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Management, Cost, and Behavioral Issues with Locally Mounted Databases

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Clemson University Library has extended the online public access catalog by mounting several commercial databases and locally generated files. Experience with the system since 1987 has produced numerous observations related to management, cost, and behavioral issues. As a major goal, Clemson has attempted to provide comprehensive access to information at the lowest possible cost to users. The DORIS system at Clemson provides access to databases online over the computer network extended throughout the state. This access provides users with comprehensive search capabilities from their offices. Design of the system focuses on common interfaces for various citation databases with screen-displayed commands and full availability of help screens. In terms of cost, analysis suggests that the greater expenditure for online versus print access is more than offset by retrieval of citations, which are increased by an order of magnitude. Interface design and screen displays accommodate user psychology and enhance ease of use. Results to date suggest that citation database selection should focus on undergraduate instruction across all disciplines and research where databases are low cost and user activity is very high.

Information services and access to information at Clemson have expanded dramatically in the past decade and increasingly have become a joint effort of the university computing services and the library. Because division of responsibility remains distinct, few redundancies in access to information have occurred. A cooperative attitude coupled with a common desire to provide efficient access have resulted in a rich environment of information sources for the campus. One of the major programs developed since 1987 is online access to citation and nonbibliographic data using the BRS Search software, which is called the Document Online Retrieval Information Service (DORIS) at Clemson. The environment and strategy that led to Clemson's aggressive program of information services have been documented in an earlier paper.[1] The intent of this article is to explore those managerial, cost, and behavioral issues that surfaced during the process of developing online access to information through DORIS.

BACKGROUND

Clemson University is a state land-grant institution founded in 1889. With programs oriented toward science and technology, the university offers degrees in sixty-four undergraduate and ninety-seven graduate programs in the colleges of agricultural sciences, architecture, commerce and industry, education, engineering, forest and recreation resources, liberal arts, nursing, and sciences. Present enrollment is about 15,200 students, of whom 2,100 are graduate students. With more than 1,000 faculty on the main campus and five agricultural experiment stations, the university maintains the state's primary programs

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for instruction and research in agriculture, architecture, city and regional planning, building construction and management, textiles, forestry, ceramic engineering, and environmental engineering. Because of the technical orientation of Clemson's mission, computing has played a fundamental role at the university since the early 1960s and is widely dispersed in the many academic programs. However, a computer network that provides access to a large mainframe and mid-range processors is the mainstay of academic and administrative computing.
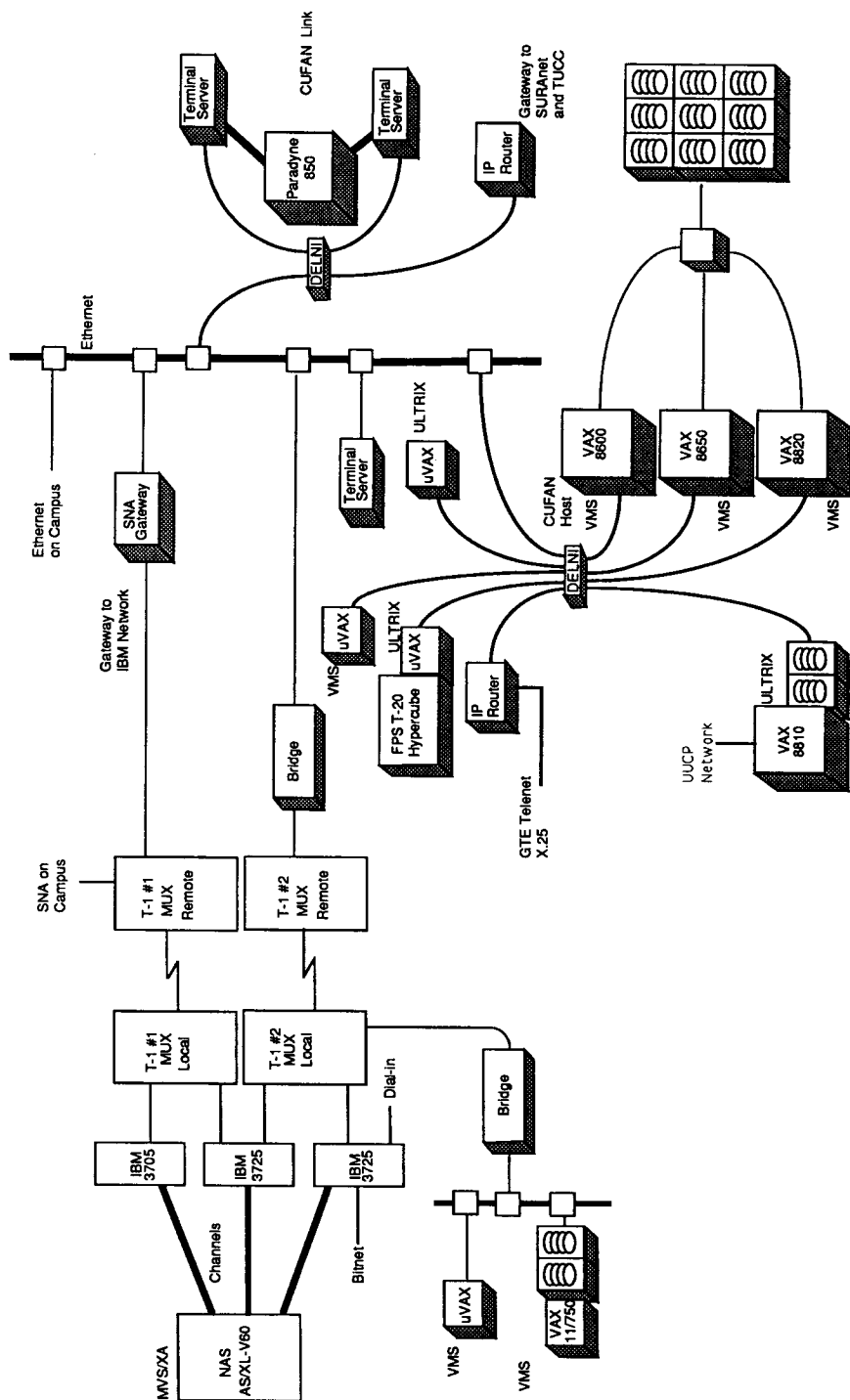
Clemson's computing facilities are operated by the Division of Computing and Information Technology (DCIT), which is composed of three departments: the Computer Center, Information Systems Development (DISD), and Administrative Programming Services (DAPS). The Computer Center operates the computing network used for all major applications, including library automation. It also operates the central timesharing computers and provides support to academic users through the Consulting and Technical Services Office. DISD develops information systems under contract to other state agencies. DAPS develops administrative systems for the university and provides all software support for library automation.

DCIT operates a statewide computing network incorporating processors from several vendors. Because of Clemson's land-grant mission, the computing network provides support to extension agents and agricultural experiment stations throughout South Carolina through the Clemson University Forestry and Agriculture Network (CUFAN). It also provides service to various state offices. As portrayed in figure 1, the network has an SNA component and a VAX/Ethernet component, connected by an SNA gateway device. All administrative computing, including library automation, runs on the SNA side of the network, although databases can be accessed from the VAX side as well. A major resource is a large IBM-compatible Hitachi AS/EX-80 mainframe computer running the MVS/XA operating system. The library's services run on this computer, using IBM's CICS transaction-processing communications subsystem. The network also provides access to several VAX computers, ranging in size from a MicroVax II to a VAX 8820.

A variety of information resources reside on the computers at Clemson. The CUFAN network includes a videotext system through which agriculture and home economics faculty share weather, market, current interest, and basic agricultural information to the farm products industry throughout the state. This system runs on a VAX node with ancillary editing and electronic mail support. From this Ethernet side, an SNA gateway links into the mainframe to provide access, along with the SNA network on campus, to several other information systems. Faculty and staff may access their leave, financial, and general personnel records in a dynamically updated, locally developed database. Similarly, students may access class schedules, transcripts, career calendars, and student services information. Both user groups also have access to computer documentation and frequently updated bulletins on computer use. The largest information resources are those developed by the library and DAPS.

The Robert Muldrow Cooper Library serves the statewide community in an innovative manner. The library encourages access to its holdings not only by Clemson students and faculty, but also by all citizens of South Carolina. In 1983 the library installed the Northwestern Online Totally Integrated System (NOTIS) from Northwestern University to automate most of its technical processes. The online catalog portion of NOTIS, called LUIS (Library User Information Service), provides access to the catalog from over 2,000 terminals on campus as well as about 300 terminals on the statewide network. Dial access is available as well. The card catalog was officially closed in May 1985 and dismantled in May 1988. Since 1985 all modules of NOTIS have been operating at Clemson, with the exception of the Multiple Database Access System, which could have provided means to mount databases other than the library catalog.

In 1987 Clemson acquired the software product BRS Search from BRS Information Technologies and began making information databases produced or acquired by Clemson available on the computing network. This service, called DORIS, provides access to the full text of databases and allows the user to search and display the portions of them containing the search terms of interest. Databases in DORIS include the commercial in-

dexes Magazine Index, Newspaper Index, Trade and Industry Index, Computer Index, and Management Contents (all made available from IAC) and the national bibliographies Agricola and ERIC, as well as such local documents as central stores inventory, campus organization minutes, and the Clemson campus directory. The database selection screen for DORIS is shown in figure 2.

Today, the electronic information access services provided by the Clemson Library have become a vital part of its mission. The development of these services involves close cooperation with Clemson's Division of Computing and Information Technology. The library automation projects are joint efforts of these organizations. In fact, the selection of the BRS software was made with criteria developed jointly by the library and DAPS. Inquiries to DAPS over a period of several years made it apparent that Clemson needed a text-retrieval package for nonlibrary applications including the faculty minutes, the telephone directory, and the central stores inventory of the purchasing office. Criteria important to the selection of a text-retrieval package in-

cluded compatibility with NOTIS via CICS, fast retrieval on very large files, and powerful Boolean/keyword access to records. In addition, it was considered important that the software contain an easily modifiable interface so that screens presented to the user could be readily updated. BRS was chosen because it runs under CICS, uses the same search engine as the keyword module of NOTIS, and has a powerful interface modification tool in the form of Mentor (a module of the BRS search software). The software was purchased rather than leased because this was more cost-effective in the long run. Given an environment where automation is as heavily used as it is at Clemson, the library has made a substantial investment in computer hardware. At this time the network in the library includes 155 sessions running on eighty-three terminals on the NAS mainframe. Twenty-four of these terminals are installed for the public. Each public terminal runs two sessions: one locked into DORIS and the other locked into the public catalog, LUIS. Switching from one to the other is simple matter of pressing the alternate key and the insert key

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Database Selection

The following databases are available.
Type the number that corresponds to the database you wish to search and press **ENTER**. If you need a more detailed description of the databases, type h and press **ENTER**.

1. CU Organization Minutes
2. CU Campus Directory
3. University Stores Catalog
4. CU Computer Resources
    Info System

10. AGRICOLA (1/84 thru 3/90)
11. AGRICOLA (3/90 Only)
12. Magazine Index
13. Newspaper Index
14. Computer Database
15. Trade and Industry Index
16. Management Contents
17. FOCUS (Dropout Prevention Database)
18. ERIC (Education Database)

Type a selection **number** and press **ENTER** or
type **q** to Quit or **h** for Help and press **ENTER** -->

Figure 2. Database Selection Screen under the DORIS On-site System.

simultaneously. This, in effect, provides hot key instantaneous switching between the two information systems. Staff in the library also have available approximately forty Macintoshes for general office automation support. Most of these are hooked to a Dec Server or other device for access to the campus network. In addition, there are two remote centers in the library: one with sixteen terminals on the mainframe and a second with forty VT320 terminals on a VAX server. These are made available for teaching and nonlibrary use, but access to LUIS and DORIS is available here as well. Access to the systems is monitored under VTAM and RAC-F to provide control of terminal identification and security. Only Clemson users are allowed access to commercial databases on DORIS, although anyone may gain access to LUIS and locally generated databases on DORIS.

During the period in which both systems were implemented, a number of management and financial issues surfaced that had to be considered. In addition, Clemson computing and library staff attempted to deal with behavioral issues that surfaced relative to online access to information. The rest of this article reports on these issues and the efforts staff made to accommodate them.

MANAGEMENT ISSUES

Automation of information services at Clemson has had one major goal: to provide comprehensive access at the lowest possible cost to users. The extent to which success has been achieved is due fundamentally to continued efforts to focus on reducing or eliminating barriers to information. Historically, barriers that have limited users' access to information have had physical, financial, and bibliometric aspects. The card catalog required users to come into the library building to determine the existence and availability of resources. This catalog, along with printed indexes to journal citations, required users to spend many tedious hours digging out information. Financial constraints traditionally have shaped cataloging codes to limit the number of access points in the catalog. Providing access by keywords or even to publishers' series would be an overwhelming task for library staff using a manual system and would certainly expand the number of cabinets required to house the cards. Combining printed indexes to different collections of data on the same subject would be so difficult that users would be required instead to repeat the same search strategy several times to be sure comprehensive retrieval is accomplished. All of these requirements impose substantial costs on users. Decisions made with a view to reducing these costs shape the program at Clemson.

One way to improve access to citations of journal literature is to acquire CD-ROM versions of the indexes. Typically, this approach provides relatively painless access for users, although there needs to be some investment in learning to use a microcomputer-driven CD-ROM index. In fact, Clemson installed the IAC Infotrac system in 1985 to improve access to basic resources for undergraduates. This approach was hugely successful as this CD-ROM product became very popular. That popularity caused staff to consider the eventual acquisition of many CD-ROM products. However, concern quickly developed that users would have to face a virtual arcade of CD-ROMs requiring many of them to learn a large variety of interfaces. Furthermore, even if networking CD-ROMs were easy, the number of access points would be limited and probably restricted to in-library use.

Locally mounted databases provide several advantages over CD-ROMs. The number of access points to the data need be restricted only by the number of computer terminals and dial access ports made available on the mainframe. This expands the number of points of contact with the system far beyond the walls of the library building. Furthermore, CD-ROMs often have some of the same bibliometric limitations of card catalogs and printed indexes. Building inverted indexes and storing these index points on a microcomputer hard disk drive for complete keyword access may overwhelm the disk drive, much the same way as too many cards in a catalog can overwhelm the cabinets available to house them.

Perhaps most significant of all, a large collection of CD-ROMs may easily mean a large number of interfaces. Networking experiments to date do not appear to have facilitated the development of common interfaces for a variety of indexes on CD-ROM. In contrast, careful selection of the mainframe software

readily allows for a common interface to as many indexes and databases as the library determines to load. In addition, eventual linking to an e-mail system and to the public catalog may be more likely with an online system than networked CD-ROMs. Efforts to accommodate these issues simplify access to information by users, but they impose the requirement on the library to develop programming resources and on staff to handle chores otherwise less familiar to librarians.

In Clemson's case, development of DORIS required a programming staff to develop the interface and to load data. Clemson has committed roughly one-half FTE to these projects. Coordinators were also needed to handle contract negotiation, training, publicity, and similar tasks. However, it should be recognized that many of these tasks must be accommodated in the case of printed resources and CD-ROM use as well. New users of either CD-ROM indexes or online systems require bibliographic instruction in the use of the product. In the case of DORIS, a segment has been included in the basic freshman orientation sessions to teach new users how to access the system. Additional workshops and tutorials have been introduced to assist faculty and graduate students with their use of DORIS. Current efforts by reference librarians who spend many hours with individualized instruction will diminish as familiarity among users with this kind of system increases.

In terms of impact on resources, the need for disk space is one of the most significant issues. The databases mentioned above together occupy 4,403 disc cylinders (3 gigabytes) after compression of data on Clemson's mainframe. (By comparison, NOTIS application with files and indexes occupies 2.37 gigabytes at CU.) Obviously, this disk space is not free; it costs roughly $30,000 per drive per year. Clemson staff take care to compress data whenever possible and to allocate this resource only when use warrants it. Current activity on the central stores catalog found on DORIS is low enough that this file will probably be dropped soon in favor of more useful information. In fact, the oldest year of data for the commercial databases, which is typically five years old, is scratched to make room for current information. Displacing older data appears to make better use of resources even though it requires acquisition of printed indexes for access to older data. Loading new data for new databases has an additional impact on resources in the form of program development.

Clemson does not buy commercial databases in a preloaded form. Preloading would make the mounting of databases easier, but it is important to Clemson to develop expertise with database loading because of locally generated data. The databases also cost less if negotiations are made directly with vendors. Overall, loading databases has not proven to be as difficult as might be perceived. The IAC databases are formatted into fixed-field records that were easily converted to the BRS fixed-field format. Clemson currently has thirteen databases available on DORIS as noted above. All were relatively easy to load. Greater difficulty was experienced in loading records available only in the MARC format, such as the cataloging records from the Government Printing Office.

The internal format used by the BRS software utilizes fixed-field records in a specific format. The BRS loader program requires records in ODCS (BRS' in-house) format with ninety byte records and tagged fields (au = author, ti = title, and so forth). A row of fifty or more asterisks between records is required, also. Therefore the library needs programs to format files for the BRS loader, that is, to reformat the records to match this form as the initial part of the load process. Several options are available to deal with this issue.

Under the current marketing approach of BRS, databases may be purchased from the company in a preloaded format. This allows the data to be loaded quickly and with a minimum of programmer effort. Databases are usually available for lower dollar outlays if negotiations are handled directly by the library with the vendor that creates the data. However, this option requires the Clemson library to acquire or write a load program to convert the data to the BRS format. The program to load from the IAC format was written in Cobol in-house. It was a fairly easy half-day effort, because the IAC format is easy to work with, consisting of eighty byte records with one field per record. A MARC format version written in-house is taking substantially more time. In some cases it may be cost-effective to have the vendor modify the

data ahead of time. Alternatively, BRS will make load programs available at approximately $5,000 each. Because Clemson has used the software to load and access several local databases, substantial familiarity with the load programs was required. This made the option of developing load programs viable as an in-house effort. Some additional considerations of importance should surface before loading of data is attempted.

However, Clemson has determined that it is prudent to acquire data from the vendor as preformatted or organized as the vendor is willing to support at no additional cost. Several examples serve to illustrate the reason. First, separate files for each year allows convenient dropping year by year if old years are rotated out on a regular basis. If several years of data are merged into one file, complex record stripping may be required to unload a single year's data effectively. Second, in the case of the IAC databases, it may be prudent to purchase some special modification of the data ahead of time. For some of their databases, IAC makes complete microfilm collections of the journal articles available in sequentially numbered reels. These sequence numbers are available in a separate file from the citation records and must be merged in if they are to appear in a search of the database. This is not an extremely difficult program to generate, but the matching process slows down the loading significantly. Third, for some databases, nonessential data may be readily stripped out by the vendor at the time they create the file for the library.

It should be noted that Clemson has installed access to the public catalog and other databases under separate, parallel systems. This is in contrast to the approach taken at other locations to install the databases all under the public catalog front end. Several reasons underlie the Clemson approach. First, the NOTIS Multiple Database Access System was simply not available at the time Clemson staff initiated the database project. Second, once the NOTIS module was made available, pricing considerations and the specific choice of indexes available ruled against a switch to it. Third, and more important, Clemson may have a more ambitious agenda than even now can be accommodated by the NOTIS system. Among projects on the drawing board are efforts to link to the Faxon and the Carl databases as well as access to the catalogs of other institutions.

COST AND BENEFIT TRADEOFFS

In addition to the cost considerations noted above, specific attention needs to be paid to cost/benefit tradeoffs and several related issues. While disk space is expensive, not having information is also costly, as is having to get information from card catalogs, paper indexes, or CD-ROMs. Who pays the cost may differ depending on the approach followed in providing resources. An additional cost is borne by the library when it mounts a database online and thus makes it faster and easier for users to locate citations. When the library simply provides the index in printed form, thus constraining users to slow, tedious searching, an alternative cost is borne by the users. Halperin and Renfro provide a very good comparison of the tradeoffs of cost of print versus online dial access versus on-site access.[2] They make the point that calculating the direct cost of alternatives for the library is reasonably straightforward, but determining the costs to users is more difficult. Indeed, they go on to mention some of the issues, but by no means all of them. Clemson has emphasized the point that reducing the effort of users doing searches in printed sources versus online sources is perhaps as important as the library's budget.

Clemson's staff considered several costs that accrue to users and developed DORIS to minimize these as much as technically possible. The DORIS system was developed in lieu of CD-ROMs to minimize the number of interfaces required for users to learn. The interface in DORIS was designed to complement the online public catalog (LUIS) interface so that the learning requirements would be reduced still further. Terminal access was provided campuswide. This saves users the effort of coming to the library building to search an index. Microfilm cartridge reel numbers were incorporated where available into the IAC databases to give users immediate feedback regarding the library's ownership of the cited material as well the material's location. As the system grows, additional cost savings should help users more. An electronic mail service on campus is being modified to include screens that users can fill out to order books, borrow materials, or acquire photo-

copies. In the future, this will be modified still further to link with the DORIS and LUIS systems. These systems will be linked also to provide users with a command in DORIS to record each citation retrieved and to search LUIS for holdings based on those citations.

The productivity of librarians is also affected by systems like DORIS. If librarians make a printed index available, the user pays a major part of the cost of a search by personal effort. If librarians make the index available online, some of that burden is lifted from the user, who then perceives the productivity of librarians to be higher. When administrators are considering costs, they should know all the benefits that may accrue from their efforts to find funds to purchase hardware and software, whether those benefits accrue to the library or its users. As an added note, Clemson's reputation as an innovator in library automation has had positive effects on recruiting new library faculty.

In the case of Clemson's library, the software turned out to be a sunk cost. The university decided to have this software for text retrieval on several locally generated databases regardless. At the end of the 1987 academic year, excess earnings from contract services provided by computing services had produced a positive balance that needed to be eliminated for tax reasons. Having already examined several software products, a quick decision was made and an order executed to acquire the BRS Search software. It is interesting to note that this purchase amounted to a one-time expenditure of $120,000, compared to BRS gateway access to nine databases estimated to cost $233,000 per year. An additional cost is borne by the university in the amount of $12,000 for annual maintenance of the software. Of course, running an on-site system imposes some other costs as well.

Loading databases as large as some of the commercial files acquired by Clemson requires significant amounts of computer run time. The first load of five IAC databases mentioned above took 54.98 hours of wall time or 5.84 hours of CPU time. This load covered the years 1985 through 1988 and included 272 tapes containing 3,503,051 citations. These are fairly impressive statistics, especially to the programmer, who was only able to acquire an acceptable priority to ac-

commodate this job early on a Sunday morning. This effort and other financially related issues, such as support for the program, had to be carefully considered.

In the case of Agricola, ERIC and two IAC databases, funding was secured from the colleges to support the acquisition of databases specific to the disciplines covered by the colleges. This may be a dangerous approach unless some guarantee to continue funding is provided by the college. If current library funding is not used to subscribe to the database, a risk is imposed if contingencies force the college to reallocate funds. The same would be true of a journal subscription purchased by research grant funds. When the grant is over, the journal may need to be dropped unless another source is located. In Clemson's three cases to date, a commitment by the college of agriculture is based on support provided because of a long-standing relation to a major corporation. The college of education provides funding support for ERIC because of its low cost and high visibility. The two IAC databases are supported by revenue from the business college's continuing education program. For all the other citation databases funding originates with the library's current operating budget.

Use of current operating funds to support subscriptions to databases appears to be a prudent choice for a library. Over the long run, the strong tradition in favor of incremental budgeting suggests that any new technology should be introduced slowly and steadily if libraries expect to be able to afford resources demanded by users in the future. Furthermore, backup copies of the indexes in a printed version need to be provided, because permanent retention of succeeding years of index data may not be justifiable. Each year of data requires continued funding for disk space, even though the data may become less valuable to users as it ages. Therefore the provision of on-site access to indexes must be viewed as an added layer of expense on top of existing, traditional operating expenses. Since provision of online access on a sporadic basis serves users poorly, the expense of providing on-site access should only be assumed if there is a willingness to keep to this path indefinitely. The same holds true for CD-ROMs. Clemson owns *Books In Print*, both in printed as well as CD-ROM

versions. The print version cannot be eliminated because it is needed for archival use and for use in areas where access is required infrequently. Duplicate copies of resources obviously add to the direct expenses of the library, but they also often make life simpler and easier for library users. The choice of which add-on service to develop is driven by some of the issues already mentioned, but price trends of various approaches also influence this decision.

In a recently published review of the Arms' book cited above, Steve Cisler pointed out that CD-ROM prices have not dropped as fast as predicted.[3] He notes that Hitachi predicted that CD-ROM drives would drop in price below $300 by 1987. That prediction was made only one year ahead of time, but it has yet to come true. This makes the relative price of on-site access more appealing each year. Cisler continues in this vein, quoting Arms, who notes that CD-ROM prices for works such as encyclopedias and Shakespeare collections may easily descend to a level affordable for individuals. However, categories of publications such as journal subscriptions and indexes may remain too costly for them ever to reach the home market. Over the long run, on-site availability may very well be the most viable option for immediate access to timely bibliographic databases.

Significant insights into relative costs may be derived from the data summarized in table 1. For several years, the Agricola database was the most heavily searched via Dialog by Clemson library users. Average direct search costs exceeded $30 each. In contrast, approximate per search cost on the local system is less than $3.75 each. This would seem to indicate potential cost savings from mounting research databases locally. However, this average is due to a large increase in the number of searches on the database, because of its free availability at Clemson. Had the number of searches remained the same, the average search cost would have been approximately $53.75. Furthermore, it must be remembered that this file can be acquired at a fairly low cost. A more expensive file such as a medical or engineering database might easily cost as much or more per search on a local system. Databases more useful for instructional purposes may demonstrate even more significant economies.

The IAC databases at Clemson have much less value for the research community than the student group. Connects to the IAC Magazine Index are largely by undergraduates actively pursuing term paper projects. Their use of this file costs the library an average of $.55 for each search. It would be hard to imagine a student for whom the few minutes of effort used to search this index online at Clemson would not be more than compensated by the results obtained. Surely the value received by the undergraduate must exceed the per-search expense assumed by the library. Overall, from a cost standpoint the experience at Clemson suggests that greater marginal value may be gained by undergraduates than by those doing research. Instructional purposes may be met by searches on limited files; whereas mounting enough years of a major research database to accommodate faculty could easily overwhelm the financial capacity of the library.

As a final word on the issue of cost of information, David Tyckoson provides a very cogent summary of the issue of pricing resources including electronic database access.[4] He makes the point that free access to information for users is only possible when the library acquires that information at a flat cost. Once made available in a library, an encyclopedia is as close to a true public good as it may be possible to achieve. As long as it is available to everyone equally and within the limits of its physical endurance, use by one person in no way diminishes use by others. That is, the same $500 expenditure on an encyclopedia may serve 100 users or 1,000 users, with essentially no difference in cost to the library.

In contrast, access to an online service such as Dialog must be priced to users so that the library can recover direct costs, which are accrued on a per search basis. Without being able to predict how much the library will spend in a year for a dial access database, it cannot be offered free of charge. Even if data are collected in one year on the level of use of dial access service, that survey serves poorly to predict how much should be allocated to provide free access the following year. However, if a database is mounted locally, the library expends a given amount to make the database available like a public good. This is analogous to the encyclopedia or printed index. Therefore libraries can make local data-

Table 1. *Direct Cost per Search on Clemson University Databases Over a Six-Month Period, October 1989 to March 1990*

Database	Yrs. Covered	Cylinders Stored	Connects						Total Connects Oct.-Mar.	Monthly Costs:			Cost/ Con.
			Oct. 89	Nov. 89	Dec. 89	Jan. 90	Feb. 90	Mar. 90		Sub.	Soft Maint.	Storage	
Agricola	1985–90	1,102	43	241	140	371	385	371	1,551	$ 583	$ 63	$ 281	3.59
Agricola Late mo.		17	14	47	26	67	84	99	337			4	1.19
ERIC CIJE	1968–90	507		128	43	117	199	144	631	19	63	51	1.05
ERIC RIE	1981–90	221		16	10	33	41	30	130	19	63	5	3.30
CIJE + RIE		728		170	59	144	253	208	834	38	63	97	1.18
Total ERIC									1,595				1.30
IAC Computer	1986–90	289	35	233	103	202	334	262	1,169	417	63	74	2.84
IAC Magazines	1986–90	441	139	1,566	570	1,140	3,169	3,049	9,633	417	63	113	0.37
IAC Manage Contents	1986–90	67	17	144	57	105	197	161	681	417	63	17	4.37
IAC Newspapers	1986–90	678	36	400	133	280	695	818	2,362	417	63	173	1.66
IAC Trade and Industry	1986–90	1,034	43	324	92	218	428	339	1,444	417	63	264	3.09
CU Stores Cat	n/a	6	24	195	80	162	227	181	869		63	2	0.44
CU Directory	n/a	21	174	1,329	841	1,608	1,976	1,484	7,412		63	5	0.05
Dropout Calendar	n/a	4	5	29	19	38	28	33	152		63	1	2.51
Dropout Profiles	n/a	6	8	69	39	50	62	77	305		63	2	1.26
CU Minutes	1988–90	6	17	118	55	113	142	111	556		63	2	0.69
CU Comp'r Resources	n/a	4		67	114	232	368	316	1,097		63	1	0.35
Total or Average		4,403	555	5,076	2,381	4,880	8,588	9,278	29,163	$2,742	$1,000	$1,091	$0.99

bases available at no charge to users (or not available at all if the decision warrants) since budget requirements are predictable.

The effect on users is made apparent at Clemson by the level of use of Agricola. The search rate on Agricola climbed from 208 searches per year on Dialog to 200 per month on DORIS by the end of six months. Access has leveled out at about 250 connects per month on this database, which is of little interest to undergraduates. Similarly, connects to the Magazine Index run to 1,500 per month, which any experienced reference librarian might easily presume to be greater than the number of accesses to traditional printed indexes covering a similar collection of journals.

The bottom line today may be unclear, but the impression is strong that the tradeoff in direct costs to at least one modest research library favors expending library dollars to make on-site access to citation databases available, especially when they have high instructional value or heavy research use. Examination of some behavioral issues may make this impression clearer still.

BEHAVIORAL ISSUES

When the staff of Clemson's library first made the online public access catalog available to users, it was done so with a carefully constructed publicity campaign. Two major concerns of that program were to maximize awareness of the catalog while making the system as inviting as possible. In order to do so, public relations staff at Clemson developed an advertising approach that ascribed a persona to the catalog. Since Northwestern had referred to their public access module as LUIS for some time, that name was retained and simply personified by means of a caricature. Campus news media portrayed the catalog as a little cartoon character that looked like a friendly being with the extremities of a hobbit and a torso and head resembling a terminal. His ready smile appears to have gone a long way toward convincing novice computer terminal users that online catalogs are no threat. That same kind of approach was followed with the introduction of on-site access to citation databases.

Although the name DORIS is an acronym, its readily familiar feminine nature was used to ascribe personality to this system as well.

This was done deliberately to humanize what may otherwise be seen as mechanical and frightening. Despite the ease with which each of these systems may be used, even by a novice, the sight of terminals where card catalogs and printed indexes previously existed can often intimidate users from the start. Giving some human aspect to the system softens the initial impact. This works particularly well in conjunction with a help desk set up especially to assist users with the catalog and DORIS. For the first three weeks of each semester, staff establish a temporary information service adjacent to the LUIS/DORIS terminals. Any user that appears to be unfamiliar with the system receives immediate assistance and instruction if desired. This interaction provides a cordial introduction that includes the suggestion that the user familiarize himself with the interface via the help screens. Even though a little study is required with these screens, they will enhance users' ability with the systems; they therefore need to be as easy to use as possible.

The LUIS interface was developed at Northwestern with a great deal of competent input and study. As a result, the interface is elegant, simple, and powerful. Despite some criticism, there may not be a better overall design available in any other system, which is a credit to the developers. In any event, Clemson users were thoroughly familiar with it at the time DORIS was installed. Therefore the DORIS interface was modeled on LUIS, but with some obvious differences incorporated in order to make sure users know which system they are using at any time. The objective was to design an interface for DORIS-thatat would be as familiar as possible and as easy to use as LUIS, yet would not confuse users over which type of data they were searching. Lower-case bold letters were used to abbreviate commands, as in LUIS. Similarly, all commands that are logically useable from any given screen are included in screen displays at all points. It is desirable that users be able to see where they can go and are going without becoming either hung up or frustrated. The screen is formatted so that the data to be searched are input at the top rather than the bottom. This differentiates it from the basic search screen in LUIS and thus provides continuous information to the user on which system is being used, as shown in

figure 3. Substantial time was consumed in communicating information from librarians into screen designs for the interface.

Each database loaded on DORIS requires slightly different packets of information for help screens, which DORIS incorporates throughout. These are generalized wherever possible, but variation in the subject disciplines covered requires variation in examples. Although the interface in DORIS is command driven, there is a logical sequence to screens, which is likely to be followed by nearly every first-time user. Indeed, users typically proceed from the introductory screens, where the user's identification is required, to the database selection screen, and from there to a basic search screen. From a search screen one may proceed to search, to review results of a search, to return to the database selection screen, or to quit the system. From any screen, specific help is available related to the function of that screen. For example, from the basic search screen one may retrieve help that starts with a menu of selections on the organization of the database, basics of searching, refining searches, field qualification, Boolean operators, truncation, named persons, combining searches, error messages, and command stacking, as shown in figure 4. A separate set of help screens is available for each of these topics.

Once viewed, the user may proceed back to the help menu, the search screen, and so forth. Time involved in developing these screens included a significant amount of screen painting by the programmer, but even more time was required to develop examples. An example that is relevant to physics may not be suitable for history. Therefore, reference librarians evaluated the help screens to develop specific examples related to their subject expertise. No effort was made to determine the cost of this labor, but it is apparent that even more effort is required if users are to maximize results from DORIS.

Although some impressions were considered as to what types of skills users bring to searching DORIS and the catalog, little systematic consideration of some of the issues raised by Anne Lipow and others was incorporated in screen design or bibliographic instruction.[5] This is an oversight that is excused only by time constraints on the developers and lack of a full staff in the bibliographic

instruction unit of the Clemson library. If the message Lipow brings (that consistency and bibliographic instruction issues are important to the online catalog) is important to the online catalog, it is doubly important with on-site databases. Commonality of search techniques between libraries in regard to on-site systems is less likely than with public catalogs. Staff in the Clemson bibliographic instruction unit are currently preparing improvements to help screens and instruction on the use of DORIS. It should be noted also that Clemson has doubled the staff assigned to this unit this year, in part to improve use of on-site services. This is important, since library staff have become more aware that faculty are not important users of systems such as DORIS at this point.

Faculty appear to depend on their own network and information-collecting techniques. Some of those techniques utilize the search skills of graduate students. Thus the students tend to use DORIS and similar systems more than faculty. Students use the system heavily to gather information relevant to writing papers as part of their learning experience. This meets the instructional mission of the university, not its research mission. In fact, in the use of Clemson's library only 15.3 percent of allowable direct library expenditures were assignable to the organized research program of the university in fiscal year 1987.[6] There is no reason to believe that a percentage such as this is atypical of research libraries. Therefore, on-site systems need to be designed with use by students and the unsophisticated kept uppermost in mind. Furthermore, the choice of databases to be mounted should be based substantially on their instructional value. The pattern of use at Clemson supports this contention, since the general citation databases are receiving four to six times as much use as the most heavily used research index. Additional insights related to user experience at Clemson and to behavioral issues affect database selection.

While Clemson as yet has no written selection policy, the need for such will probably arise in the near future. Currently, databases are selected on the basis of price, the general subject content's appropriateness to Clemson, and the availability of access by other means. Whether the software can handle the data, the quality of the product, the

```
                    Search Screen for Magazine Index


Search Query -->




NOTE : The Magazine Index may also be called MAGS in subsequent screens.


========================  Search  Instructions  ========================

1. To search for a reference, type the word or words you wish to seek in
   the search query line, then press ENTER.

2. If you wish to refine your search strategy to obtain specific results,
   type h and press ENTER for Help screens with detailed instructions.


========================================================================


Type r to Review/Combine previous searches, h for Help,
    c to Change databases, or q to Quit and press ENTER.
```

```
LUIS:  LIBRARY USER INFORMATION SERVICE

LUIS can be used to find BIBLIOGRAPHIC information, LOCATIONS, and CALL NUMBERS
for cataloged publications held by Clemson University Libraries.  CIRCULATION
information is available for most titles in LUIS.


       SEARCH options:       COMMANDS:
   To search by  TITLE:          t
                 AUTHOR:         a
                 SUBJECT:        s
                 KEYWORD:        k

A SEARCH MAY BE MADE FROM ANY SCREEN.  Type t= , a= , s= ,or k= ,followed by
the search term.  TO CORRECT A MISTAKE, type over the error or clear the screen
to start over.



TO QUIT LUIS FROM NON-LIBRARY TERMINALS, CLEAR THE SCREEN

TYPE m FOR MORE LUIS INFORMATION.
TYPE a, t, s, or k for APPROPRIATE HELP SCREENS
TYPE news FOR LIBRARY-SYSTEM NEWS.
TYPE st FOR LIBRARIES HOURS.
TYPE COMMAND AND PRESS ENTER==>
```

Figure 3. Basic Search Screen Displays for the DORIS and LUIS Systems.

Search Help for Magazine Index

1. **Organization** of the Magazine Index database.
2. **Basics** of searching the Magazine Index database.
3. **Refining (broadening or narrowing)** a search.
4. Using **Field Qualification**.
5. Using **Boolean Operators**.
6. Using **Truncation**.
7. Searching for **Named Persons**.
8. **Combining** searches.
9. **Error Messages** while searching.
10. Using **Command Stacking**.

To get help with any of the above topics, type the number of the
topic and press **ENTER**. After viewing the help screen(s) on the topic,
you will return to this screen.

Type a number and press **ENTER**,
Or to return to the search screen, press **ENTER**. -->

Search Help for Magazine Index
Using the **AND** Operator

The and operator will narrow the search by decreasing the number of records retrieved.
This operator requires that all the combined terms appear in any record before it will retrieved.

For example, the search query:
terrorism and **Ireland**
will retrieve the following record:

TI TITLE: **Terrorism**: tracing the international network.
DE DESCTIPTOR: Northern **Ireland**--Crime

Press **ENTER** to continue with Boolean Operators help or
type **m** and press **ENTER** for search help menu or
type **s** and press **ENTER** to Search. -->

Figure 4. Search Help Screens for the DORIS On-site System.

number of years needed, and an evaluation of the file contents against some standard are considered in selection as well. Overall, Clemson staff currently believe that the library should try to convince departments to pay for databases for instructional use if they can, and insist on it for research. This has had some impact on departmental budgets and raises an issue of ownership that may become a problem in the future. As a selection policy is developed, the need to develop alternate financial support will be examined with the need for the library to retain its autonomy in relation to evaluating the instructional resource needs of the students. To date, the databases selected have largely affected users positively.

Online access to indexes and other databases is very popular. For example, one of the most frequently used databases is the campus telephone directory. Part of this popularity may be due to the power of keyword access to retrieve the telephone number of Jennifer who lives in Johnstone Hall or Jeffrey who majors in journalism. However, queues at the twenty-four terminals in the public area of the library occur frequently.

As measured by wear and tear on the journal collection, use has increased significantly. Some unsolicited input from faculty has been more serious and very encouraging. Several faculty members have indicated that the online catalog and databases have contributed positively to the quality of student papers submitted for class assignments. This is probably attributable to the improvement in access to citations over printed indexes, which leads to more articles being read. The easier it is to find information, the more likely it is to be used. On the negative side, however, students tend to retrieve only a selected, current portion of the information available on a topic. For instructional purposes, this may be acceptable, but one must recognize that students may be reinforcing cursory research skills. (This same tendency probably occurs with printed indexes but is less easily observed.) Future design must address this problem, perhaps by making the link to further information even easier. In fact, additional encouragement has arisen in the form of requests for other added services.

The public catalog, LUIS, created a demand from users for access to journal cita-

tions. Online access to book citations, especially subject, motivated students to request improved access to journal contents. This demand provided significant input to the library staff in terms of seeking means to mount on-site access to citation databases. Following this, as users determined the existence of citations to articles relevant to their study, they immediately began to enquire as to when the full text would be available through the system. Alternatively, many voiced an interest in being able to move from a search of DORIS into a search of LUIS for information on holdings relevant to the cited journals. This has created demand for an electronic mail link and document delivery. The Clemson library has begun to deliver books, and future plans include developing projects to better meet both of these demands. Once those are met, still newer demands will surely surface. It is premature to predict, but a few suggestions of what kinds of things to do differently have become apparent.

If the IAC databases were loaded today, some additional modifications would be made to improve their usefulness. First, book reviews would be stripped out and loaded in a separate database. A significant number of largely irrelevant citations to book reviews are frequently retrieved in searches of the general indexes. These tend to be an interference, because book reviews are usually important only under circumstances where the user specifically desires them. Second, citations to the newswires would be removed from Newspaper and Trade and Industry Indexes if these files were reloaded. Again, these interfere with user success, since Clemson does not subscribe to any newswire. In fact, staff are investigating the value of loading on-site access to the full text of several newspapers and/or newswires as an alternative.

CONCLUSION

Clemson's program to mount general-interest and research databases designed to meet the needs of students and faculty appears to have been implemented only shortly before this approach became generally popular among research libraries. In 1987 Clemson was one of five or six research libraries that had mounted databases locally. Since then, a survey reported by the Reference and Adult Services Division of the American Library

Association in January 1990 listed thirty-three institutions with on-site access to databases. Clearly, the dawning of a new age has come to research libraries.

The full portent of this new age is hard to envision. However, the lessons learned from early efforts at Clemson and similar schools with on-site access help clear the vision. Certainly, the power of local online access to information databases enriches the learning environment for students and eases the burden of information retrieval for faculty. Clemson's library and DAPS will continue to pursue this program in order to facilitate access to information by removing the barriers that constrain users.

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