need to be devised with the ability to deal with data on its own terms and programs that would be task oriented and highly modular rather than file dependent. The programming situation, wherein each data base has its own individually tailored software, must be treated by a programming strategy which would enable the center system to deal with any input data file on its own terms. Unlike industry, the center in the university has no easily defined set of goals and must accomodate its services to the changing demands of faculty research and curriculum.

Since the center in the university is analogous to the library--really an extension of its services--its locus is best seen as within the realm of the university library as the responsible permanent agency for the university community's information needs and these new techniques of mechanized information storage, retrieval, and dissemination may be viewed as a logical extension of its more traditional role.[16]

Feasibility of University Based Information Systems

In late spring of 1966 the Institute of Library Research (ILR) of the University of California at Los Angelos under funding from the NSF began the Phase I (Planning) study, Mechanized Information Services in the University Library. The purpose of the study was to define the problems which would be faced by the university in creating the capability to process nationally produced data bases and tying them into mechanized information systems for local

use. Questions to which the study addressed itself have ramifications for the role of mechanized information services in any university setting:

1) Is it worthwhile to provide mechanized information services to the university community?

2) Should the university library be regarded as the appropriate agency for such services?

3) How should the single campuses proceed in relation to efforts in development at other campuses and at a national level?[17]

The 13 part study produced by UCLA was a major developmental effort toward defining what was required to implement a system in an academic environment. Its 13 parts outline the problems that must be faced before such a system becomes operative:

1) Mechanized Information Services in the University Library--Introduction and summary
2) Summary of Symposia on Mechanized Information Services in the University Library
3) Inventory of Available Data Bases
4) Standards for Cataloging of Magnetic Tape Material
5) Nature of Typical Data Bases
6) Eva luation of Generalized File Management Systems
7) Experience with Library of Congress MARC Tapes
8) Experimental On-Line Mathematics Citation Data Base
9) Developmental Program for a Center for Information Services
10) Preliminary Specifications (Hardware and Software) for a Center for Information Services
11) On the development of Social Science Information and Documentation Services
12) Joint development and Design of Library Systems
13) Library and Human Memory[18]

This study was exceptionally important because it synthesized much data and crystalized for the university environment the scope and needs of a university based system.

While it is not within the scope of this paper to discuss at great length the UCLA Phase I report, it would be worthwhile to sumarize a few points because it was a study that helped to formulate thinking and creation of the milieu for mechanized information services in universities.

Part 2 of the report summarizes five symposia held at UCLA for discussion of potential difficulties when introducing mechanized information services to a university environment. Of special concern was the question of the information center's relation to the library: where should such services be provided? what agency should administer them? (This question has yet to be satisfactorily resolved.) The viability of mechanized information services was considered: will they offer services not already available, and will there be sufficient exploitation of the system to justify the costs of acquiring the data bases and maintaining the hardware? While no substantiating statistics were available the participants felt that provision of mechanized information services was justified and would be used increasingly by faculty and students as they were educated to the existence and potential of such service. Discussion of potential caused symposia participants to note the varying requirements of users (e. g., users at the forefront of research in their field would probably proceed as they were used to for the subject at hand but would use mechanized information services for background research.)

Another problem considered was acquisition of the data bases by individual centers versus the use of national networks. The consensus was that if centralized service via networking was provided transfer of information will be frustrated, nevertheless, since as the level of demand for mechanized services increases, single points will become saturated. Also the point was made that large research universities should function at the forefront of the development of mechanized services. In addition acquisition of machine readable data files was seen as an extension of traditional library services and there was no question that each university required its own library. As pointed out before, the needs of each university differ and the local provision of such services will make it feasible to manipulate programs in a manner that conforms to

user needs rather than accepting a pre-programmed format. However, it should be noted that by the early seventies such a proposal was considered and funded by NSF and has just completed its first year of operation. (For more information concerning NASIC see page 29.)

The desirability of the content of the data bases was also treated. Mechanized information services offer three types of storage: 1) bibliographical, 2) full text, and 3) numerical data files. Bibliographic files are descriptive since they characterize the primary text by title, descriptor, abstract, or all three. Examples are Chemical Abstracts, Engineering Index, Science Citation Index, MEDLARS, and MARC. Full text files are as one commentator put it, "the real heart of everyone's dream about automation--and still is--to have available in this mode the actual body of information, not just a reference to it."[19] However costs and storage factors have minimized the extent to which this use of computers is extended. Numerical files are of particular interest to the social scientist. The primary example of manipulation and use of numerical files is census data.

Once the symposia had treated viability, acquisition and content they turned to the problem of the location of the mechanized service. As noted above concensus was that the service should be an extention of the library. The library has long served the information needs of the community and the usual functions of the library of acquisition, storage, cataloging and circulation of books, serials, microforms and special collections should be extended to include the acquistion, storage and indexing of machine processable media such as magnetic tapes. The question arose of who would mediate between user and data--librarian or information scientist. Though some felt that librarians were unfamiliar with mechanized systems it was pointed out the real need will be to have personnel with expertise in serving informational

needs--skills that are the province of the librarian rather than the programmer.[20]

These general issues were discussed and then the report (as may be noted from the table contents on page 14 above) went on to tackle individual problems attendant to the implementation of the mechanized information service.

Six University Based Information Systems

The National Bureau of Standards (NBS) and the Office of Science Information Services of the National Science Foundation established an interagency agreement in December of 1971 to assess the status of automated information systems. Oneof the outgrowths of this agreement was a report on six university-based NSF funded information systems: University of California at Los Angelos, University of Georgia, Lehigh University, Ohio State University, University of Pittsburgh and Stanford University. NSF involvement in these systems had been specified for development, not operations, and was granted with the stipulation that the systems operate beyond the grant time on their own funds. The NSF report on these systems included a summary matrix to assist in gaining an overview of the varying scopes and goals of each system. (See page 17a.)

Common features of the six systems were:

1) All six operate as retail information centers providing services to individuals.
2) All primarily serve their campus communities, although they either do or plan to serve others on a cost-recovery basis.
3) Five of the six offer current awareness services; all six offer or plan to offer retrospective search services in the near future, either batch or on-line.
4) All six use several large commercially available data bases (although Stanford used only one, MARC).
5) All six use large third generation computer systems.
6) All, except for Stanford, use scientific data bases. Most started with one of the Chemical Abstact Services data bases.[21]

Before we examine each of these systems it is important to note that most of the available literature on mechanized infromation services in a university

C. SUMMARY MATRIX

University and Project	Hardware	Anticipated Principal Mode of User Service	No. of Commercially Available Data Bases	Names of Commercially Available Data Bases	Operational Status: Current Awareness	Operational Status: Retrospective	Library Relationship	Software Transferability Potential	Special Features
UCLA Center for Information Services	IBM 360/91	Batch and on-line searches and current awareness.	6	BA CA-C CAIN CIJE COMPENDEX RIE	Spring '71 (interim software)	Planned for Fall '72 (interim software)	Joint participation between library and computer center	Moderate, for interim software (IBM TEXTRAC).	Systematic library acquisition & cataloging procedure for machine-readable data bases. Modular software structure in system under development
U. of Georgia Information Center	IBM 360/65	Batch search of large data bases.	18	BA, BIOSI, CA-C, CAIN, CBAC, CIJE, CITE, CT, COMPENDEX, GEOL, GEO-REF, GPA, NSA, RIE, SOCAB, SPIN, TOXI, USGRDR	Since May '68	Since May '68	Computer center project--no formal ties to library	Moderate, transferable within 360 family. Documentation & programs available for purchase.	On-line profile entry and editing. Very large production-oriented operation. Many large data bases.
Lehigh U. Project Leadermart	CDC 6400	On-line interactive access to major as well as local data bases.	4	ASCE CA-C COMPENDEX MARC	Since '71	Since '71	Project in the library	Moderate, programmed in FORTRAN. Modules have been run on 360/65 with only I/O statements changed.	Natural language-oriented. Interactive searching with very large data bases.
Ohio State U. Mechanized Information Center	IBM 370/145	Batch current awareness of large data bases.	5	PANDEX, ISI, NTIS, MARC (*) CT * merged	Since Oct. '71	Planned Fall '72	Project in the library	Moderate, programs are not generalized but written in COBOL & PL/1	Multi-disciplinary data base. Used existing software, hence short implementation time. Data base overlap studies conducted.
U. of Pittsburgh Campus Based Inf. System	PDP-10	Batch search of large data bases	6	CA-C CT COMPENDEX GRA NASA ASM/IM	Summer '72	Summer '72	Integrated project among library, computer and academic departments	Low, machine-dependent. Only transferable to PDP-10 with similar peripherals	On-line profile negotiation using subset of the data base. Discipline-oriented centers providing "one-stop" information service. Emphasis on information networks and access to special subscription services.
Stanford U. SPIRES II	IBM 360/67	On-line interactive access to both large and small local data bases.	1	MARC	Not applicable	Planned Fall '72	Computer center project--no formal ties to library	Low, embedded in ORVYL Monitor and written in PL 360	Capable of using WYLBUR text editor. Tutorial features in conversational mode. Generalized re-entrant parser and semantic routines.

setting derives from one of these six systems. The literature available in library and information journals, ERIC and NTIS is concentrated on these systems. It is evident that the NSF seed money has been instrumental in advancing the knowledge about mechanized services. In each case discussions of the services available, while taking off from the NBS report,will be augmented by other available literature on the respective systems. A focus on these six systems will provide a resonably complete state-of-the-art report for the deployment of information services in the university.

University of California at Los Angelos

The system implemented at UCLA is titled the Center for Information Service (CIS) and is designed to meet the daily information needs of the university community, not simply as a research or experimental system. Ir is envisioned as a general purpose system--able to accept a wide variety of databases and able to satisfy a variety of users with enough adaptability to meet unanticipated demands. It is replicative--designed to be installed at many sites and easy to use in order to encourage user receptivity. It is conceived as an extension of the library--designed so that library personnel can integrate it into their operation. Also, it is intended as a potential node in an inter-university network.

Begun in 1966 with the feasibility study discussed above the CIS was planned for implementation in several phases: IIa, requirement specifications and basic design; IIb,detailed design and prototype development; III, prototype operation and system completion; and IV, implementation and evaluation of services.

User committees wre established to actively participate in the selection of data bases. The summary matrix indicates the bases selected. As was indicated in the feasibility study, these were chosen with an intention to correspond

to the actual needs of users with the same rationale that governs library acquisition policies. At the time of the NASIC survey in 1973, the CIS had decided to drop COMPENDEX on the basis of low demand, problems with delivery and quality, and high cost.[22] This decision is worth noting here for it indicates that acquisition policy concerning data bases is analogous to that concerning more traditional library materials. In a similar manner CIS decided to add the ISI Social Science Citation Index on tape. The capacity to still search COMPENDEX, should the demand arise, was left in the system by an agreement with the University of Georgia, which was granted in turn the right to share in the use of SSCI. The CIS committment to the social sciences had been planned for. Part 11 of the Phase I feasibility study was a lengthy survey by Ralph L. Bisco of the need for social sciences to be served by machine readable data (the tacit assumption being that those active in the hard sciences already had a clear rationale). The addition of SSCI to the CIS service base is consistent with his argument. An added service to the social scientist provided by the CIS is access to numerical data bases such as the 1970 census.

User services at CIS include current awreness and, in 1974, retrospective searching. The CIS has recognized the importance of user interface in effective man/system interaction and is presently jointly conducting a study of this interface with the University of Georgia under NSF funding.

Discussion of the provision of services at the interface is the subject of Phase IIa Part 6.[23] In order to properly prepare the library for the extension of its information services into mechanization, the CIS conducted seminars for the library staff to enlist their active cooperation in bringing CIS into being. These seminars included sessions on Boolean Strategy, ERIC, CAS, MEDLARS, MARC, the 1970 Census, acquisition and cataloging of data bases. Sessions on the extension of public service and interaction with mechanized

services included discussions of "what are we expecting the reference service (as it exists) to provide" and "should a special person be designated as an 'information specialist'?" The CIS seminars seem a model for the implementation of mechanized services within the library because of their emphasis on input from practicing librarians already familiar with the needs of the community at hand.

The extensive documentation of the UCLA CIS available in NTIS reports is a model for the university seeking to investigate the implimentation of mechanized information services. The feasibility study and careful planning through the phases cited above give a clear picture of the problems and questions that arise with the implimentation of such services. Articles by the CIS Director, Peter Watson, in professional journals (see bibliography) have done much to ease the conceptualization of such services by the librarian involved in traditional information services.

University of Georgia

Another visible system is that of the University of Georgia. This system, the Georgia Information Dissemination Center (GIDC), is designed to serve the university system of Georgia, which is comprised of 27 state-supported colleges and universities. It is seen as an extension of traditional library services but is not formally linked (as is the CIS at UCLA) to the library. In 1973 the director of GIDC wrote that it had grown from 10 search profiles on a single data base in 1968 to over 3,500 standing profiles on 10 data bases. Retrospective searches are run on 16 bases and number 400-500 each month. As may be seen from the summary matrix GIDC handles three times as many data bases as the next largest system considered by the NBS study. It also has the longest history of current and retrospective services, both starting in 1968--two years in advance of the other systems. The NASIC survey found that

little marketing was done to encourage use of the system and that users were informed through other satisfied users. One additional indication of the increase of use was the 100% increase in the demand for photocopies at the library from sources indicated in the GIDC bibliographies.

It seems possible to extrapolate that since the GIDC's only real edge other other centers is its earlier start-up time, that as other centers provide service and satisfy users they too will be called upon to add data bases and accordingly refine delivery service. Perhaps because of this longer start-up time it is appropriate that one of the most persuasive articles to be found in a non-"information science" journal on the use of "Reference Service and the Computer" originates from the Georgia Institute of Technology, which is served by GDIC. Jean Kirkland, head of the reference department, notes "if general librarians conclude that computer oriented research has no practical application for them, they may eventually find...that they have lost control of this area of the profession to outsiders."[24] Her contention is that no one is better qualified to translate the user's questions into the indexing language of computers than the librarian. Steps used to code profiles for use in the GIDC data bases include a user interview to acquaint the user with the subject scopes and capabilities of the service, concept identification, search strategy formation, concept expansion and profile refinement, (This sequence of steps will be discussed in part three of this paper at greater length.) profile coding, search output, profile revision. The GIDC reference librarians feel that user services are enhanced by the use of computerized services. Early experiments with users coding their own profiles was a complete failure.

Lehigh University

The Lehigh mechanized information center is unique because of its

experimentation with on-line conversational access to data bases. Strongly led by Donald Hillman, the Lehigh project, LEADERMART, operates on the assumption that scientists do not want documents or references to documents when they have a need for data. LEADERMART is the only system which, at the time of the NBS report, was providing on-line interactive access to major and local data bases. LEADERMART allows users to pursue their natural inclination to be problem rather than literature oriented. It is the system which has implemented the most full-text storage and comes closest to the "dream" of information that Watson referred to above (page 16). LEADERMART has several special facets: creation of specialized data bases of localized use through textual analysis such as the "Tall Buildings" data base. Queries are made in natural language. Browsing features are extant; see summary matrix for breakdown.

Ohio State University

The Mechanized Information Center (MIC) at Ohio State University (OSU) is clearly aligned with the library--its inception was the result of the joint interest in mechanization of the Chairman of the Information and Computer Science Department and the Director of Libraries. OSU's proximity to the Battelle Institute and OCLC headquarters gave impetus to the institution of the MIC. Its objectives are clearly defined as: acquiring machinereadable data bases; maximizing their potential; and encouraging user oriented research into the problems of information centers. The highly aggressive marketing approaches of the MIC is disscussed in section three of this paper. The most unique aspect of the MIC is its utilization of an integrated discipline crossing base. The MIC is administratively part of the library and its director reports to the Director of Libraries. It is the only center under NSF funding which provides access to the NTIS data base (GRA) reformatted into PANDEX. MIC has conducted a data base overlap study. At the time of the NASIC study a number of new

data bases were available (not indicated in the summary matrix): ERIC, SSCI SCI CAIN, PA.[25] MIC has experimented in document retrieval providing a detachable stub on its batch output which the user may submit to the MIC in order to receive a photocopy of the first page of the document. The user interface is mediated by a user/Information Specialist dialogue. No training of users is necessary since the Information Specialist codes the profile, but users are queried for satisfaction on a quarterly basis.

University of Pittsburgh

The Campus Based Information System (CBIS) at the University of Pittsburgh has antecedents in the NASA/funded Knowledge Availability Systems Center (ASC) which demonstrated Pittsburgh's early committment to the use of mechanization in information dissemination. In addition to the NASA Regional Dissemination Center (RDC), a Chemical Information Center was established at the chemisty library which provies data from Chemical Titles under NSF funding. In 1966 the extant information programs, library and library school consolidated and backed a program which was funded for NSF support resulting in CBIS. The CBIS project differs from the other NSF projects in that it is administered with an integrated approach by library, computer and academic departments. Research has a higher priority than at other mechanized information centers and research information utilization and the users' needs for specific information are considered more important than access to machine readable data bases and services.

To this end Information Utilization Laboratories (IUL) have been created to conduct systematic research into the methodologies for characterizing the information requirements of the engineering and social science disciplines. The IUL's are coordinated by a Central Analysis Unit which performs the compilation, data reduction, and analysis of user case histories to determine user trends and problems and to offer recommendations to the CBIS for operations or

service improvement. The IUL staff operate at the user interface. On-line profile negotiation offers immediate searches of sample data in order to re-define the profile. Pittsburgh offers a greater service to industry than other centers (a six month study in 1973 showed that forty per cent of the profiles and sixty-nine percent of the searches were being executed by the external community) but the location of the Institute for Scientific Information may have stimulated this visibility.

Stanford University

The Stanford Public Information Retrieval System (SPIRES) has two long range goals: provision of a user-oriented, interactive, production on-line information storage and retrieval system for research groups in the Stanford community and support of the BALLOTS automation program. Access to data bases for the Stanford community is through CIS at UCLA. The SPIRES project differs from the others in that it is a switching facility to appropriate data bases and an information center for information about data bases. The only data base processed by SPIRES is MARC, actually the first module for the BALLOTS project. SPIRES is a generalized data system listing locally available private files and has no data base transferability.

General Observations on the NSF Funded Systems

These six university based systems are all engaged in the provision of information services. They have as their basic goal the efficient dissemination of information to users in order to save the time of the user. Though costs are certainly high they do result in time saved and greater efficiency over perusing manual indexes. The director of Lehigh's program, Donald Hillman, noted in a panel that it is a myth that these services can be provided inexpensively, but user response has generally been that they are saved days of research.[26] It is possible to extrapolate that as use grows the total hours saved the

university in research time will create a significant savings in terms of hours spent though this cost effectiveness is not translatable back to the system itself.

Special features of the six systems so far surveyed are woth noting. The MIC at Ohio State University has merged four large data bases into one. Pittsburgh offers on-line profile negotiation to better insure the user that the profile he/she has selected will be adequate to his/her needs. Most of the systems have followed the IITRI route of converting the purchased or leased data bases into a common internal format so that one set of processing routines services all data bases regardless of content. Lehigh uses natural-language, the logical and syntactic structures of which is analyzed by the system.

The role of the information specialist has not been diminished by the implementation of mechanized services. All attempts at having the user inerface with the machine have been unsatisfactory. Rather than replacing the specialist, the mechanized systems simply provide better tools for the specialist's manipulation. While Lehigh and Sanford are allowing user interface with the machine, the other four systems continue to provide information specialists.

The state of the art has been much advanced by NSF funding. Experiments with automated profile definition, natural language, automatic indexing proceedures and thesarus building have been made. The close relationships with campus libraries are emphasized in most of these systems and mechanized services are seen as a highly desirable and perhps necessary augmentation of tradition service. For economy (to the user) and greatest response it seems that each university should have at least minimal automated systems tailored to the neeeds of its community. The information explosion will mandate this decision more compellingly with each passing year.

Other programs of automated service are operative. We now consider some

of these in order to complete our survey of current projects, which also make up part of the state-of-the-art.

Other University Based Information Services

The success of MEDLINE and ERIC is will known and well documented. These two data bases have been distributed extensively and are greatly responsible for the knowledge most librarians have about computerized information services. Though each functions well for users of their respective disciplines, perhaps their greatest contribution is as trail-blazers on the road to more automated coverage of bibliographic data.

MEDLINE

Because the use of MEDLARS is common knowledge it is not really a part of our survey. Most medical libraries and medical centers have access to this system. In 1966 MEDLARS was produced as a batched bibliography which did not provide the speed required by medical researchers. In 1968 this service was instituted on-line and was made available by the State University System of New York (SUNY) which allowed researchers computer-produced bibliographies. In 1970 the National Library of Medicine instituted AIM-TWX followed in 1970 by MEDLINE. The University of Minnesota Bio-Medical Library instituted a system using both SUNY and MEDLINE depending on the subject, depth, time, vocabulary and urgency of the request.[27]

ERIC

The Education Resources Information Center (ERIC) furnishes ready access to the nation's current significant knowledge relevant to developing more effective educational programs. This service is available on tape (as RIE and CIJE) and is implemented at many universities that do not run full scale mechanized information centers. A 1974 survey lists 120 organizations which provide computerized ERIC searches.[28] Because of ERIC's unique retrieval system (most RIE publications are available on microfiche at the institutions running

the computer searches) the user satisfaction is very high. It is conceivable that the highly successful experience of users with ERIC will cause users to demand similar services of such high efficiency in other disciplines.

University of New Mexico

The University of New Mexico, while not funded by NSF has had parallel experiences and the final report of its experimental program provides some facets of the mechanized search service not yet considered. At UNM the General Library and Technology Applications Center (TAC) cooperatively provided free search services on 29 data bases to to the university community. Search stategies were developed in the reference department and two copies of each search result are sent to the library to be checked in as a serial continuation. Funding derived from the fact that UNM was a NASA RDC. A report on the UNM experience notes, "To an even greater extent than is is found in other reference encounters, successful manual or computer literature searches depend on personal direct interaction with the user."[28] More on the UNM's philosophy of user-interaction will be covered in the next part of this paper.

The report on the UNM/TAC experience differs from the others in its inclusion of "testimonials from users." This feature was a welcome change from the usual method of reporting which emphasized only the number of profiles run with minimal feedback. Also included were sample searches which give an idea of the scope of services demanded in the experimental year. Since this is one of the few reports that really emphasizes user response it seems worthwhile to list some of the searches in order to give a sense of the manner in which these mechanized services are employed in a university environment.

"Methods of Control of Tamarix Pentandra" (Biology)
"The Effects of Road Salting on the Environment" (Biology)
"Studies Dealing with High-altitude Lakes in the Western United States (Geology)
"Cattle Feedlot Effect and Management" (Agriculture)
"Futurism"(Business)

"American Gypsies: Cultural and Educational Problems" (Educational Foundations)
"The Meteorological Glory Phenomenon" (Physics and Astronomy)
"Small Groups" (Sociology)
"Politics and Technology" (Political Science)
"Ion Selective Electrodes" (Chemistry)
"Art Therapy" (Art)
"Cities or Towns Built on in Oceans or Seas" (Architecture)
"Intercultural Communications" (Speech Communication)[29]

The user responses to these searches as recorded in the UNM report were overwhelmingly positive. The users indicated that they used the reports to prepare classes, in their own research and to gauge library holdings. One researcher even asserted that the time freed from manual searching allowed him more time with his family and made his marriage more secure.

UNM searched 29 data bases with current awareness, retrospective searching and standard interest profiles. The results do not differ so much from the NSF funded systems surveyed but the facets brought by UNM's report round out the picture of the state of such services. UNM's decision to treat TAC output as serial for inclusion in the library was not instanced in the report of any other institution.[30]

Northwestern University

The Remote Inormation Query System (RIQS) at Northwestern is designed to handle both textual and quantitative information. Files are created as a batch-processing job. The most interesting aspects of RIQS are their experience with users and these will be covered in the next section of this paper.[31]

Project Intrex

From 1965-1973 the Massachusets Institute of Technology undertook a program of experimentation to learn how libraries might provide better access to recorded technical information. The information transfer experiments were called Intrex. Intrex was seen as a three part program: 1) an augmented catalog, 2) full txt access and 3) direct fact retrieval. This project sought to improve

direct fact retrieval and full text access. However, the Overage survey of Intrex notes that this is still not feasible on economic grounds.[32]

Northeast Academic Scientific Information Center

Before we turn to the position of the user in the mechanized information service let us mention the NASIC project which offers a vision of regional brokerage of information on a ten-state scale: Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont. NASIC is a project which represents an attempt to apply on a regional basis the brokerage of information services. Its concept is that computer-based information services will constitute a logical extension of traditional information services provided by the college and university library in the Northeastern United States. Eventually NASIC expercts to extend its services to all in need of information in its area of coverage.

To implement the NASIC system Imformation Service Librarians (ISL's) are trained to staff each node in order to facilitate use. The ISL will assist the user in the definition of his specific information requirement and select the most appropriate source for the information (determination of appropriate data base and an awareness of the search algorithms employed at the information certers process that data base to guarantee the most effective fulfillment of the particular requiements of the user). The librarian will also develop a search profile that will yield the greatest recall of citations anabstacts needed, while minimizing irrelevant and unnecessay citation; he/she will aid in the review of search output and will facilitate document deliver. An important aspect of the early stages of NASIC was readying the academic community to accept computer-produced information as an extension of library service.

Underlying NASIC is the concept that universities cannot individually support such systems, a concept that had been rejected by the UCLA Phase I

Feasibility Study, but which now seems to the point in view of the general financial squeeze experienced by most institutions. The four volume NASIC Phase 1 report issued in 1974 and the study of NASIC's experimental phase at MIT from March, 1974 to February 1975 are available from RIE. These provide extensive documentation of recent developmental considerations for mechanized information services. The MIT experiment was operated on a cost-recovery basis (in the main funded from departmental budgets and government grants) but the results indicate the NASIC system will not function on a cost recovery basis without discouraging use and undercutting its objective of availability of information to all who need it. It is interesting to note that the Phase I Study at UCLA did not emphasize cost disproportionately to service, but that the MIT experiment keeps the consideration of cost paramount--an indication of changing priorities.[33]

The NASIC project will serve as a model for information service networking --the least developed of library automated services. As more librarians become aware of the time saved through the use of computerized services the frustration experienced by those to whom the systems are inaccessible due to affiliation with a university or college unable to afford its own systems may be alleviated by the institution of such programs as NASIC or the projected IRLC project discussed above.

Now that we have surveyed the scope of mechanized information services in the university we can turn to the center-piece of this elaborate structure of computers and data-bases: the individual user.

Part III: The User/Data Interface

Introduction

So far we have discussed the scope and working operations of machine readable data bases in the provision of information. We will now focus on the most important aspect of the mechanized information center: the user/data interface, the actual implementation of these services in the every day library situation. The user, whose needs sometimes seem eclipsed by the impressive build up of increasingly sophisticated hardware and software, is, after all, the occasion for this complex. His needs should be the focus of the structure of information services, whether they be traditional or mechanized. In a panel discussion on the implementation of information retrieval systems Herbert Landau noted, "the information retrieval and library community can [no longer] afford the luxury of simply generating a plethora of machine-readable files in the hope that users will eventually find a way to fit these files into their operation."[34]

In our survey of university systems we have noted some response to user needs (UCLA-CIS' decision to drop PANDEX) but nothing that parallels the acquisition function of the traditional library, even though this has been called for from time to time.[35] As was noted above the main criticism of the NCLIS statement on goals was its emphasis on the electronic transmission of bibliographic data rather than provision of the needed documents. In the same discussion where Landau made his remarks, another participant commented, "we seem to get farther and farther from the fact that the user wants hard copy of 'information' he is seeking, not information where he might find information....Why isn't someone concentrating on providing what the customer wants and needs."[36]

There is little in the vast literature of information storage and retrieval that really considers the user and his requirements. Most of what is available is included in other discussions or added as an afterthought. It is the purpose of this section of this paper to briefly assess what has been written about the user/data interface in an effort to prepare the ground for future consideration of this aspect of mechanized information service.

The Role of the Librarian in Mechanized Information Provision

There has long been a dichotomy between the "information scientist" and the "librarian." The former is characterized by his knowlege of computer hardware and software and an ability to command respect because of his skills in manipulating these once sacrosanct techniques. The librarian has suffered in comparison (at least in the eyes of researchers and the information scientists) because of his humanistic orientation. As long as the province of the information scientist was the rather esoteric manipulation of machines, files and programs the library community was reasonably content to let the separation continue. However, now that machine readable data can be processed for recognizable ends, the librarian is compelled to acknowlege that the once remote activities of the information scientist have a real place in the librarian's environment.

As the librarian comes to a realization of the role of mechanized information services and the need to access them for the user, he is confronted by an established profession of information scientists who are not quite ready to hand over the tools of their trade to be exploited by mere librarians.

In Britain, where the dichotomy between information science and librarianship is clearly demarcated by the presence of Aslib and the Library Association, an information scientist, writing of ways to encourage use in an information

center noted, "Scientists, particularly academic scientists, do not often exhibit a high regard for the services of librarians, so to encourage the use of a query-answering service the centre should present the image of being part of the scientific community rather than of the library world."[36] Another British writer notes that if university libraries develop mechanized SDI functions they will be able to offer service that is impressive enough to accord them status on the same level as other academic departments.[38] The implication is, of course, that some greater intelligence and social value is attached to the information purveyor in the guise of scientist which does not adhere to the traditional librarian.

To overcome such discriminations the librarian, once he accepts the concept that mechanization may be considered a logical extension of traditional services, must become fluent in the language of techniques of computer systems and data management. Herbert Landau addresses this problem in an article in Special Libraries and notes that the reason that librarians do not manage information centers, even though the actual purpose of the information center is the same as the library, is simply that they do not know how. Landau contends that:

> the computer data base should be viewed as an extension of the traditional bound volume library, in the same sense bound volumes replaced parchment and papyrus scrolls and clay tablets before that. While the medium of storage and techniques of access may change the basic organizational principles and logic remain the same. As evidence of this one has but to witness the joy exhibited by the computer software designers when they are introduced to such "elegant" (and old)library concepts as controlled vocabularies, classification schemes, descriptive cataloging, cross references, index files and the like. Indeed, the techniques employed by designers of advanced data management software are conceptually quite similar to those of the library world.[39]

Landau feels that "because of a love affair with the paper storage medium" librarians have failed 1) to realize the potential of the computer as a tool for the storage of information, 2) to learn the language of data processing,

and 3) to learn how to communicate with computer people. His prognosis is that "information conservatism...ensures that the design and administration of the growing number of machin-readable data bases will go by default, to computer specialists and not librarians."[40]

While Landau's predictions are not irreversible--he does acknowledge that the librarian's skills are highly compatable with mechanized information systems and desire to learn them could overcome the precedents--his warning needs to be listened to. Librarians are urgently needed who can comprehend the possibilities as well as the limits of the computer, so that the vast potential of its services might be ordered to the less sophisticated user-community, as it expands beyond the purview of information scientists and encroaches on the domain of library service.

At UCLA, the studies preliminary to setting up a mechanized information center clearly placed that center's activities within the province of the library. We have noted that in most instances operative university mechanized information systems are linked with the library. Watson notes that the area of public service is the most critical in setting up a viable mechanized information service but asks,

> Can the refernce staff undertake the complex task of providing professional information services from them to their users, which is of coure the aim and object of the whole venture? Our answer at mid-1971 would be 'not yet, in most cases, but we believe that the next few years will see the definitive change.'"[40]

He suggests that there is scope here for the definition of a new set of library duties and a new position of "Information Specialist," but warns that this may result in the person so designated becoming the conduit of all user questions concerning data base use. His hope is for a "new breed" of librarians who will be conversant with both traditional and computerized information systems.[41]

Often the computer center staffs are simply oblivious to the skills of the librarian. At Northwestern University the RIQS staff found that they needed a "sympathetic middleman" to mediate between the user and the information data base. They recruited a librarian, who, after half an hour of on-line terminal time was able to manipulate the system. This experience proved to them that the system was not so difficult for one already versed in information handling. All subsequent RIQS system use was mediated by the librarian. The article, however, does not acknowledge the skills of the librarian, but simply notes the she seemed to be the person most able to help the user interface with the system.

Obviously, the librarian has certain skills that make him a natural mediator between information and user. While computer skills are necessary, communication expertise is the real locus of the librarian's strength. The next section of this discussion of the user/data interface will concentrate on the actual experience of the user with emphasis on the librarian's skills at mediating the process.

Quey Formulation at the User/ Machine Interface

A recent article by Gerald Jahoda delineates the problems that machines experience in question analysis and search strategy for reference questions. Twenty-eight reference questions were analyzed in terms of steps needed to answer them and answers to each step were examined in order to determine whether rules for performing the individual steps by machine could be developed.[42] Jahoda found that the limitations of the machine made it very difficult to convert the reference process into machine operation. Factors limiting the machine's ability included 1) the machine's lack of knowledge of the universe and the bibliographic world, 2) inability of the machine to recognize different meanings

of the same word, 3) inability of the machine to reject stupid questions, 4) inability of the machine to reject mispellings or inaccurate quiries.[43] He concludes, "the human operator will continue to play the central role in performing the reference process for the foreseeable future." He does contend that more data is needed on how reference work is performed. His conclusion is borneout by nearly all discussions of the user/machine interface.

At the University of Georgia GDIC attempts to allow user/machine interaction were unsuccessful. Instead, librarians were trained to interact with patrons because "the well-trained reference librarian is already familiar with the data bases in their traditional printed format."[44] The process of interfacing the user with the machine simply becomes an extension of traditional reference work.

In an explanation of the user/machine interface, Jean Kirkland cites Charles A. Bunge's summary of reference skills[45] and notes that his summary closely parallels the operations of profile preparation for data base access. The eight step process of preparing a profile for a computer search consists of: 1) User interview--this acquaints the user with the subject scope as well as capabilities and limitations of the service. At this point the user's needs are closely questioned in order to identify the major concepts, suggestions for synonyms (profiles are created on a term match basis), related words or phrases, and authorities in the field. 2) Concept identification--once the question has been clarified concepts are identified. 3) Search strategy formulation--the number of search term groups and the Boolean logic relationhips between groups control the way in which search terms will be combined in order to determine in order to determine whether a given document will be a hit. A Boolean logic expression must be constructed to link the various terms. 4) Concept expansion. 5) Profile refinement--term truncation and weighting may be used to refine the

profile which may improve retrieval by picking up words otherwise overlooked. 6) Profile coding. 7) Search output. 8) Profile revision--assures that SDI searches are in the desired limits of the user's needs.[46]

At the University of New Mexico a similar procedure assures users that access to machine readable records will be the most expedient. Document retrieval is an added facet of service at New Mexico and the inclusion of bibliographies produced by data base searches in the library's collection assures the community that the results of earlier searches are available and need not be repeated.[47] The wholehearted enthusiam of the University of New Mexico staff is refreshing. Of the user/machine interface, John F. Harvey notes, "to an even greater extent than is found in other reference encounters, successful manual or computer literature searches depend upon personal and direct interaction with the user, careful search strategy development, based on detailed discussion, and a good theoretical and practical understanding of the subject to be searched."[48]

These two positive experiences with the use of traditionally trained librarians (who are usually specially trained for work with computers <u>after</u> they have been practicing reference librarians) indicates that the librarian's special skill is irreplaceable even as machine readable data-bases proliferate. Margaret Maxwell in an <u>RQ</u> article, "The Machine in the Reference Room," observes, "The analysis of these problems [how do people ask reference questions?] in a systematic fashion must be a part of the foundation for the ultimate exploitation of computer potential for reference retrieval."[49]

The special skills of the librarian in query formulation and question negotiation cannot yet be replicated by machine operations. There is still a need for a mediator sensitive to the real or unspoken needs of the user who is able to translate these needs into concepts that are in the language of

of the computer. This is only an expansion of the librarian's traditional activity of rephrasing questions that can be answered by the resources at hand. It is evident from these examples that the role of the reference librarian will be enhanced rather than endangered by the implementation of mechanized information services if the librarian is willing to view these services as a significant extension of the means at hand.

Very little data was available on the effects of implementation of mechanized information services upon traditional services. Most centers kept statistics of their own operations, but only in the roughest way made any observations about the changes these services had wrought on traditional services. There seemed to be a feeling that mechanized services increased inter-library loan demand--but no studies have yet appeared which contribute significantly to clarifying the situation. We must repeat, here, that the history of these services is barely a decade old and data is yet elusive.

Education of Users to the Existence of Mechanized Information Services

The user is not generally aware of the proliferation of machine readable information. An Aslib paper by P. O'N. Hoey contends that information services should be 'sold' to potential users and public relations must be fostered to keep users aware of the resources and capabilities of information services as they change and become more responsive to user's needs.[50]

Because mechanized information services cost money (unless the costs are picked up by the NSF) the brokerage centers (mechanized information centers) have felt aneed to "market" their product. The most extravagant documentation of this is a paper by Louis W. Stern in the Journal of the American Society for Information Science, "Promotion of Information Services: An Evaluation of

Alternative approaches." Stern describes the efforts of the MIC at Ohio State University to promote its services. Three programs were devised: 1)Opinion leadership--profiles were prepared for the most respected members of the academic community in an attmpt to create confidence in SDI services in the most influential sector of the university. 2)Blitz--blanketing of departments with literature and information about the services and presentations by the MIC staff. 3) Telephone solicitation. The results of a study to determine the most effective method of marketing found that it cost $13.53 to deliver a user under the "blitz", $13.78 under telephone solicitation and $23.07 under the opinion leadership method. The article concludes with the observation that "promotional strategy of SDI and similar services must become a fundamental concern of those involeved with these types of service."[51]

While the justification of marketing for commercial services is obvious there is some question about the fragmentation of information provision that is inherent in the information center conducting its own compaignof publicity. As we have emphasized, the mechanized information service is an extension, not a replacement of the traditional information service: an advertisement for the whole specturm of library information services might be a better approach to the publicization of mechanized information.

Concluding Observations on Mechanized Information Services

The user is the most important consideration in the provision of information services. The true measure of these services is the meaning of information for the user. Because mechanized information searches give more thorough and speedier access to the data in a field they must be considered as adjuncts to traditional service. These technological advances combined with the special and growing expertise of the reference librarian in question negotiation should result in

improved access to information. If the NCLIS vision of true cooperation and provision of documents is realized mechanized information systems will aid in the democratization of information. One of the most basic contributions of the working librarian will be to continue to keep in perspective the fact that the user and not the system is the reason for the implementation of more elaborate hardware and software. If librarians master the rudiments of mechanized information and develop techniques to mediate in a more efficient manner the needs of the user, these services will become the vehicle for greater resource utilization and, most importantly, increased user satisfactin.

ACRONYMS USED

ASIDIC	Association for Scientific Information Dissemination Centers
BIOSIS	Biosciences Information Service of Biological Abstracts
CA	Current Awareness
CAIN	Cataloging and Indexing Data Base (National Agriculture Library)
CBIS	Campus Based Information System (University of Pittsburgh)
CIS	Center for Information Services (University of California)
COMPENDEX	Computerized Engineering Index
ERIC	Educational Research Information Clearinghouse
GIDC	Georgia Information Dissemination Center
GRA	Government Reports Announcements
IITRI	Illinois Institute of Technology Research Institute
IRLC	Illinois Regional Library Council
ISI	Institute for Scientific Information
MIC	Mechanized Information Center (Ohio StateUniversity)
NASIC	Northeast Academic Scientific Information Center
NBS	National Bureau of Standards
NCLIS	National Commission on Libraries and Information Science
NELINET	New England Library and Information Network
NSF	National Science Foundation
NTIS	National Technical Information Service
OCLC	Ohio College Library Center
PA	Psychological Abstracts
PANDEX	Current Index to Scientific and Technical Literature
RIE	Resources (formerly Research) in Education
RDC	Regional Dissemination Center (affiliated with NASA)
SCI	Science Citation Index
SDI	Selective Dissemination of Information
SSCI	Social Science Citation Index

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