

**ANALYSIS AND REDESIGN OF A  
LIBRARY ELECTRONIC REFERENCE AREA**

by

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Report submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

**MASTER OF SCIENCE**

in

Systems Engineering

**APPROVED:**



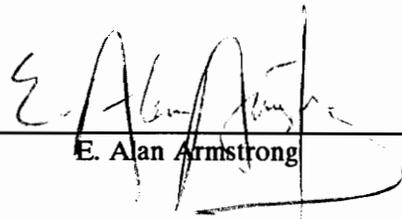
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May, 1991  
Blacksburg, Virginia

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## I. INTRODUCTION

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### A. Executive Summary

The Electronic Reference Area (ERA) at the Virginia Tech Newman Library is analyzed from a systems engineering perspective. The ERA provides library users with access to computerized bibliographic indices to serial and other literature, and to a variety of self-contained statistical and full-text databases. Advances in hardware technology have outpaced those in software sophistication, resulting in widespread problems in usability and effectiveness. Even so, an ERA remains "a flagship or showpiece program for the entire library" (O'Leary, 1990b, p. 33).

In Section II, the Newman ERA is thoroughly described and ERA usage and users are defined, partially on the basis of two surveys conducted as part of this project. The user task of information retrieval is described and a new, comprehensive model is presented.

In Section III, 10 problem areas are identified; 7 are discussed in detail while 3 are mentioned briefly in Appendix B. For each of the seven main problem areas, an objective measure of performance is stated and evidence for the importance of the problem is presented based on the literature and on local investigations.

In Section IV, 24 recommendations are presented in five groups:

- Expand the Network: Extent and Access,
- Improve the Facilities and Equipment,
- Adopt New Procedures for Selecting Vendors and Databases,
- Expand User Assistance and Training, and
- Manage the ERA Using Performance Objectives.

In the concluding section, an optimistic vision is presented for the future of library automation. Appendix D contains a description of "AutoLibrary," a prototype library user interface of the type that I hope will be part of that future.

## **B. History of The Project**

This project began when I contacted the University Libraries seeking a suitable project area for my Systems Engineering Project and Report. I described my experience and capabilities, and explained that a suitable project topic would need to be a fairly complex system with several existing areas perceived to need improvement.

After discussion by management, the Electronic Reference Area was proposed, and I accepted. In discussions with ERA Manager Alan Armstrong, only two problems were originally identified: supply/demand/ scheduling issues and consumption of paper and ink during printing. Unlike some systems engineering projects, where a client has clearly identified a need or problem, it

was obvious that this project would require a fact-finding phase to determine if additional suspected problems actually existed. This fact-finding phase is described in Section II.

Based on my expectations of the problems that would be revealed, I submitted a proposal on January 15, 1991 stating the goals and objectives of the project.

**Goals:** The Project will assist the University Libraries to:

- (1) Improve the quality, availability, and ease of use of the Libraries' electronic reference system.
- (2) Improve the efficiency of electronic reference activities in terms of patron time, staff time, equipment utilization, and supplies expense.
- (3) Provide a plan designed to regain a position at the forefront of new technology leading to the evolving concept of a "library without walls."

**Objectives:** Specific objectives to be accomplished are:

- (1) Analyze and document the existing system to provide library administration and staff with a better understanding of this area.
- (2) Collect new data on the system's operation and performance that may lead to improvement. Such data will include usage statistics, user satisfaction, and user problems and suggestions.

- (3) Assess the adequacy of the number and selection of databases relative to usage, subject representation, queuing, etc.
- (4) Assess the ease of use of the system as a whole with particular attention to the user's tasks of selecting which PC stations / databases to use and handling the various different software packages.
- (5) Assess the allocation of user assistance tasks between library staff vs. systems not requiring direct human support, such as training manuals, help cards, or automated systems.
- (6) Analyze and diagram the detailed process or flow of tasks carried out sequentially by a library patron during a search using electronic tools vs. traditional manual methods.
- (7) Assess the adequacy of the computer hardware, furniture, and software relative to published human factors standards and guidelines.
- (8) Combine the analyses and recommendations into a preliminary specification and implementation plan for an improved system.

This proposal was accepted and all of these goals and objectives have now been met.

### **C. Structure of the Report**

In this report, I:

- Describe the Newman Library Electronic Reference Area (Section II),
- Set measurable standards for the ongoing performance of the Electronic Reference Area and identify areas needing improvement to meet these standards (Section III),
- Suggest actions that can be taken to make the needed improvements and demonstrate how the University Libraries can play a leading role in library automation (Section IV), and
- Share a vision of the future regarding library computer technology (Section V).

### **D. Library Automation**

Libraries are undergoing a continuing revolution in computer systems dealing with collection holdings, bibliographic databases, circulation, and other functions. Many of these automated systems operate behind the scenes from the perspective of the library user. At many libraries, for example, cataloging information for library acquisitions is obtained online from one of the large national databases

maintained by bibliographic utilities such as the Online Computer Library Center (OCLC). This method of acquiring bibliographic data ensures uniform treatment of authors' names and eliminates considerable original cataloging work at the local library level. Other library functions that are usually fully or partially automated include acquisitions, circulation control, and inter-library loan. Of course, normal office and management functions such as word processing and payroll are also automated.

There are two library automation functions which most directly affect library users: the card catalog (library holdings) and bibliographic reference (to published items -- books, journal articles, etc. -- that may or may not be held by the library).

#### **D.1. Card Catalogs**

The manual card catalog -- with sections for author, title, and subject -- began to be replaced by computer systems in the 1960s and 1970s. The first computers in most libraries were used not for cataloging but for circulation: handling the check-in and check-out of library materials. The physical circulation cards were replaced by abbreviated records stored in a computer database. The next step was the expansion or replacement of these early systems so that full card catalog records could be used. Now known as Online Public Access Catalogs (OPACs), these first-generation automated card catalogs were usually only searchable by author, title, and call number.

More features have been added over the years. Current "second-generation" systems typically include:

- integration with circulation (showing users which items are available vs. those that are checked out or otherwise unavailable),
- searching by subject (using the Library of Congress Subject Headings),
- searching by keywords (as used in the title, subjects, notes, etc.),
- browsing (easily moving to alphabetically adjacent subjects, authors, titles, and call numbers),
- full display of bibliographic records, and
- printing (Hildreth, 1989).

## **D.2. Bibliographic Reference**

The automation of bibliographic reference began in 1963 with Lockheed's Dialog system. Dialog's computer databases were accessed from users' computer terminals connected via telephone lines. Developed partially under contract to NASA, Dialog first offered commercial service in 1978. Part of Knight-Ridder since 1988, Dialog remains the largest of several online reference services, with more than 350 databases and 100,000 subscribers. The primary user for this type of online service has been the library professional. Over the years, sophisticated search strategies have evolved which require experience and repetition in order to master. The computer systems have grown larger and faster, but have remained

relatively unintelligent, forcing the users to deal with such complexities as Boolean operators (AND, OR, NOT) and alternative spellings (color vs. colour). This was not much of a problem because most users were librarians who mediated between the library patron ("end user") and the complicated computer system.

The creation of the personal computer in the late 1970s changed the picture. In 1982, Dialog created a simplified service, Knowledge Index, and marketed it directly to end users. Other services created similar programs at about the same time, and thousands of users took advantage of these lower-cost, off-hours services. End user searching was widely heralded as part of the expected "videotex" and "global village" revolutions. Many libraries established end user programs whereby library patrons could do their own searches using library microcomputers to connect with the online services. Usually, arrangements were made to subsidize all or part of the cost of the searches.

The 1980s brought a major change. Optical storage technology, usually CD-ROMs (Compact Discs - Read Only Memory), allowed entire databases to be stored on one or several 12 cm discs. Instead of connecting with the online services by phone and paying by the minute, libraries rapidly began to bring the databases in-house on CD-ROMs. Now, the majority of academic libraries have in-house CD-ROM bibliographic reference systems. Throughout this report, such systems are referred to as electronic reference areas or ERAs, and they may include online as well as CD-ROM services.

### **D.3. Integrated Systems**

A small number of leading edge libraries are experimenting with the integration of their OPACs and bibliographic reference systems. Presently, this is usually accomplished by expanding the OPAC computer system to include third-party bibliographic databases. Such a library no longer uses CD-ROMs for the main bibliographic databases. For example, about 50 libraries (mostly academic) are using locally mounted Wilson databases (Tenopir, 1991). This Wilson project was launched in 1988, and agreements have been made between Wilson and such OPAC companies as NOTIS, Innovative Interfaces, Intex, Dynix, Data Research, and VTLS (Tenopir, 1991).

### **E. The Virginia Tech Library**

The Virginia Tech University Libraries (hereafter called "the VT Library" or "the Library") comprise branches serving a student population of 23,000. The VT Library is a major academic library with a collection of 1.7 million volumes, subscriptions to 18,000 journals, and a circulation of approximately 490,000 items per year. The Library employs 203 people, including 50 faculty-level librarians, and has an annual budget of \$8.7 million.

The Virginia Tech Library has a history of being at the forefront of library computer technology. The automated card catalog developed at Virginia Tech in

the mid 1970s was later spun off as a private company. VTLS, Inc. (Virginia Tech Library System) remains one of the 10 largest suppliers of OPACs.

The VTLS OPAC system at Virginia Tech now includes over 800,000 records and provides circulation control and card catalog functions. Patrons can search for library holdings by author, title, call number, and Library of Congress Subject Headings (LCSHs). There are about 130 computer terminals plus connections to the university mainframe computer network, which includes telephone access. Compared to other second-generation systems, the Virginia Tech OPAC lacks several of the more advanced features, such as keyword searching and printing by end users.

The VT Library also has a growing Electronic Reference Area featuring a state-of-the-art network of 10 personal computers sharing 16 CD-ROMs. The ERA is explained and examined in the remainder of this report.

#### **F. Benefits of Electronic Reference**

Electronic reference systems, such as Virginia Tech's Electronic Reference Area, are immensely popular with library users (Taylor, 1989). "Among all the lessons of [electronic reference], one stands out: users love it.... To anyone who desires to see more people using information, [electronic reference] is, simply, a profound success" (O'Leary, 1990b, p. 30 and 1990a, p. 16). "Clearly, users are drawn to this service and it has rapidly become a preferred source of information

for many, offering both the convenience and retrieval advantages over its print counterparts" (Sandore, 1990, p. 33). As a result of this popularity, there are now more than 500 CD-ROM databases on the market (Tenopir, 1989d).

A recent study had 42 undergraduate students (mostly from business classes) use both CD-ROM and print indices. More than 60 percent of the participants said that the CD-ROM databases were easy to use and that the search produced useful references. Fully 85% said they would pick the CD-ROM product over the print index for their next information search (Schultz and Salomon, 1990).

### **G. Problems with Electronic Reference**

As described in Section I.D, electronic reference areas have evolved from computer systems rooted in the 1960s and designed for professional, skilled users. In their current application as systems used by untrained members of the public, many problems have emerged (Allen, 1990; Basch, 1990a; Charles and Clark, 1990; Jaros, 1990; Maciuszko, 1989; Meyer and Ruit, 1990; Puttapithakporn, 1990; Rosen, 1990; Stieg, 1990; Taylor, 1989; Tenopir, 1989a, 1989c, 1990; Zink, 1990). These problems and their solutions are addressed in the remainder of this report.

It is important to note that the mission of the reference function and the library should never be lost in the excitement of advancing computer technology. The mission remains that of service to the library patron -- and this service is

traditionally provided in a person-to-person format (Stieg, 1990). The goal of the service "is to facilitate understanding through knowledge, ... to solve information problems" (Schuman, 1990, p. 38).

With increasingly complex technology, reference librarians have found themselves helping patrons learn the technology rather than helping them meet their information needs. Information technology is rapidly changing the library profession (Buschman, 1990; Jaros, 1990; Rumsey, 1990; Schuman, 1990; Stieg, 1990) and many believe this is "a case of the tail wagging the dog" (Buschman, 1990, p. 1029). Such concerns are a subset of similar criticism directed toward computer technology in general, which is blamed for causing a deterioration of office work: increased stress, decreased personal control, and information overload (Foegen, 1989).

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## II. ERA SYSTEM DESCRIPTION

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### A. Introduction

Electronic reference services for use directly by VT Library patrons have expanded to include 25 local databases and two remote database services (see Figure 1). Most of the workstations are centralized in the Electronic Reference Area on the second floor of Newman Library. This ERA is described further in the following sections.

Other workstations exist at other library locations:

- Newman 4th floor (near the Science Reference Desk). Two workstations which are part of the network of PCs (personal computers) on the second floor.
- Art & Architecture Library. One personal computer with CD-ROM drive, used for the Sweet's database of construction product information.
- Veterinary Medicine Library. One personal computer with CD-ROM drive, used for the Medline medical database.

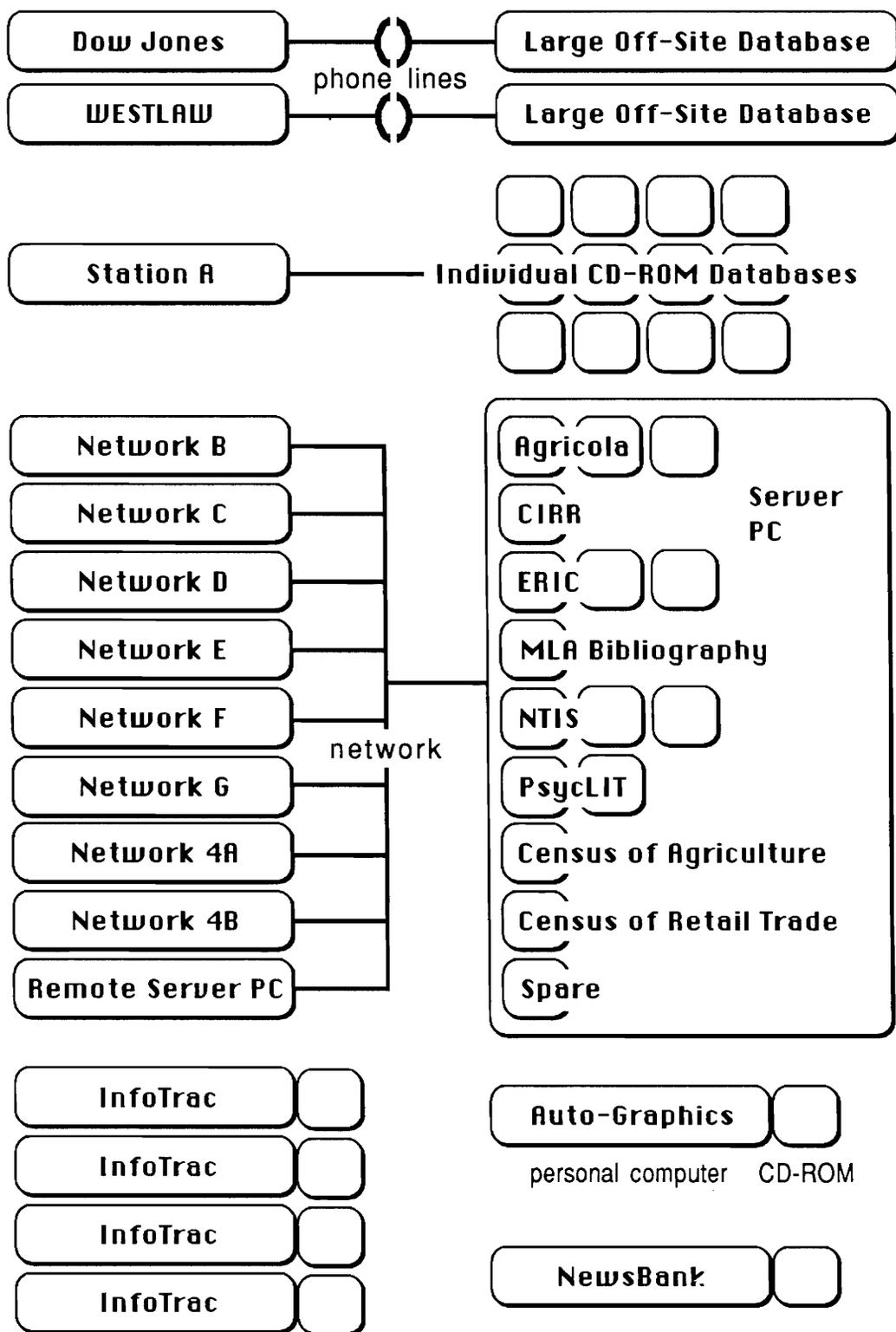


Figure 1. ERA System Schematic

## **B. Physical System Description**

### **B.1. Location and Environment**

The Newman second floor ERA (Figure 2) occupies 1400 square feet of floor space adjacent to the main reference desk. The main door to the floor is at the corner of the ERA and there is perceived to be a relatively high amount of foot traffic in the area (see Figure 3). Lighting is provided by fluorescent fixtures attached to the 10.5 foot ceiling. There are 91 square feet of windows along the south wall overlooking the courtyard. Direct sunlight never passes through the windows.

### **B.2. Furniture**

As of April 6, 1991, 10 of the 17 workstations use 30-inch high tables to support the PCs. The centers of the PC screens range from 38 to 46 inches above the floor. A variety of chairs is provided for these workstations:

- Six office-style chairs of an "ergonomic" design,
- Eight other office-style swivel chairs on casters, and
- Two padded straight-leg chairs.

Newman Library 2nd Floor

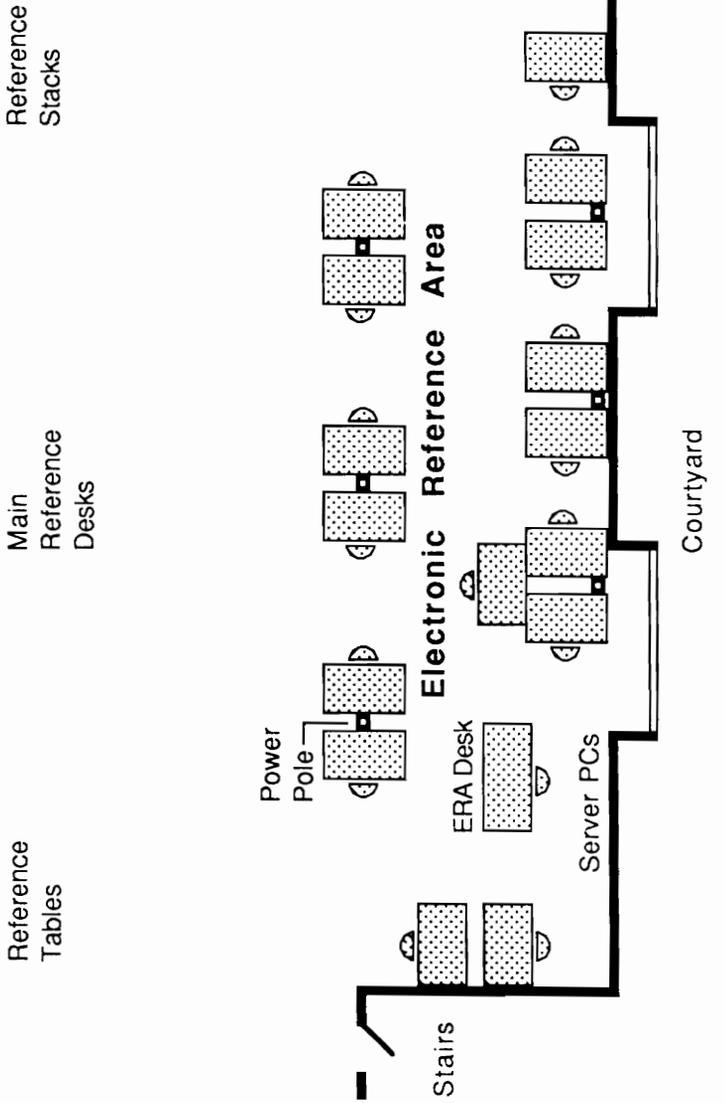


Figure 2. ERA Floor Plan



Figure 3. Two Views of the ERA

Seven workstations use 40-inch high tables (screen centers about 53 inches above the floor) and 30-inch high wooden stools. Users often choose to stand at these workstations.

### **B.3. Computer Hardware**

The ERA workstations include 17 PCs, each with an attached printer. Each workstation's configuration is shown in Table 4, excluding two of the stations which are currently on trial from the Information Access Company. For the network, there is an additional IBM-PC which is the file server -- 16 CD-ROM drives are connected to this machine -- and one additional PC to provide remote modem access. Three of the parameters listed in Table 4 (keyboard, glare condition and printer) will be discussed in Sections III and IV.

## **C. Software System Description**

### **C.1. Databases**

The ERA includes eight databases on the CD-ROM network, which can be used by several patrons simultaneously (see Table 5). There are 12 additional database packages on CD-ROMs that can be used one at a time at workstation "A," which has an attached CD-ROM drive (see Table 6). There are five dedicated subsystems with one or more PCs devoted to a single database or group of databases (see Table 7).

Table 4. ERA Workstation Configurations\*

| No. | Use                          | Computer   | Drives  | Keyboard           | Monitor          | Type            | Glare Condition     | Printer           | Misc.              |
|-----|------------------------------|------------|---------|--------------------|------------------|-----------------|---------------------|-------------------|--------------------|
| 1   | Dow Jones                    | IBM PC-XT  | H, 5    | 84 "   " IBM       | IBM              | green           | fair                | HP Thinkjet       | modem              |
| 2   | WESTLAW                      | IBM PC-XT  | H, 5, 5 | 84 "   " IBM       | IBM              | green           | fair                | Epson FX-80       | modem              |
| 3   | Station A                    | Zenith 386 | H, 5, 3 | 101 "   " Zenith   | Zenith           | VGA flat screen | no glare at all     | Epson FX-80       | Hitachi CD-ROM     |
| 4   | Network B                    | IBM PC-XT  | H, 5, 3 | 101 "—" IBM        | NEC Multisync    | EGA             | poor                | HP Thinkjet       | Hitachi CD-ROM     |
| 5   | Network C                    | IBM PC-XT  | H, 5, 5 | 101 "—" IBM        | Taxan 420        | EGA             | fair                | HP Thinkjet       | ---                |
| 6   | Network D                    | IBM PC     | H, 5, 3 | 84 "   " IBM       | Taxan 420        | EGA             | fair                | HP Thinkjet       | ---                |
| 7   | Network E                    | IBM PC-XT  | H, 5, 5 | 101 "   " BTG      | Taxan 420        | EGA             | fair                | HP Thinkjet       | ---                |
| 8   | Network F                    | IBM PC     | H, 5, 3 | 84 "   " IBM       | Taxan 420        | EGA             | fair                | HP Thinkjet       | ---                |
| 9   | Network G                    | IBM PC-XT  | H, 5, 3 | 101 "—" IBM        | NEC Multisync    | EGA             | poor                | Epson FX-850      | ---                |
| 10  | Auto-Graphics <sup>(1)</sup> | clone      | 5, CD   | 84 "   " clone     | Samsung MD-1252G | amber           | fair                | Epson FX-800      | ---                |
| 11  | NewsBank <sup>(1)</sup>      | clone      | 5, CD   | 101 "—" (special)  | Amdek AM/210+    | amber           | fair                | Panasonic KXP1180 | ---                |
| 12  | InfoTrac #1 <sup>(2)</sup>   | clone      | 5       | 84 "   " (special) | Amdek 310A       | amber           | fair <sup>(3)</sup> | HP Thinkjet       | 2 external CD-ROMs |
| 13  | InfoTrac #2 <sup>(2)</sup>   | clone      | 5       | 84 "   " (special) | imTEC 1256A      | amber           | poor                | HP Thinkjet       | 2 external CD-ROMs |
| 14  | InfoTrac #3 <sup>(2)</sup>   | clone      | 5       | 84 "   " (special) | imTEC 1256A      | amber           | poor                | HP Thinkjet       | 2 external CD-ROMs |
| 15  | InfoTrac #4 <sup>(2)</sup>   | clone      | 5       | 84 "   " (special) | Amdek 310A       | amber           | fair <sup>(3)</sup> | HP Thinkjet       | 2 external CD-ROMs |

\* see notes on the following page

## NOTES TO TABLE 4

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- (1) Leased hardware.
- (2) Leased-to-own hardware which will become property of the Library.
- (3) Has anti-glare screen surface which does not eliminate glare, and which significantly degrades image quality.

### Drives:

- H = hard drive;
- 5 = 5.25" floppy drive;
- 3 = 3.5" floppy drive;
- CD = CD-ROM drive.

### Keyboard: Indicates number of keys and orientation of the Enter key:

- vertical and displaced to the right: "|";
- horizontal: "-";
- reverse L shape: "┘".

"(Special)" indicates that several standard keys have been replaced with differently-named, color-coded keys.

Table 5. Networked CD-ROM Databases

| <u>Name</u>            | <u>Subject</u>                 | <u>No. of Discs</u> |
|------------------------|--------------------------------|---------------------|
| Agricola               | agriculture                    | 3                   |
| Census of Agriculture  | census                         | 1                   |
| Census of Retail Trade | census                         | 1                   |
| CIRR                   | corporate research reports     | 1                   |
| ERIC                   | education                      | 3                   |
| MLA Bibliography       | literature & language          | 1                   |
| NTIS*                  | government technical documents | 3                   |
| PsycLIT                | psychology                     | 2                   |

\* available only from Newman 4th floor

Table 6. Individual CD-ROM Database Packages

| <u>Name</u>                                 | <u>Subject</u>   | <u>No. of Discs</u> |
|---|------------------|---------------------|
| Compact Disclosure                          | business         | 1                   |
| Compustat PC Plus                           | business         | 1                   |
| Congressional Record, 1985                  | --               | 1                   |
| County & City Data<br>Book: 1988            | census           | 1                   |
| Economic Census, 1987                       | census           | 2 and growing       |
| GPO Monthly Catalog                         | government       | 1                   |
| Index to U.N. Documents<br>and Publications | --               | 1                   |
| Microsoft CD Reference<br>Library           | various          | 4                   |
| National Trade Data Book                    | trade statistics | 2 and growing       |
| U.S. Exports of<br>Merchandise              | census           | 1                   |
| U.S. Imports of<br>Merchandise              | census           | 1                   |
| Variety's Video Directory<br>Plus           | video tapes      | 1                   |

Table 7. Dedicated CD-ROM Databases

---

| <u>Name</u>              | <u>Subject</u>                                      | <u>No. of Stations<br/>x No. of Discs</u> |
|--------------------------|---|---|
| Auto-Graphics            | government documents                                | 1 x 1                                     |
| General<br>BusinessFile* | business journals and newspapers                    | 1 x 2                                     |
| InfoTrac                 | general periodicals and five<br>national newspapers | 4 x 2                                     |
| LegalTrac*               | legal journals                                      | 1 x 1                                     |
| NewsBank                 | local newspapers nationwide                         | 1 x 1                                     |

\* on a temporary trial

Finally, there are two dial-access information services: WESTLAW and Dow Jones News/Retrieval Service (see Table 8). Summary information on the main databases, as prepared by the Library, is shown in Appendix A.

## C.2. User Interface Software

The user interface software provides the connection between the database records and the user. The software includes many integrated functions, such as:

- database records management,
- "search engine,"
- user input from keyboard, mouse, etc., and
- output to the PC screen, printer, etc.

Sometimes, only the portions of the software which directly interact with the user are called the user interface. However, I will use the term in its broadest sense, because it is extremely difficult to draw a clear dividing line between user-level software and "underlying software." Especially with online dial-access bibliographic reference systems, the user interface software is sometimes called the "front end software."

A librarian recently wrote:

"User interface (UI) design is big business, and an academic discipline with international conferences devoted to its study. An online service's user interface includes both search language and document display. UI also comprises screen layout, the choice of

Table 8. Dial-Access Information Services

---

| <u>Name</u>                 | <u>Subject</u>          | <u>No. of Databases</u> |
|-----------------------------|-------------------------|-------------------------|
| Dow Jones<br>News/Retrieval | business and investment | more than 50            |
| WESTLAW                     | law                     | hundreds                |

---

default settings, terminology used in menus and messages, and determining how the system will respond to any conceivable action the user might take at any point. UI encompasses the overall look and feel of the program and of one's interaction with it, and it determines the degree of 'user friendliness,' if any, that one will experience" (Basch, 1990a).

Each user interface requires varying amounts of specific training and familiarity to be used successfully.

The Newman second floor ERA includes 21 separate user interfaces: 10 of these are for the network, dedicated, and dial-access services (see Table 9) and 11 are for the 12 less frequently used individual database packages. Seven user interfaces, excluding the network main menu, are used a significant amount (accounting for more than one percent of ERA usage).

### **C.3. Networking Software**

The PC network sharing the CD-ROMs uses the LANtastic commercial networking software. This software package is economical and well-respected in library circles. The network was installed in the fall of 1990 and has worked reliably since that time (Kriz, Jain, and Armstrong, 1991). Even when several people are accessing the CD-ROM simultaneously, delays are seldom noticeable. A separate software package -- Direct Net -- presents a simple main menu of

Table 9. User Interfaces

| No.                             | User Interface   | Database or Service                         | Type of Station | No. of Stations | % of Use |
|---------------------------------|------------------|---|-----------------|-----------------|----------|
| ---- Major User Interfaces ---- |                  |   |                 |                 |          |
| 1.                              | InfoTrac         | --  | Dedicated       | 4               | 36%      |
| 2.                              | SilverPlatter    | Agricola<br>CIRR<br>ERIC<br>NTIS<br>PsycLIT | Network         | --              | 33%      |
| 3.                              | Dow Jones        | --  | Dial-Access     | 1               | 8.8%     |
| 4.                              | WESTLAW          | --  | Dial-Access     | 1               | 6.6%     |
| 5.                              | WILSONDISC       | MLA Bibliog.                                | Network         | --              | 3.6%     |
| 6.                              | NewsBank         | --  | Dedicated       | 1               | 3.6%     |
| 7.                              | Auto-Graphics    | --  | Dedicated       | 1               | 1.1%     |
| ---- Minor User Interfaces ---- |                  |   |                 |                 |          |
| 8.                              | Census Bureau #2 | Retail Trade                                | Network         | --              | 0.3%     |
| 9.                              | Census Bureau #1 | Agriculture                                 | Network         | --              | 0.2%     |
| 10.                             | Direct Net       | Main Menu                                   | Network         | --              | --       |

database choices. After selecting one of these options, the user is then transferred to the selected program and its specific user interface.

## **D. User Task Analysis**

### **D.1. Definition of Users**

The starting point for any task analysis is the user. For the Electronic Reference Area, users include the general public, but particularly members of the Virginia Tech community: undergraduate and graduate students, faculty and staff, their spouses and family members. It is well known that students make up the vast majority of users at academic libraries.

A brief survey of users was conducted at the Newman ERA from April 6-13, 1991, in order to determine the type of people using the ERA and their frequency of use. Thirty-two samples were taken during the week during the times when the ERA reference desk was staffed. All samples were at least one hour apart, and about half of the available time slots were sampled in each time period subdivision (9am - 1pm, 1pm - 5pm, 5pm - 10pm, weekday, weekend). The total sample size was 213 and the overall results were:

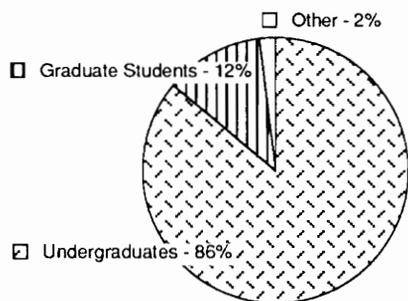
- 71% undergraduate students,
- 26% graduate students,
- 0.5% faculty, and
- 3% other.

Usage can be divided into two roughly equal categories: general reference (InfoTrac, LegalTrac, General BusinessFile, Auto-Graphics, and NewsBank) and specialized (network, Dow Jones, WESTLAW, and Station A). General reference users were 86% undergraduates, while specialized database users were only 49% undergraduates. The complete results are shown in Figure 10. A surprising result was the finding that 20% of the respondents were using the ERA for the first time during the semester, and for many of these people, it was their first time ever. Including these people, more than 50% of the respondents said they use the ERA about once a month or less frequently. On the other hand, four people (2%) use the ERA once or twice a day. These were all Dow Jones users who were monitoring their personal investments.

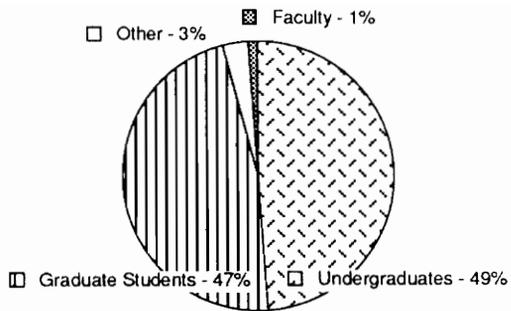
A fundamental principle of human factors is that systems should be designed to accommodate nearly the full range of expected users. For example, physical systems are typically designed for the range of human body sizes between the 5th and 95th percentiles. Of course, it is not realistic for any system to accommodate 100% of the user population. In the field of user interface design, the recommended approach is to first define the least-capable users for whom the

system is designed. For the Electronic Reference Area, users are anticipated to share these (minimum) characteristics:

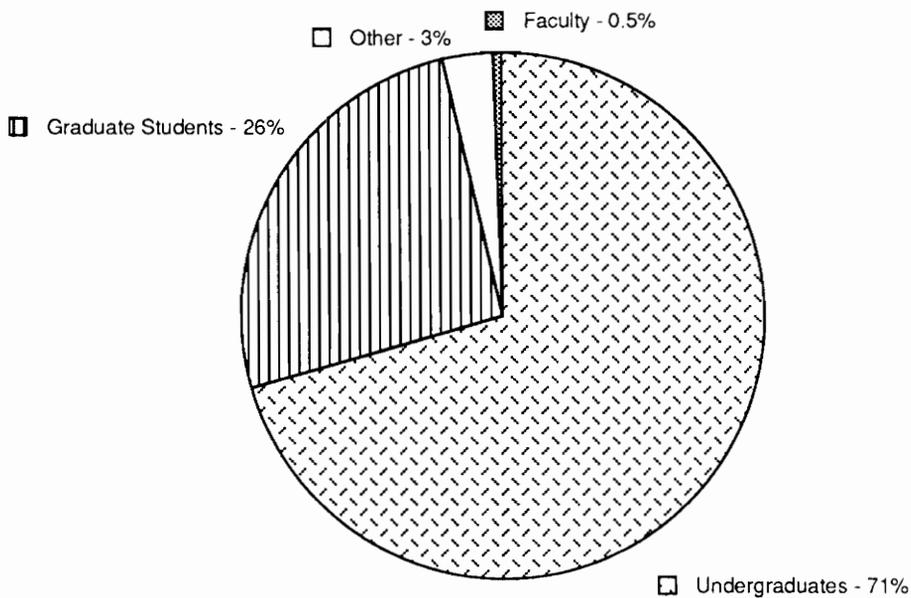
- ability to read and write English,
- physical dexterity sufficient to use a keyboard and other input devices such as a mouse or a touchscreen,
- visual ability to read the computer monitor on which text is displayed at the large end of the recommended size -- 0.14 inch high by 0.11 inch wide at a viewing distance of 20 inches (Human Factors Society, 1988). (This is roughly the size of text on a typewritten page at a spacing of six lines per inch),
- ability to locate commonly-used keys on a keyboard (alphabetic, numeric, arrow, delete/backspace, escape, break, return/enter) and to type words and phrases,
- minimal computer sophistication, with successful experience using such devices as automatic teller machines and pushbutton telephone systems,
- moderate familiarity with libraries and cataloging, but no prior experience with the ERA, and
- moderate familiarity with the tasks they are seeking to accomplish by using the ERA. For example, familiarity with the subject areas of their searches.



**General Users**



**Specialized Users**



**All ERA Users**

Figure 10. Virginia Tech ERA Users

It is important to recognize that this definition describes the extreme case -- perhaps a member of the public with no PC experience (or affinity) whatsoever.

For example, such a person is not necessarily familiar with:

- the "Numlock" key and its function on the IBM-PC keyboards,
- common mouse interactions such as "double clicking", or
- the function of a "form feed" button on a printer.

Several specific handicaps should also be accommodated:

- color blindness,
- deafness, and
- confinement to a wheelchair.

A good system design must also accommodate more experienced, capable users. For the ERA, the best example of these types of users are library staff members with online search expertise.

## **D.2. Information Retrieval Models**

The task performed by ERA users is information retrieval (IR). The classic model of information retrieval (Figure 11) includes a straightforward matching process between an information need and a document (Robertson, 1977). This model implies a linear process during which the user proceeds from a well-defined information need to a collection of relevant documents. It is widely recognized that most real-life subject searches (whether using hardcopy or computer-based indices) do not proceed this way. Rather, most searches proceed with an iterative

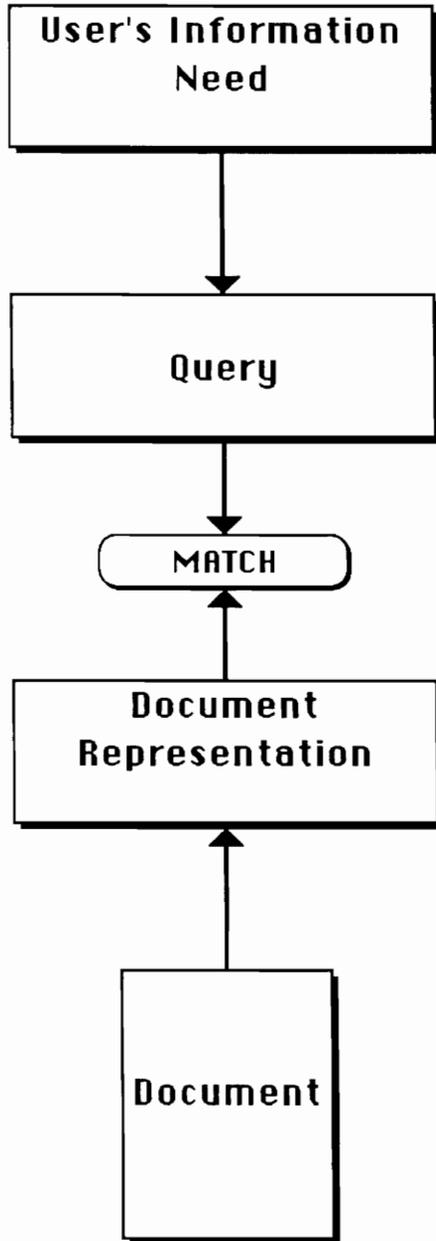


Figure 11. Classic Information Retrieval Model

process during which both the query and the underlying information need are modified. Researchers have recently documented that this evolutionary process occurs in the user's thoughts, feelings, and actions. During the process, typical feelings evolve from uncertainty and frustration to confidence and relief (Kuhlthian, Turock, George, and Belvin, 1990). An important finding of the study was that participants tended to think they were farther along in the process than they really were. For example, during task initiation, "they perceived their task as 'gathering information' rather than 'recognizing information need' " (Kuhlthian et al., p. 27). The researchers speculate that this lack of alignment may contribute to users' uncertainty and frustration during the early stages of the process.

Many automated IR systems recognize and encourage an evolutionary search process. These systems present the user with feedback from the current query so that the query can be modified. For example, the InterBrowse system is designed to present the user with:

- the result set, sorted by a specified field,
- graphic "idea maps" of subject coverage,
- attributes of the result set as shown by various size graphic icons, and
- co-citation cluster maps (Kahn, 1988).

Thus, the original IR model can be modified to form the Conventional Information Retrieval Model (Figure 12). IR systems based on this model

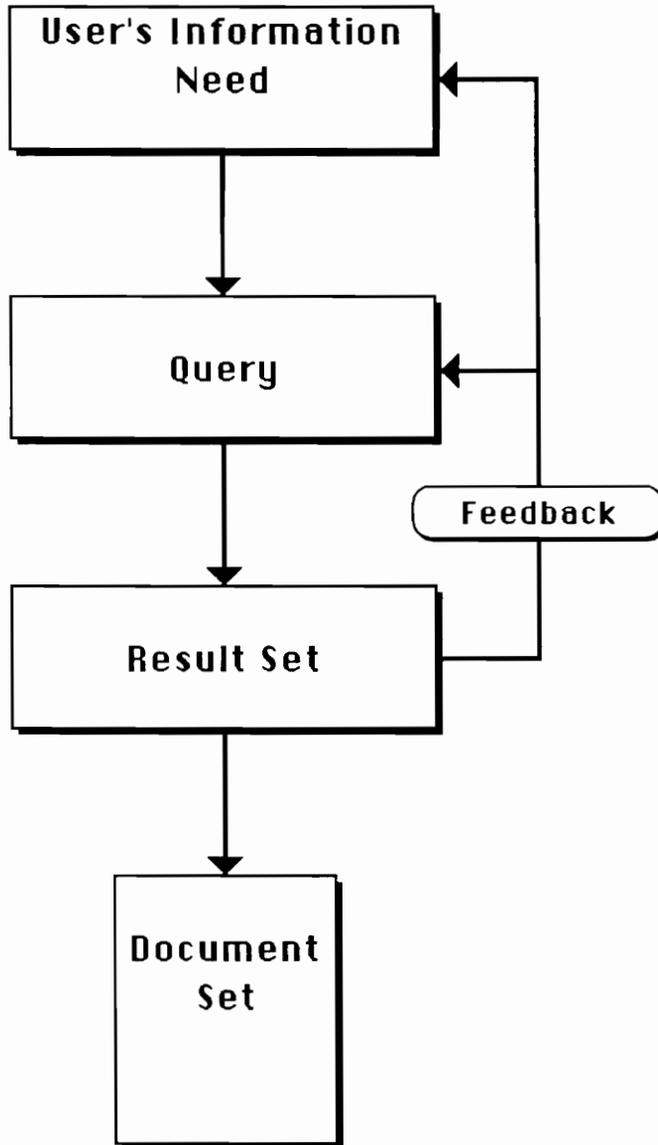


Figure 12. Conventional Information Retrieval Model

attempt to guide the user to progressively refine the query, leading to a single, "best" set of documents.

Marcia Bates (1989) has recognized that the IR model needs an additional feature. This feature permits the user to select interesting and relevant documents during the entire search process, in addition to the final set. She calls this type of search "Berry picking" (Figure 13). An additional feature available to searchers is the consultation of a subject index (hardcopy or automated) to assist in formulating the need or the query. These features are combined into what I call the Iterative Information Retrieval Model (Figure 14). After task initiation, the searcher proceeds along various paths, collecting documents along the way.

Only one additional set of features needs to be added to construct what I believe is the most complete IR model. Experience has shown that many searchers follow a wide variety of "leads" or pathways to new information. As presently practiced, most of these methods involve the physical documents themselves. Bates (1989) discusses five widely-used strategies:

- *Journal Run.* After locating several relevant articles in a particular journal, the searcher scans every issue of the journal during the range of time of interest. A typical technique is to manually read the tables of contents of all issues more recent than the latest article retrieved via the ERA search. In many subject areas, this can be a fairly efficient technique since only one or two dozen journals will need to be scanned. The Journal

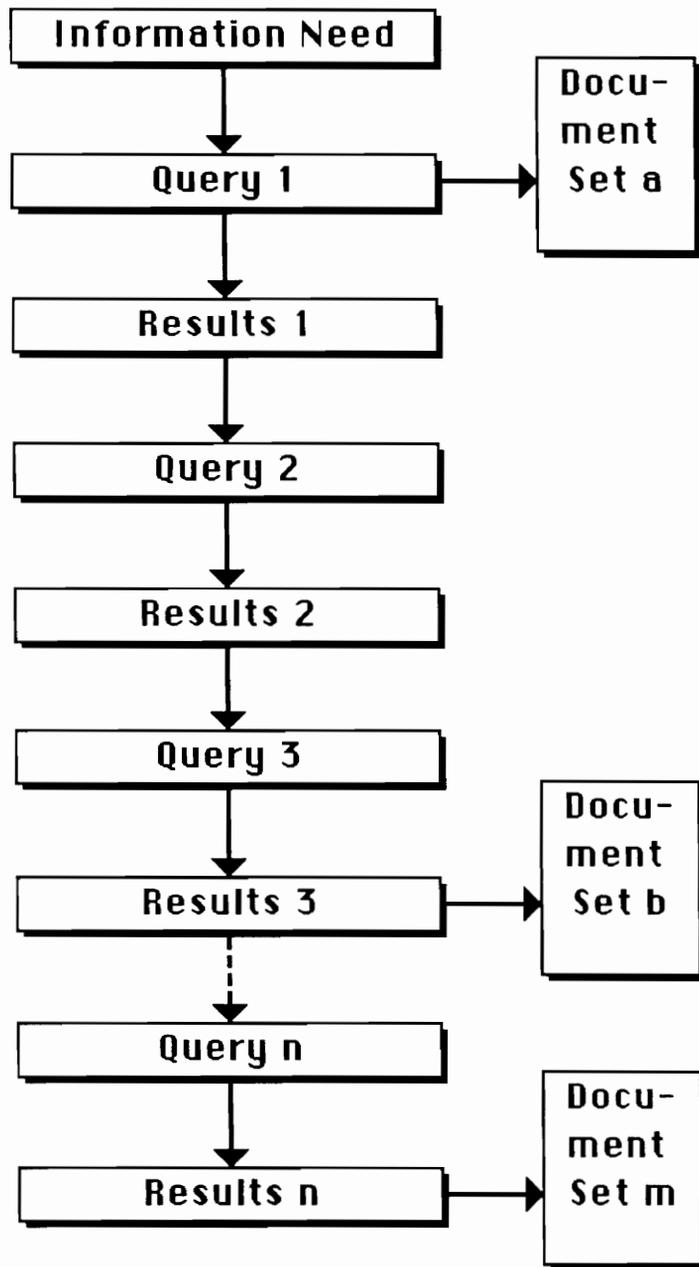


Figure 13. Berrypicking Information Retrieval Model

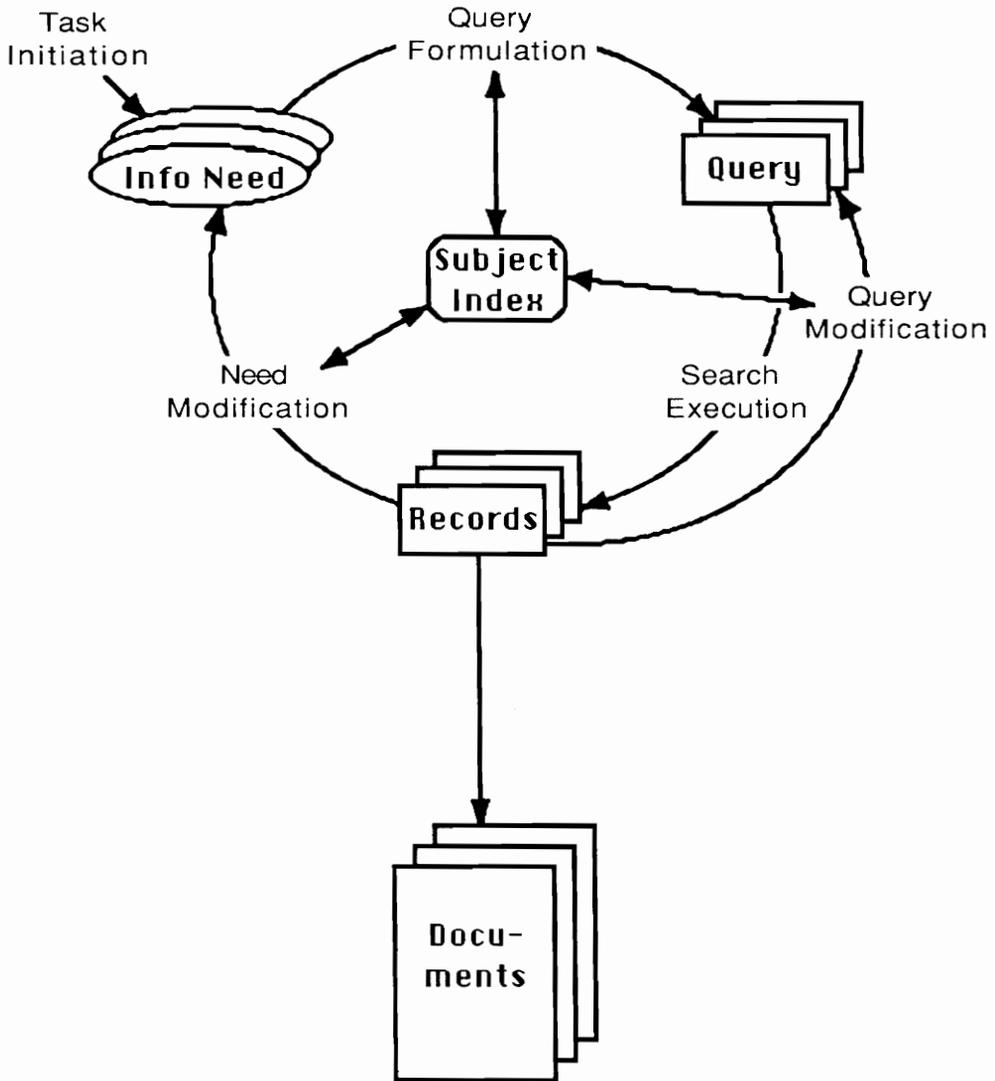


Figure 14. Iterative Information Retrieval Model

Run strategy is also effective in overcoming a significant shortcoming of CD-ROM ERA databases: the fact that the data are three to nine months out of date (Charles and Clark, 1990). Especially in graduate-level research, where refereed journals have up to a year's delay before publication, acquiring the latest available literature is essential.

- *Area Scan.* The searcher browses materials that are located near previously identified items. This is usually done physically, but it can also be done via call number browsing on an automated IR system. When the identified item is a journal article, the Area Scan strategy often leads to a Journal Run strategy.
- *Footnote Search.* The searcher retrieves items listed in footnotes and references of previously retrieved items. Effective use of this technique requires reading the retrieved item to determine which references are worth retrieving.
- *Citation Search.* The searcher consults a citation index to find more recent articles whose authors have cited a retrieved item. This strategy has the advantage of locating more recent work, but risks considerable divergence from the searcher's subject area.
- *Author Search.* The searcher retrieves other materials by the same author as that of a previously retrieved item of interest.

For authors who write primarily in one subject area, this is an effective technique.

Adding these features to the previous model produces the Comprehensive Information Retrieval Model shown in Figure 15. In addition to producing documents, the five strategies listed above may also contribute to modifications to both the information need and the query.

### **D.3. Information Retrieval Tasks**

Based on the Comprehensive model, the specific tasks of the ERA user are:

- (1) Define information need.
- (2) Select database or information service.
- (3) Formulate query.
- (4) Execute search.
- (5) Review results. This may include the selection of some items for physical acquisition -- i.e., berrypicking.
- (6) Evaluate results vs. need and
  - a) modify need (go to task 1), or
  - b) modify database / service selection (go to task 2), or
  - c) modify query (go to task 3), or
  - d) continue to task 7.

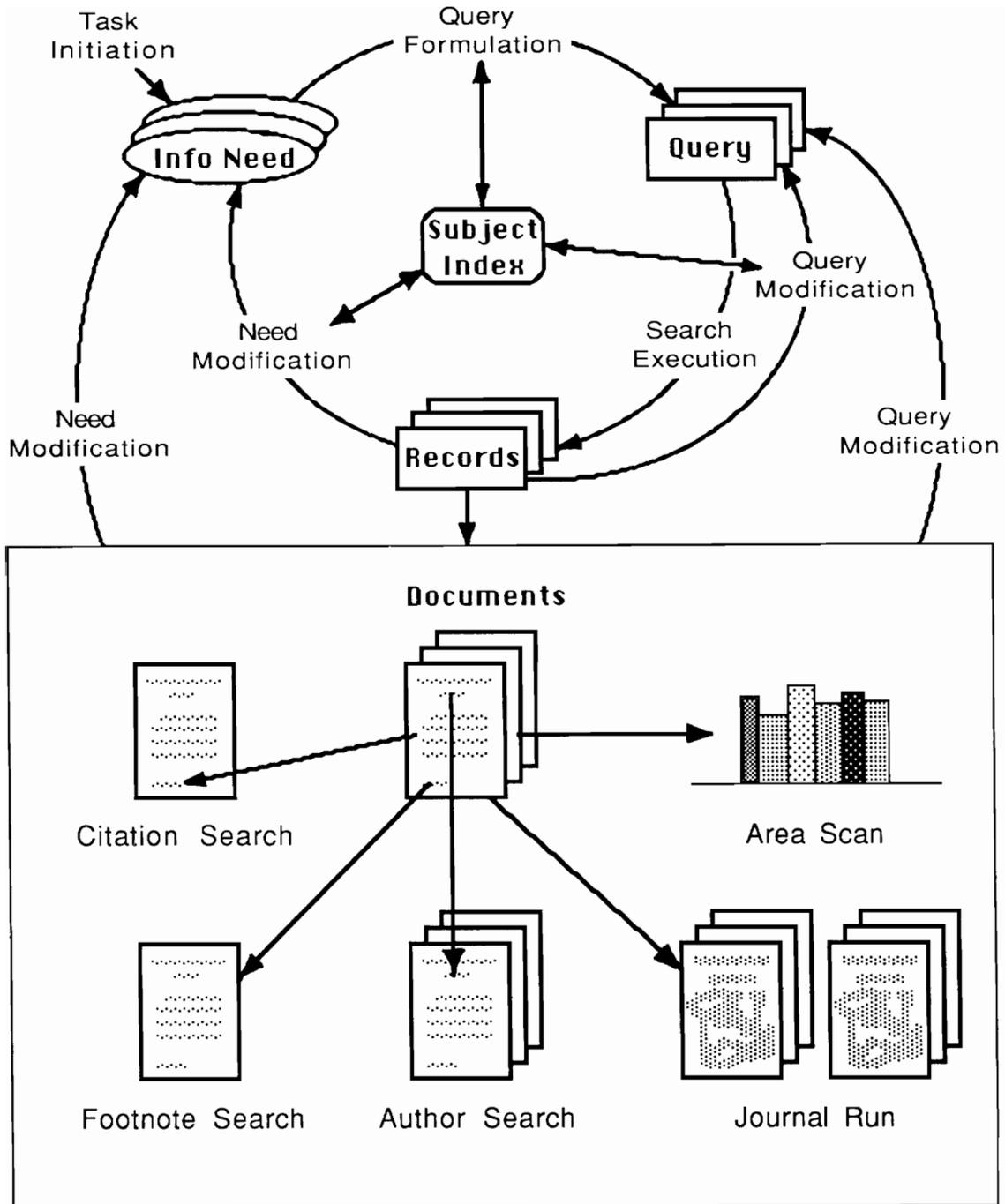


Figure 15. Comprehensive Information Retrieval Model

- (7) Transform selections. Transform the set of selected items to a more useful form (sorted by call number, printed out on paper, etc.).
- (8) Acquire selections. This task typically includes consulting the OPAC before attempting physical acquisition, and it includes photocopying journal articles, etc. For this task, the user will:
  - a) Go to the stacks for items which are owned by the library and available,
  - b) Pursue recall requests for items owned by the library but checked out to another borrower,
  - c) Pursue search requests for items owned by the library but missing from the stacks, and/or
  - d) Pursue inter-library loan requests for items not owned by the library.
- (9) Evaluate documents and select additional retrieval strategies, some of which result in returning to tasks 1, 2, or 3:
  - a) Journal Run,
  - b) Area Scan,
  - c) Footnote Search,
  - d) Citation Search, and/or
  - e) Author Search.

There can be considerable variation between searchers and searches even if the same general sequence of tasks is involved. For example, Searcher A may:

- use the ERA to produce a list of 22 document records (tasks 1 through 5),
- pick the three best items and acquire physical copies (tasks 6-8),
- read the documents carefully and acquire seven more documents from the list of references (task 9c), and
- note that 6 of the 10 documents retrieved so far are from just two journals, and conduct a Journal Run on the latest two years' issues producing five more articles (task 9a).

Searcher B may:

- use the ERA to produce an initial list of 22 documents (tasks 1 through 5),
- spend an additional two hours exploring different databases, subject terms and query forms to produce a comprehensive list of 153 items (tasks 1-6),
- carefully evaluate the records of the 153 items, select the 15 best items and acquire them (tasks 6-8).

Both searchers acquire 15 documents, both may spend about the same amount of time, but their approaches to the IR activity were vastly different. Even with identical search topics, their approaches would produce largely unique document sets.

#### D.4. Questions and Comments by ERA Users

The monitoring from February 15 through March 7, 1991 also included the collection of the most recent ERA questions asked of the librarian on duty. These 159 questions were categorized and analyzed. Also, open-ended feedback forms were placed at each ERA station. Between February 22 and April 6, 1991, eighteen of these were filled out and returned to a box at the ERA Reference Desk.

**Questions.** The questions proved to be a rich source of information. Eight main categories of questions were identified. They are listed below along with their overall percentages.

- (1) May I use/sign up for \_\_\_\_\_? (9%).
- (2) How to use. These were mostly first-time users, whom the librarian introduced to the appropriate database and helped get started (29%).
- (3) User interface questions. These questions concerned the straightforward mechanics of using the software, such as printing, understanding the printout, simple search mechanics, and downloading (21%).
- (4) Search strategy questions. These more advanced questions dealt mostly with formulating the search query, using the thesaurus,

modifying or limiting the query, combining search sets, and using Boolean operators (15%).

- (5) Database selection. These mostly involved Dow Jones or WESTLAW, and also included questions about the coverage and recency of the databases (4%).
- (6) How to find the articles listed on the printout (9%).
- (7) Hardware problems (10%).
- (8) Other questions (3%).

There were noticeable differences among the databases regarding the relative number and types of questions generated (see Table 16). Differences among the proportions of questions (2), (3), and (4) should not be emphasized as the separation of questions into these categories was difficult and largely subjective. However, the data clearly indicate that Dow Jones and WESTLAW generated the most relative number of questions (see bottom row of Table 16). This is as expected, since these databases are generally regarded as the most difficult to use in the ERA. On the other hand, InfoTrac generated relatively few questions (only 12), and a fourth of these were how to find the listed articles. One interesting issue is the relative ease of use of the SilverPlatter vs. the WILSONDISC user interface. With only a single database from Wilson, only seven questions were asked -- too few to draw any firm conclusions. However, the indication is that WILSONDISC may be easier to use.

Table 16. ERA User Questions

| Type of Question            | Silver-Platter* | Dow Jones, WEST-LAW | MLA Bib.    | News-Bank   | Info-Trac   | All Other   | Total       |
|-----------------------------|-----------------|---------------------|-------------|-------------|-------------|-------------|-------------|
| 1. May I use/sign up for... | 19%             | 0%                  | 0%          | 0%          | 0%          | 11%         | 9%          |
| 2. "How to use..."          | 37%             | 16%                 | 71%         | 50%         | 33%         | 14%         | 29%         |
| 3. User Interface           | 19%             | 34%                 | 14%         | 0%          | 17%         | 17%         | 21%         |
| 4. Search strategy          | 14%             | 26%                 | 0%          | 25%         | 8%          | 9%          | 15%         |
| 5. Database selection       | 2%              | 8%                  | 0%          | 12%         | 8%          | 3%          | 4%          |
| 6. Finding articles         | 8%              | 0%                  | 0%          | 12%         | 25%         | 14%         | 9%          |
| 7. Hardware problem         | 2%              | 16%                 | 14%         | 0%          | 8%          | 20%         | 10%         |
| 8. Other                    | 0%              | 0%                  | 0%          | 0%          | 0%          | 11%         | 3%          |
| <b>TOTAL</b>                | <b>100%</b>     | <b>100%</b>         | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> |
| Number of questions**       | 59              | 38                  | 7           | 8           | 12          | 35          | 159         |
| Percent of questions**      | 48%             | 31%                 | 6%          | 6%          | 10%         | --          | 100%        |
| Percent of usage            | 33%             | 15%                 | 10%         | 4%          | 36%         | 2%          | 100%        |
| Ratio of questions to usage | 1.5             | 2.1                 | 0.6         | 1.5         | 0.3         | --          | --          |

\* Agricola, CIRR, ERIC, PsycLIT

\*\* where the database in use was identified

**Comments.** Only 18 user comments were submitted by 14 people. This is too small a sample to draw very many conclusions. Four types of comments were expressed by at least two people:

- Compliments about the new layout, number of computers, ease of use, and "wonderful" staff -- 5 comments;
- Requests for four (different) databases -- 4 comments;
- Complaints about Dow Jones' lack of availability, difficulty of use, and noise and foot traffic in the area -- 3 comments;
- Requests to add keyword searching to VTLS (!) -- 2 comments.

Single comments were received complimenting Auto-Graphics and General BusinessFile, requesting dial-access to the network, and asking for "easier directions for non-computer people."

## **E. ERA Usage Data**

### **E.1. Method**

Data on the usage of the ERA were collected during a three-week period from February 15 through March 7, 1991. During the hours when the ERA was staffed, the librarian on duty filled out a monitoring form once per hour. In the opinion of the ERA Manager, Alan Armstrong, the monitoring period occurred

during a time of relatively light ERA usage. In academic libraries, it is typical for OPAC and ERA usage to vary widely over a semester (Kaske, 1988).

Also during this period, data were collected from the network software that tracks which CD-ROMs are being used. Duration of use data cannot be used, because there is no time-out feature with the CD-ROM programs. That is, if a user simply leaves a station without returning to the network main menu, the tracking software continues to register the current database until the next user comes along -- sometimes hours later. However, the number of times each database is accessed is tabulated. These data were used to further break down the network usage into the individual databases.

## **E.2. Results and Discussion**

InfoTrac was by far the most widely-used database, accounting for 36% of total ERA usage. At 87% of the observation times, someone was using at least one of the four InfoTrac stations. Other popular databases, accounting for at least six percent of total usage, were (in order) PsycLIT, ERIC, Dow Jones, WESTLAW, and Agricola. The network as a whole was popular, with at least one station in use 87% of the time. The average InfoTrac station was in use 52% of the time, while the average network station was used 39% of the time. The usage results are shown in Table 17. (Data on the NTIS database -- available only on Newman fourth floor -- were also included.)

Table 17. ERA Usage by Database/Service

| Database or Service and (User Interface) | % of Total ERA Use | % of Time in Use | % of Time Printing |
|--|--------------------|------------------|--------------------|
| <i>Network Total</i>                     | 38%                | 87%              | 16%                |
| InfoTrac                                 | 36%                | 87%              | 26%                |
| <i>PsycLIT (SilverPlatter)</i>           | 14%                | 73%*             | ---                |
| <i>ERIC (SilverPlatter)</i>              | 10%                | 63%*             | ---                |
| Dow Jones                                | 8.8%               | 50%              | 34%                |
| WESTLAW                                  | 6.6%               | 38%              | 23%                |
| <i>Agricola (SilverPlatter)</i>          | 6.5%               | ---              | ---                |
| NewsBank                                 | 3.6%               | 21%              | ---                |
| <i>MLA (WILSONDISC)</i>                  | 3.6%               | ---              | ---                |
| LegalTrac                                | 3.1%               | 17%              | ---                |
| All Station A Databases                  | 2.5%               | 14%              | ---                |
| <i>CIRR (SilverPlatter)</i>              | 1.9%               | ---              | ---                |
| Auto-Graphics                            | 1.1%               | 6%               | ---                |
| <i>NTIS (SilverPlatter)</i>              | 1.0%               | ---              | ---                |
| <i>Census of Retail Trade</i>            | 0.3%               | ---              | ---                |
| <i>Census of Agriculture</i>             | 0.2%               | ---              | ---                |

## Notes:

\* Estimated from 30 observations 2-15-91 through 2-18-91

--- Not calculated, or insufficient data

*Italics* indicate databases that are on the network.

The activity of printing was found to make up an average of 21% of users' time in the ERA (see Table 16). Dow Jones users spent about twice as much time printing as Network users.

Only 20 patrons were observed to be waiting to use the ERA stations. This number amounts to less than 2% of the 1,069 patrons tabulated. This low result probably does not accurately reflect the actual waiting or demand for the various services. First, all of the services, except InfoTrac, Auto-Graphics, NewsBank, and LegalTrac, operate on a sign-up basis. This procedure would be expected to reduce the waiting rate for these services. Second, for InfoTrac especially, users may have been waiting nearby and watching for a station to become available. The survey could only record those people who were clearly waiting for a station (i.e., standing in line). Twelve of the 20 observed people were waiting for InfoTrac -- a 3% waiting rate.

A more effective method of analyzing the demand for the major ERA services is to examine the distribution of the number of users at one time. For the ERA as a whole, the number of simultaneous users ranged from one to twelve, with a median of five. As shown in Figure 18, this is an approximately normal distribution. The distribution for the six network stations is also approximately normal, with all six stations in use only 2% of the time. However, the InfoTrac distribution illustrates much heavier use. The distribution is not normal, and all four stations were in use 16% of the time. Another effective measure is the percentage of time the average station is in use. These figures were 35% for the

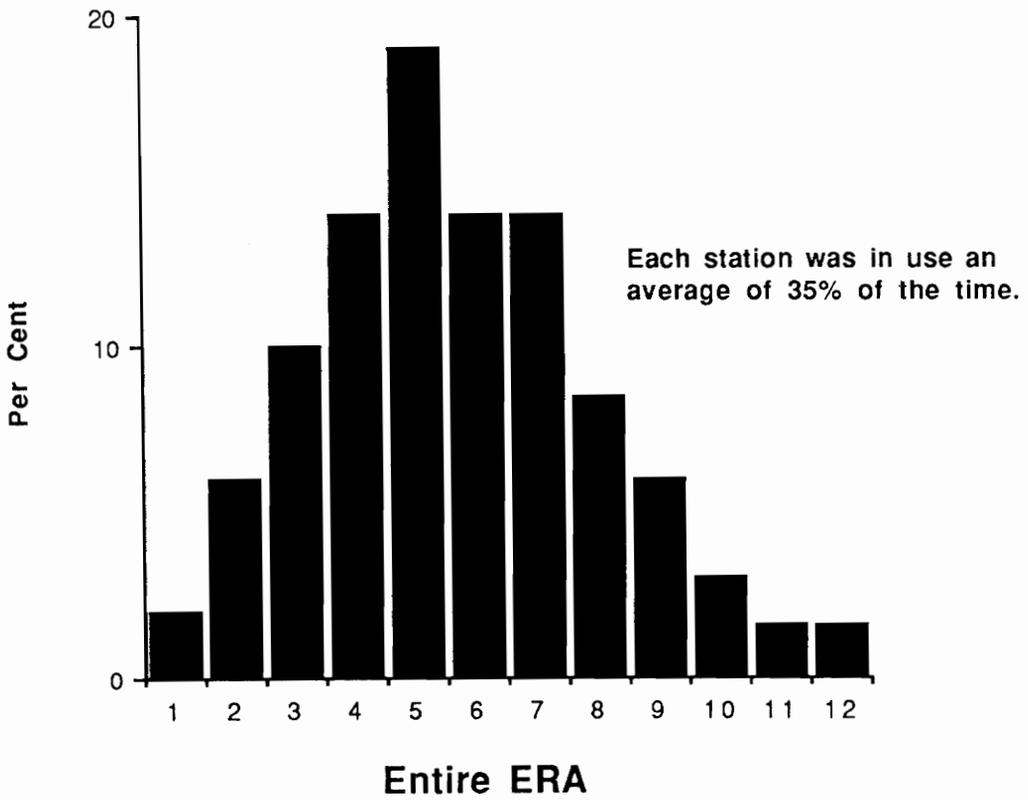
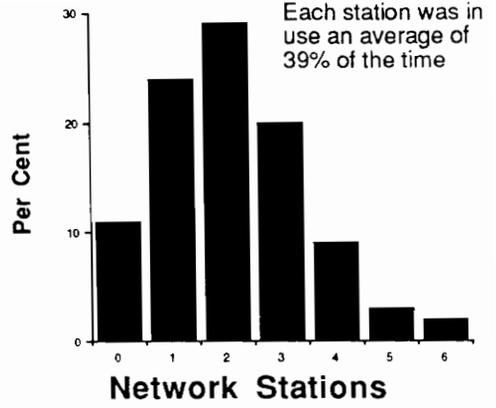
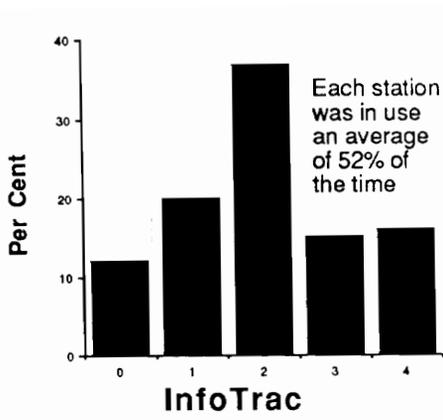


Figure 18. ERA Usage: Number of Simultaneous Users

entire ERA, 39% for the network stations, and 52% for InfoTrac. An increase in this measure, accompanied by a flattening of the right side of the distribution histogram, is an indication that demand is becoming too high.

A final area examined by the survey was system reliability. There were 99 station samples during which the stations were not working at the observation times. This represents a 3.3% down time figure for the 16 stations (there were 189 observations). Most of the problems were with the network, which had 8.2% downtime -- a 92% availability. The sampling period included a time when one network station was in the process of being repaired for nine days.

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### III. AREAS NEEDING IMPROVEMENT

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#### A. Introduction

Ten areas needing improvement have been identified. The Virginia Tech Library is by no means alone in needing improvement in these areas. In fact, much of the evidence for these problems comes from the literature and from the disciplines involved (human factors engineering, human-computer interaction, user interface design, etc.). Many of these problems occur in all libraries which include ERAs.

#### A.1. Detailed Discussions

Seven of these problems have been selected for detailed discussions. They are:

- Supply and demand of ERA stations,
- Physical conditions,
- Database availability,
- Consistency among user interfaces,
- Software usability,
- Database selection by users, and

- Quality of user searches.

These are not necessarily the seven most critical problem areas, but they share the following characteristics:

- They are verified problems that are easily observable by people skilled in the subject area of each problem.
- Objective measures of effectiveness can be formulated to allow ongoing monitoring and to determine when each problem area has been adequately addressed.
- The problem areas are solely or principally within the jurisdiction of Electronic Reference Area activities.

Each of these seven problems will be described, beginning with a general statement of the problem and a proposed objective or measure of effectiveness. Then, in the Discussion sections, the evidence will be presented supporting the assertion that these are problems that should be addressed. The proposed objectives have been developed in conjunction with the ERA Manager, Alan Armstrong. For convenient reference, all seven objectives are listed in Section III.E.

## **A.2. Auxiliary Problems**

Three selected issues do not meet the criteria for a detailed discussion. These problems are:

- Faculty involvement with the ERA,
- Usage of paper and ink, and
- User acquisition of documents.

Each of these issues is discussed briefly in Appendix B.

## B. Physical Areas

### B.1. Supply and Demand of ERA Stations

**Problem.** Demand exceeds supply at times, for some ERA services. As many as a dozen people have been observed standing in line to use one of the four InfoTrac stations.

**Objective.** For each service or database, maintain the supply of ERA stations such that: (a) single dedicated stations are in use no more than an average of 75% of the time (during ERA staffed hours), and (b) networked or multiple dedicated stations are in use no more than an average of 50% of the time, adjusted for stations out of order.

**Discussion.** The problem of supply and demand for CD-ROM stations was well-summarized by David Taylor (1989, p. 454):

The high demand for CD-ROM searching represents a potential frustration for library users. At the busiest times, we have a new bottleneck in the library. There are not enough machines. [We have] resorted to making appointments to handle the number of people who want to use ERIC and PsycLIT.

How can the library satisfy the demand for CD-ROM searching? The statistics indicate that adding twice or four times the number of stations would multiply the number of searches, but probably would not satisfy the demand. As more people use CD-ROM, more will want to use it. CD-ROMs seem to be a service that people like so much that we will never be able to provide enough of them.

This supply and demand issue stems from a common engineering principle: easier access to a resource (CD-ROM stations, travel by highway, etc.) actually creates additional demand for the resource -- there is a "positive feedback loop". In the case of highways, more convenient transportation leads to more residential and non-residential development along the route, which then leads to more traffic. For library ERA facilities, more convenient access leads to more use by those who are aware of the ERA. More use leads to increasing user proficiency and satisfaction. These satisfied users, in turn "spread the word" to those who have not yet used the ERA, creating more users.

I don't agree with Taylor that this demand can "never" be satisfied. After all, the user population of the library is a fixed number in the short term and limited in the long term. But the essential truth of positive feedback systems is this: some level of inconvenience or discomfort *must* be continued in order for the system to reach a steady-state level of service. The steady-state level (number of ERA stations) will depend directly on the level of inconvenience (waiting time) selected for the system. Waiting time is a function of the average usage of the system: the more heavily used, the higher the average waiting time. The stated objectives of 75% and 50% average usage may need to be raised during the next few years if the ERA growth rate is judged to be too high.

Once the growth rate is tracked for a period of time, future growth could be accurately predicted by a computer model. When the projected size of the Library's ERA reaches a level of, say, half of the OPAC's 130 terminals, the need to integrate the ERA with the OPAC would be obvious.

## **B.2. Physical Conditions**

**Problem.** ERA users are exposed to physical and environmental conditions which do not comply with accepted national standards and which, therefore, are potentially detrimental to the users. The detrimental effects may be increased stress and reduced task performance, or more serious issues such as contribution to cumulative damage to the eyes, wrists, or spine. A second problem is that

certain types of users -- those confined to a wheelchair, for example, cannot use some of the ERA stations.

**Objective.** Comply with the appropriate national standards -- ANSI/HFS 100-1988, American National Standard for Human Factors Engineering of Visual Display Terminal Workstations (Human Factors Society, 1988) and accommodate all persons within the defined user population.

**Discussion.** There is a great deal of experience with the design of workstations for computer operators. The consensus of numerous experts was recently codified in the 1988 standard written by the Human Factors Society (HFS) for the American National Standards Institute (ANSI). The standard provides the best available guidance on computer workstation design. The importance of ergonomic issues has been recognized by the library community. For example, an OCLC committee said:

Ergonomic issues concerning workstations and work areas must also be taken into account, both for staff and users.... Furniture designs, ... lighting, CRT placement and maneuverability, chairs, footrests, static pads, etc. are all important. Safety issues, particularly those related to the use of CRTs, are important to both staff and users (OCLC, 1988).

The ERA physical conditions (see Section II.B) have a number of shortcomings relative to the standard:

- Reflected glare from the overhead light fixtures is present on almost all of the computer monitors. Particularly bad are the network PCs with fixed-position monitors with upwardly inclined screens. On the worst monitors, the glare greatly interferes with viewing the text on the monitor.
- Noise probably exceeds the standard's suggested limit of 55 dBA. There are well-known effects of noise at these low levels. "The physiological and psychological effects of [the types of] noise... found in a library a.e stress, exhibited by headaches, and annoyance, exhibited by irritability and a decrease in the quality of task performance" (Eagan, 1991, p. 46).
- The standard's furniture requirements are quite complicated. The main approach is to make one or more furniture components adjustable in order to be able to accommodate the considerable range of human sizes from the 5th to the 95th percentiles. In its present arrangement, none of the ERA furniture complies with the standard. The 30-inch tables are too high for keyboard supports since none of the chairs is adjustable in height. The standard does not address standing height workstations with optional stools. However, it is well known that

sitting on stools which provide no backrest is virtually the worst possible sitting posture, contributing to very high pressures on the lumbar intervertebral discs (Chaffin and Anderson, 1984).

One controversial issue not covered by the ANSI/HFS standard is the potential hazard of electromagnetic fields created by computer monitors. This issue has been the subject of much recent discussion. The Environmental Protection Agency concluded in 1990 that extremely low-frequency electromagnetic radiation is a significant risk factor for developing cancer (Schulman, 1990). Several VDT manufacturers, including IBM, are reducing electromagnetic emissions (Underwood, 1990). The City of San Francisco passed an ordinance designed to reduce the VDT emissions risk (Damore, 1991). VDT workers who have expressed concern about the potential health hazard include those at the Library of Congress (Flagg, 1991). However, the latest carefully-controlled scientific study (Lewis, 1991) found no increased health risk, and there are no applicable U.S. standards. Nevertheless, it may be prudent to take a cautious position even though a final scientific verdict is probably years away. Testing has shown that a typical computer monitor creates higher field strengths to the sides and back as compared with the front. One author recommends that users should sit at arm's length (28 inches) from the front of a monitor and at least four feet from the sides and back (Stefanac, 1990).

Finally, one last physical conditions issue is that the ERA prevents users confined to wheelchairs from accessing InfoTrac, NewsBank, and Auto-Graphics.

## C. Software Areas

### C.1. Database Availability

**Problem.** The allocation of CD-ROM databases among the various subject areas is perceived by many users to be inadequate. Frequently cited omissions are engineering and medicine. (Medline is available at the Veterinary Medicine Library, but not at Newman Library.)

**Objective.** Maintain the topical distribution of specialized databases in approximate correspondence with (1) overall topical serials expenditures, (2) an average of graduate and undergraduate student enrollment, and (3) actual usage by patrons.

**Discussion.** *Introduction.* The distribution of library acquisitions across the various subject areas and disciplines is one of the major decisions made on an ongoing basis by the subject specialist librarians. CD-ROMs are handled in the same manner as other library materials. Currently, this CD-ROM selection process is an informal one, based on such factors as:

- popularity of existing CD-ROMs,
- cost of CD-ROM databases,

- ease of use of the corresponding paper index,
- requests from users (primary attention is given to those from faculty), and
- opinion of the appropriate bibliographer.

For decades, librarians have been devising formulas to assist the allocation process. Such formulas tend to be quite similar and are composed of quantifiable internal variables (student enrollment, number of faculty, etc.) and external variables (cost, literature size, etc.) (Budd, 1991). It is beyond the scope of this report to deal with the issue of whether allocation formulas should be used at the VT Library. (Currently, they are not, but the procedures *do* involve a broad allocation among the humanities, social sciences, and sciences.)

*Part 1.* For the purposes of Part 1 of the objective, the current overall allocations will be assumed to be optimal, and the emphasis will be on comparing the CD-ROM topical allocations to the overall serial allocations. The serials budget was chosen to be the standard of comparison because:

- serials make up three-quarters of the topical acquisitions budget,
- topical CD-ROM databases are primarily indices to the serial literature, and
- there are substantial topical variations in the serials-to-monographs budget ratio (0.3 to 1 for communications, 12 to 1 for chemistry, for example).

It is also assumed that cost variations among CD-ROMs approximately correspond to the cost variations among the serials on those topics.

Thus, Part 1 of the objective calls for devoting an approximately equal portion of each subject area's budget on electronic databases. The first step in analyzing this objective is the creation of new subject areas. As mentioned previously, the Library currently uses three broad areas: humanities, social sciences, and sciences. These areas are so large that they contain many dissimilar categories, and the areas do not correspond cleanly to any of the Colleges within the University.

For this report, six new subject areas were created along College lines. The subject areas and corresponding weighted percentages of student enrollment (see below for a definition of these weightings) are:

- General Reference,
- Architecture, Education, and Human Resources (19.7%),
- Business (14.0%),
- Agriculture and Veterinary Medicine (12.9%),
- Arts and Sciences (26.5%), and
- Engineering (26.9%).

Each ERA database and service was assigned to a single subject area, and the current costs were totaled. (A known weakness of this method is that database/service topics do not fall cleanly into single subject areas. However, further breakdowns of the databases/services were beyond the scope of this report.)

These calculations are shown in Table 19, along with the percentages of use at the

Table 19. ERA Database/Service Costs\*

| Subject Area                                    | Database or Service | Annual Expense         | % of Expense       | % of Use                        |
|---|---------------------|------------------------|--------------------|---------------------------------|
| 0. General Reference                            | Auto-Graphics       | \$2,250                | 4.4%               | 1.1%                            |
|   | InfoTrac            | 13,728 <sup>(1)</sup>  | 27%                | 36%                             |
|   | NewsBank            | 1,313 <sup>(2)</sup>   | 2.5%               | 3.6%                            |
|   |                     | <u>\$17,291</u>        | <u>34%</u>         | <u>41%</u>                      |
| 1. Architecture, Education, and Human Resources | ERIC                | \$650                  | 1.3%               | 10%                             |
|   | Sweets              | 0 <sup>(3)</sup>       |                    | --- <sup>(4)</sup>              |
|   |                     | <u>\$650</u>           | <u>1.3%</u>        | <u>10%</u>                      |
| 2. Business                                     | WESTLAW             | \$13,140               | 25%                | 6.6%                            |
|   | Dow Jones           | 8,800                  | 17%                | 8.8%                            |
|   | CIRR                | 1,075                  | 2.1%               | 1.9%                            |
|   |                     | <u>\$23,015</u>        | <u>45%</u>         | <u>17%</u>                      |
| 3. Agriculture and Veterinary Medicine          | Agricola            | \$650                  | 1.3%               | 6.5%                            |
|   | Medline             | 1,495                  | 2.9%               | --- <sup>(4)</sup>              |
|   |                     | <u>\$2,145</u>         | <u>4.2%</u>        | <u>NA</u>                       |
| 4. Arts and Sciences                            | PsycLIT             | \$4,525                | 8.8%               | 14.0%                           |
|   | MLA Bibliography    | 1,495                  | 2.9%               | 3.6%                            |
|   |                     | <u>\$6,020</u>         | <u>12%</u>         | <u>18%</u>                      |
| 5. Engineering                                  | NTIS                | <u>\$2,500</u>         | <u>4.8%</u>        | <u>1.0%</u>                     |
| TOTAL   |                     | <u><u>\$51,621</u></u> | <u><u>100%</u></u> | <u><u>93%<sup>(5)</sup></u></u> |

\* see notes on the following page

## NOTES TO TABLE 19

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- (1) Excludes \$4,000 allocated to hardware.
- (2) One-third of the total cost for software, hardware, printed index, and microfiches.
- (3) Included free with printed index.
- (4) Not measured.
- (5) Others: LegalTrac (free trial) - 3.1%, all individual CD-ROMs used at Station A - 2.5%, Census of Retail Trade (no cost) - 0.3%, Census of Agriculture (no cost) - 0.2%.

Newman ERA (to be discussed later). The Library's topical serials budget categories were redistributed into the six new subject areas, and the percentage of each subject area's budget used for ERA products and services was then calculated (see Table 20). As shown in Table 20, there is more than six times as much ERA spending relative to the Business budget (5.3%) than in any of the other topical areas (0.8% or less). ERA spending in the Business area totals two-thirds of all ERA database/service spending outside the General Reference area.

*Part 2.* Part 2 of the objective calls for a comparison of ERA databases with the average of undergraduate and graduate enrollment. Graduate (including professional) students make up about 19% of the Virginia Tech on-campus enrollment, but they are proportionately heavy users of the specialized (non-general reference) databases in the ERA. As described in Section II.D.1, there is roughly a 50-50 split (actually 49-51 in the survey) between graduate and undergraduate ERA users of specialized databases and services. Accordingly, an average of the graduate and undergraduate enrollment percentages is used. The difficulty is determining what measure of the ERA databases to compare with the student enrollment. Database cost is largely invalid, because cost varies widely between databases and between subject areas. The measure chosen is number of CD-ROMs (or equivalent for the online services). Even this measure is a weak one, for two reasons. First, database quality varies widely. NTIS, for example is a poor substitute for a large index to the engineering literature like Compendex Plus. Second, the number of databases available in the various subject areas

Table 20. ERA Costs as Percent of Serials Budget

| Subject Area  | Library<br>Serials<br>Budget<br>(\$1,000) | ERA<br>Expenses<br>(\$1,000) | ERA %<br>of Serials<br>Budget |
|---|---|------------------------------|-------------------------------|
| 0. General Reference                                  | \$55                                      | \$17                         | 32%                           |
| 1. Architecture,<br>Education, and<br>Human Resources | \$120                                     | \$0.65                       | 0.5%                          |
| 2. Business   | \$433                                     | \$23                         | 5.3%                          |
| 3. Agriculture and<br>Veterinary Medicine             | \$254                                     | \$2.1                        | 0.8%                          |
| 4. Arts and Sciences                                  | \$1,241                                   | \$6.0                        | 0.5%                          |
| 5. Engineering  | \$314                                     | \$2.5                        | 0.8%                          |
|   | <hr/>                                     | <hr/>                        | <hr/>                         |
| TOTAL   | \$2,417                                   | \$52                         | 2.2%                          |
|   | <hr/> <hr/>                               | <hr/> <hr/>                  | <hr/> <hr/>                   |

varies widely. It is said that more than 80% of all journal literature deals with scientific and technical subject areas (Gash, 1989).

The comparison between the number of CD-ROMs and student enrollment is shown in Table 21. As before, the conclusion is that there are many hundreds of CD-ROM equivalents available in the Business area, which has only 14% of the students. There are at least two CD-ROMs in each of the other subject areas, in very rough correspondence to enrollment.

*Part 3.* The last part of the objective calls for a comparison of database distribution with actual usage. This comparison is made using database cost and number of CD-ROMs in Tables 19 and 21, respectively. Interesting observations that emerge from these data include:

- General Reference CD-ROM expense is high (especially InfoTrac) but usage is also high,
- Business ERA services account for 45% of the ERA cost, but only 14% of the enrollment and 17% of the overall usage,
- The only engineering database, NTIS, accounts for just one percent of total use, even though its expense is five percent of the ERA spending; its two discs are 14% of the total number of local CD-ROMs, and engineering students are 27% of the weighted average enrollment.

*Analysis by category.* Analyzing topical allocation in finer detail than these broad subject areas is not straightforward, in part because of considerable use

Table 21. ERA CD-ROMs vs. Student Enrollment

|    | Subject Area                                 | Database or Service | No. of CD-ROMs                   | % of Local CD-ROMs | "50-50" Student Enrollment | % of Use |
|----|--|---------------------|----------------------------------|--------------------|----------------------------|----------|
| 0. | General Reference                            | Auto-Graphics       | 1                                | NA*                | NA                         | NA       |
|    |  | InfoTrac            | 8                                |                    |                            |          |
|    |  | NewsBank            | 1                                |                    |                            |          |
|    |  |                     | 10                               |                    |                            |          |
| 1. | Architecture, Education, and Human Resources | ERIC                | 3                                | 29%                | 20%                        | 19%      |
|    |  | Sweets              | 1                                |                    |                            |          |
|    |  |                     | 4                                |                    |                            |          |
| 2. | Business                                     | WESTLAW             | hundreds                         | 7%                 | 14%                        | 32%      |
|    |  | Dow Jones           | hundreds                         |                    |                            |          |
|    |  | CIRR                | 1                                |                    |                            |          |
|    |  |                     | hundreds                         |                    |                            |          |
| 3. | Agriculture and Veterinary Medicine          | Agricola            | 3                                | 29%                | 13%                        | 12%**    |
|    |  | Medline             | 1                                |                    |                            |          |
|    |  |                     | 4                                |                    |                            |          |
| 4. | Arts and Sciences                            | PsycLIT             | 2                                | 21%                | 26%                        | 35%      |
|    |  | MLA Bibliography    | 1                                |                    |                            |          |
|    |  |                     | 3                                |                    |                            |          |
| 5. | Engineering                                  | NTIS                | 2                                | 14%                | 27%                        | 2%       |
|    |  | TOTAL*              | 14 local +<br>hundreds<br>online | 100%               | 100%                       | 100%     |

\* excluding the General Reference Area

\*\* Agricola only

made of materials on a topic outside of the related department. For an extreme example, a study of faculty usage of the VT Library found that only four percent of psychology materials usage came from within the psychology department (Metz, 1983). Furthermore, the VT Library budget categories correspond to fewer than half of the current academic departments, and include several categories for which there are no departments. The entire College of Engineering has two budget categories, while each of the four departments in the much smaller College of Human Resources has its own category. Nevertheless, it may be useful to note the top three serials budget categories which *do* correspond to departments. They are:

- Chemistry,
- Biology (including the Botany and Zoology budget categories),  
and
- Physics.

Together, these three categories make up more than 23% of the entire topical serials budget.

## C.2. Consistency Among User Interfaces

**Problem.** ERA users are confused by many different user interfaces. Most of the confusion is due to different software, but some is also due to different hardware (keyboards).

**Objective.** Steadily reduce the number of different general-use software user interfaces to a single, integrated ERA interface by 2001, and eliminate significant hardware user interface (e.g. keyboard) differences.

**Discussion.** The term "general-use software user interfaces" is meant to exclude certain dial-access products such as WESTLAW and Dow Jones Information Service. These services are complicated, extensive, and specialized. Users tend to maintain a fairly high activity level over an extended period of time and gradually learn how to operate the systems satisfactorily (Stieg, 1990). Also excluded are the databases which are used one-at-a-time at ERA Station A. These are the most specialized, infrequently used databases. It is assumed to be not worth the effort to integrate the user interfaces of these databases with those of the frequently used bibliographic reference CD-ROMs.

It has long been known by human factors professionals that the use of different, inconsistent user interfaces reduces task performance and increases training demands. Examples of inconsistent user interfaces are different airplane cockpits, word processing programs, and computer keyboard layouts. As the number of CD-ROM vendors has grown, user interface inconsistency has become a significant problem for libraries with numerous user interfaces.

Here is a sampling of comments on this issue from several librarians and observers:

- "If you ever search more than one online system, you have grappled with the hassle of remembering different command languages for different systems" (Tenopir, 1989a, p. 56).
- "The lack of standardization in search interfaces is one of the biggest complaints voiced by reference librarians, both for themselves and on behalf of their patrons. It is hard enough for librarians themselves to master several CD-ROM search systems, without also expecting patrons to do the same" (O'Leary, 1990b, p. 28).
- "CD-ROM user interfaces vary widely.... There is no standardization in CD-ROM menu design.... The more CD-ROM products that are purchased with a variety of search and retrieval interfaces, the higher the budget and resource allocations for user training" (Rosen, 1990, pp. 101-102).

The various CD-ROM user interfaces differ at all levels: superficial command names or function key assignments, mid-level actions such as printing one record at a time or saving all selected records for one printing operation, and underlying functions such as the capabilities of the search engine. A sample of several differences of the major CD-ROM families is shown in Table 22 (from Rosen, 1990, p. 102, with my addition of InfoTrac).

Table 22. CD-ROM User Interface Differences

| CD-ROM Family | Function         |                   |                                       |                                    |                         |
|---------------|------------------|-------------------|---------------------------------------|------------------------------------|-------------------------|
|               | Help             | Print             | Previous Record                       | Main Menu                          | Exit                    |
| InfoTrac      | <b>HELP (F2)</b> | <b>PRINT (F3)</b> | <b>PRIOR LINE (8/1)</b>               | <b>START/ FINISH (press twice)</b> | <b>F7</b>               |
| SilverPlatter | <b>F1</b>        | <b>F6</b>         | <b>F9</b>                             | <b>Esc</b>                         | <b>Esc-Q</b>            |
| Dialog OnDisc | <b>F1</b>        | <b>F8</b>         | <b>Ctrl-Page Up (previous screen)</b> | <b>Esc</b>                         | <b>Q (at main menu)</b> |
| WILSON DISC   | <b>F1</b>        | <b>F6</b>         | <b>F5</b>                             | not available                      | <b>F2</b>               |
| OCLC          | <b>F1</b>        | <b>F7</b>         | <b>F5</b>                             | <b>F8</b>                          | <b>F10</b>              |

Note: Key names are **bold**

As noted in Section II.E, the most-used interfaces at the Virginia Tech ERA are InfoTrac and SilverPlatter. The user interfaces of these two products are almost completely different.

There are only three ways to deal with this issue:

- do nothing,
- increase user training, or
- reduce user interface inconsistency.

The conflict between training vs. product/system design is a familiar one in the human factors field. Many poorly designed systems can be made more useful through careful user training. However, the proper first step is to fix the system rather than apply the band-aid of training.

There are three actions available to the Library to improve user interface consistency:

- select a limited number of vendors for most CD-ROM products (short term),
- apply a "front-end" or "gateway" software program between the user and the variety of databases (medium term), or
- encourage vendors to voluntarily standardize their products (long term).

Many libraries have chosen the first, short-term strategy after first experiencing the confusion of interface proliferation. One example is the McHenry Library at the University of California at Santa Cruz:

The decision was made to standardize on the SilverPlatter product line, despite the fact that the library was more satisfied with Dialog's version of ERIC.... Standardization on one interface cut down on user training and allowed the McHenry Library to control costs. The library staff immediately noticed that SilverPlatter's standard interface promoted ease of use among both professional and novice users. After encountering difficulty in training users on more than one "family" of products, the library focused investments almost entirely on SilverPlatter's disc offerings.... Staff members now move more quickly among the workstations, able to diagnose problems and help the next user much faster. Users are able to explore the databases autonomously with instruction focusing on content and strategy (Rosen, 1990, pp. 102-103).

Standardization on one or two vendors is by no means a panacea. First, the chosen interface may not be very good (as is the case with the current version of SilverPlatter -- see Section III.C.3). Second, standardization severely limits the choice of CD-ROM products, although many of the most popular and useful databases, such as ERIC and PsycLIT, are available from multiple sources.

The second, medium-term, strategy of a front-end gateway to CD-ROM databases from multiple vendors can be implemented in several ways. The most popular current method (as mentioned in Section I.D) is to incorporate locally-mounted bibliographic databases into a library's OPAC. With some systems, the OPAC's user interface is also used with the bibliographic databases. With other systems, a second, different user interface, such as the BRS SEARCH software package, is used with the bibliographic databases. A second way to implement this gateway strategy is to use a commercial gateway software program. Many such programs now exist for dial-access information services. Perhaps the most well-known of these is EasyNet, introduced in 1984 by Telebase Systems. Other companies in the information industry provide programs such as Pro-Search and Sci-Mate Searcher (Tenopir, 1989a) and other lesser-known programs are available from small entrepreneurial companies. To my knowledge, gateway programs are not yet available for CD-ROM network systems, but it only seems a matter of time, and they may in fact already exist. A third way to implement the gateway strategy is for the Library to develop its own software package. With modern software development tools such as Hypercard (for Macintosh computers) or HyperPAD (for IBM-PCs), this is no longer such an imposing prospect. Again, this approach has been frequently taken for online services and OPACs, but apparently not yet for CD-ROM networks.

The third, long-term strategy -- industry standardization -- can be influenced but not controlled by the library. There is considerable interest in and movement

toward a Common Command Language (CCL) for information retrieval (Basch, 1990). Activities have been continuing for over a decade. Currently, there are proposed standards from both NISO (National Information Standards Organization) and ISO (International Standards Organization). These standards differ from each other and "are meant as an alternative, standardized way to search online databases, not as a replacement of the unique languages of existing online systems" (Tenopir, 1989a, p. 56). Yet, Telebase has implemented a modified, partial version of the ISO standard as part of its EasyNet software. These standardization activities center on traditional, dial-access information services, rather than CD-ROM databases. One observer has commented that "it is difficult to imagine that there will ever be standards for search and retrieval software design for CD-ROMs" (Rosen, 1990, p. 102).

Lastly, *hardware* user interface inconsistency problems are relatively minor and easily corrected. The only significant problem area is the computer keyboard, where the location of certain keys (such as enter, function, escape, break, and cursor movement) varies from model to model. Since these keys receive heavy use, inconsistencies lead directly to user errors.

### C.3. Software Usability

**Problem.** The user interface software is too difficult to use and too inefficient.

**Objective.** Reduce the number of "obvious deficiencies" in software usability by 50% by 1993 and by 90% by 2001. An obvious deficiency is a software feature which leads to a user error in more than 10% of the searches or which causes noticeably extra user effort and for which there is a feasible solution.

**Discussion.** Software usability can mean many different things. As used here, it refers to the fairly superficial aspects of the CD-ROM software which are directly responsible for user errors or inefficiencies. More fundamental software problems, such as the inherent difficulty in selecting databases or conducting a Boolean search, are discussed in Section III.D.2.

The term "user error" is somewhat of a misnomer -- most errors are simply mismatches between a user's actions and the expectations of the system designer. It should not be inferred that the user has done anything wrong. A better term for most user errors would be "usability errors."

The remainder of this section discusses numerous examples of CD-ROM and OPAC usability errors cited by librarians in recent journal articles. The purpose of this discussion is to help those readers who lack first-hand experience in software usability testing to appreciate the magnitude and importance of software usability problems. In well-designed software -- developed with a commitment to frequent user testing of interim program versions -- very few of these types of errors should be produced by released versions of the software.

A recent study of CD-ROM usability errors involved 33 students who were familiar with computers and experienced in searching computerized databases -- but with little or no experience with ERIC on SilverPlatter (Puttapithakporn, 1990). The author used a 1989 version of ERIC on SilverPlatter and observed the participants during their first 30 - 50 minute search session, which included an online tutorial. Ten different errors were observed to occur a total of 312 times. The number of occurrences per error ranged from 2 to 118. Note that any error that occurred four or more times would be an "obvious deficiency" according to the objective presented at the beginning of this section.

Following is a selected list of the frequencies and problems experienced by the 33 students:

- 118 times: Failure to use the built-in shortcut to re-enter a previous query. (The shortcut method is to type "#4" to re-execute query number 4.) The 118 times represented 27% of all queries.
- 86 times: Failure to use hyphens in multi-word queries where such phrases corresponded to phrases from the built-in index. Omitting the hyphens caused the search to be conducted with implied Boolean ANDs. One result was increased execution time from, for example, 4 seconds to 1.5 minutes.
- 35 times: Failure to continue reading the multi-page help text long enough to receive the answer to the current question. The

software's help facility consisted of 21 sets of help text ranging in length from 1 to 19 "lengthy and crowded" screens (p. 199).

Sixteen subjects accessed help 65 times, but 35 of these times were canceled after one or two screens.

- 29 times: Erasure of the search history by using the "quit" and "restart" commands before the end of the session. Sixteen participants used these commands in order to get from the "print" mode to the "find" mode. Even though doing so required users to have to re-enter their search terms, several of the subjects did so more than once.
- 10 times: Inability to correctly type in a required command, such as "citn" (for "citation").
- 9 times: Confusion and inability to proceed through one part of the "basics" lesson of the online tutorial. Six subjects could not understand the concept of the Boolean OR.
- 8 times: Misunderstanding of an on-screen prompt and selection of an unwanted menu option.
- 4 times: Misunderstanding of search syntax and typing, for example, "title" as a word to be searched when the desired action was to restrict the search to the title field.

Two additional problems were identified from post-session questionnaires:

- 20 participants (77%) desired the ability to print a given record at the time of viewing, rather than having to write down desired record numbers and type them in again in a subsequent "print mode" operation.
- All participants did not understand at least some of the two-letter codes used to identify the fields of the displayed and printed records. All participants understood "LA" (language) and all but one or two understood the codes for author, title, journal, publication year, and abstract. All of the other nine codes were *misunderstood* by 30-100% of the participants. These codes included important concepts such as the descriptor, ERIC identifier, and document type.

The author concludes the findings section of the report with the sobering remark that "presumably, these results might have been much worse had the subjects not been graduate students of library and information science" (p. 200). And recall that these students were experienced both with computers and automated searching.

Other usability studies produce similar "surprising" stories of the propensity of users *not* to read the minds of the system designers. See, for example, Jackson's (1990) account of local loading of three Wilson databases accessed via the Texas A&M OPAC.

Even systems designed with the novice user in mind have usability problems. Two examples of InfoTrac deficiencies illustrate the concept of "noticeably extra user effort" mentioned in the objective.

- InfoTrac printouts include the phrase "LIBRARY SUBSCRIBES TO JOURNAL" following records to which this applies. If the system knows this, why not give the users what they really need in order to retrieve the item: the call number?
- InfoTrac's subject category system indexes the same record under numerous headings. During any reasonable amount of browsing under alternate headings, users see (and perhaps print) the same records over and over again. Why not automatically eliminate these duplicate displays?

## D. User Task Areas

### D.1. Database Selection by Users

**Problem.** ERA users often don't select the best databases for their searches. For example, it is thought that many patrons use InfoTrac instead of a more specific and academic network database.

**Objective.** Provide a system such that at least 90% of ERA users select (or have selected for them) one of the best two reference choices (hardcopy or ERA) for their specific search.

**Discussion.** Many people believe that the ideal solution would be for the automated system to make this database selection decision for users. Such a development is being advocated (Basch, 1990a), researched (Thornburg, 1987) and even practiced (Hu, 1989). Until such a "seamless" system is available at Virginia Tech, today's reality is that users often fail to select the best databases to search.

"As [online] databases have proliferated, sorting out and keeping track of what's available, where, and in what version, has become a major concern" (Basch, 1990a, p. 18). With hundreds of online databases, this is understandable. What is perhaps surprising is that this problem exists at growing numbers of CD-ROM or locally mounted ERAs where there are only a dozen or two databases from which to choose.

A recently reported study conducted in 1988 dealt with 82 searches carried out in an academic ERA (Allen, 1990). The ERA included InfoTrac and nine Wilson CD-ROM databases, and six other databases were available in adjacent library buildings. For the 82 searches, three independent judges each selected three "best" databases, and these selections were compared to those of the library patrons.

Interestingly, the three judges were unanimous in their first-place selections only 40% of the time. Perhaps partially because of this, there was no correlation between the selections of the patrons and the judges:

- 35% of the searches were in substantial or complete agreement (score 7-9),
- 33% were in substantial or complete disagreement (score 0-2), and
- 32% were somewhere in between (score 3-6).

Another finding was that "there was no significant correlation between appropriateness of database selection and ... success in the search," where a "success" was scored when a citation was printed out. This may "indicate that patrons may not know they are working in an inappropriate database, and may continue with their searches as though they were retrieving useful citations" (p. 72). The report concludes: "Librarians should be aware of the significant differences in database selection ability by their patrons and of the desirability of providing training and assistance in database selection" (p. 74).

The possibilities for automating this database selection decision are unclear. Thornburg (1987) applied rule-based Artificial Intelligence (AI) technology to a problem of selecting among 18 databases. As in Allen's study, the "experts" disagreed in their database selections and this interfered with the validation of the AI system. The author concluded that database selection seems to be largely a matter of taste, wisdom, and experience.

An alternative and more straightforward approach to automation would be to determine the number of hits in a number of databases and rule out databases with, say, 10% or fewer hits compared to the most prolific database. As computer hardware technology advances, this type of approach may eclipse an AI strategy.

On the larger question of hardcopy vs. electronic indices, the widespread assumption that electronic searching leads to superior results has not been adequately tested. The one study I located included the conclusion that "neither mode shared an overall noteworthy advantage over the other" (Maciuszko, 1989, p. 56). This study involved 22 questions in the fields of biology, business, and popular interest. The questions were posed by six students and searched by librarians in 12 different libraries. Three Wilson indices were used, in both hardcopy and electronic versions. One finding was that recall (percent of relevant documents retrieved) and precision (percent of relevant documents in the retrieved set) "hovered around 50%" for both modes (p. 56). However, hardcopy searching was slightly better in recall, and electronic searching was slightly better in precision. (The differences were statistically significant based on t-tests.) A surprising finding was that "there was very little overlap in citations between the two systems. An average of only six percent of the combined total citations retrieved from the hardcopy and online searches were common to both systems" (p. 57).

Since users prefer electronic searching to hardcopy searching, it would be an uphill battle to attempt to encourage users to do hardcopy searching when an

appropriate electronic database is available. However, since there are some major subject areas whose journals are not covered in the Virginia Tech ERA, the use of hardcopy indices is the only no-cost alternative and may produce better results than many users might think.

## D.2. Quality of User Searches

**Problem.** ERA users don't conduct high-quality searches and they don't realize that this is the case.

**Objective.** Provide a system such that at least 90% of ERA users achieve at least a "satisfactory" rating when their actual ERA searches are evaluated as to "quality."

**Discussion.** "Except for the use of personal computers, present online systems do not differ greatly from those which were first introduced nearly 20 years ago" (O'Leary, 1990, p. 15). As discussed in Section I, these systems, now packaged as CD-ROM databases with microcomputer software, are used in library ERAs by untrained users. Perhaps more important than the types of usability errors discussed in Section III.C.3 are the more fundamental problems discussed in this section.

In a study of 45 Agricola CD-ROM users in 1988, the authors came to the unexpected conclusion that the majority of the participants did not understand the basic concepts of searching -- such as selection of search terms, use of Boolean operators, truncation, and limiting (Charles and Clark, 1990). Ninety percent of the participants had done CD-ROM or online searching during the previous year and 60% were graduate students. Substantial personal, printed, and online help was available, but CD-ROM users were not required to undergo any training prior to using the system.

The authors reported a number of problems:

- "Many participants had difficulty with the most basic principle of searching -- selection of appropriate search terms" (p. 327).  
Example: failure to use the scientific names of organisms.
- "Few of the patrons used Boolean operators or if they did, most used them incorrectly" (p. 327).
- Only 10 of the 45 searches included truncation.
- "Not a single patron limited the search to specific fields (title, descriptor, etc.)" (p. 327).

The authors concluded that:

...it is obvious that these searchers were not doing their online and/or laserdisk searches in the most effective way possible. These end users, doing both online and ondisk searches,

Table 23. User Search Quality Checklist

| <u>Did the user...</u>  | <u>Yes</u> | <u>No</u> | <u>NA</u> |
|---|------------|-----------|-----------|
| 1. Select appropriate search terms?   |            |           |           |
| 2. Select terms in the best way: by using the online thesaurus/index which retrieves descriptor terms?  |            |           |           |
| 3. Restrict the search to specify fields?   |            |           |           |
| 4. Use Boolean operators correctly?   |            |           |           |
| 5. Use truncation or equivalent ("system or systems")?  |            |           |           |
| 6. Combine search sets with the least effort -- avoiding retyping?  |            |           |           |
| 7. Properly set the format, and start/stop the printing?  |            |           |           |
| 8. Understand the printout (field identifiers, ERIC ID, etc.)?  |            |           |           |
| 9. Persist in acquiring the needed assistance from the program's online "help" facility?  |            |           |           |
| 10. Understand the role of the ERA search as part of the larger information retrieval process, i.e., in conjunction with a Journal Run, etc.? |            |           |           |

seemed satisfied that they were able to find something and find it quickly. They were impressed by the speed of the system and the large number of citations. When using both the online and ondisk systems, some of the participants happily printed out hundreds of citations. These observations also indicate that little attention is given to quality of the search results when the end user can quickly print the citations and is charged little or nothing for the search (Charles and Clark, 1990, p. 327).

Similar results were obtained at the Virginia Tech ERA, where a small survey (sample size of 22) revealed that only 36% of the searches were rated "satisfactory" by ERA Manager Alan Armstrong. The satisfactory/unsatisfactory determination of SilverPlatter ERIC or PsycLIT searches was made on a holistic basis. In addition, a User Search Quality Checklist (Table 23) was used to find how users performed various specific tasks. Users generally did a good job of:

- selecting search terms (86%),
- combining search sets (59%), and even
- using Boolean operators (65%).

Their biggest problem was that only three searchers (14%) made use of the online thesaurus or index to select their terms. Thus, while they began with reasonable

terms from their points of view, they used many queries, playing a trial-and-error game to see what the system "liked." Also, only two searchers (9%) searched specific fields and no one used truncation. Figure 24 shows a search sequence that was rated "satisfactory." Even though it was one of the better examples, it illustrates the repeated retyping of queries. This retyping occurred, to some extent, in 100% of the samples.

For the survey, search strategies were obtained from the computers after users had finished their searches, but had left the individual database software on the screen. (As mentioned earlier, the network has no time-out feature.) This method of acquiring searches is obviously biased toward those users who choose to leave the computers in this condition, rather than exiting the database and returning the computer to the network main menu. This may be a bias in favor of the more inexperienced searchers. Because there were no observations of or personal interviews with the searchers, items 7-10 of the Table 23 checklist could not be scored.

Some people have maintained that users' subjective satisfaction is more important than search quality. "An individual's search strategy may be deplorable by the standards of an experienced online searcher, but if that person goes away happy, who is to say which standard should apply?" (O'Leary, 1990b, p. 31). Thus, we have an apparent paradox: people are overwhelmingly satisfied with CD-ROM searching and yet people are getting overwhelmingly substandard results -- and they don't even know it. User's oblivion to the low search quality is the

| No. | Records | Request                                 |
|-----|---------|---|
| 1:  | 3378    | STRUCTURED                              |
| 2:  | 25055   | CLINICAL                                |
| 3:  | 5344    | INTERVIEW                               |
| 4:  | 124     | DSM-III-R                               |
| 5:  | 3       | STRUCTURED CLINICAL INTERVIEW DSM-III-R |
| 6:  | 47538   | S                                       |
| 7:  | 3378    | STRUCTURED                              |
| 8:  | 25055   | CLINICAL                                |
| 9:  | 5344    | INTERVIEW                               |
| 10: | 124     | DSM-III-R                               |
| 11: | 3       | STRUCTURED CLINICAL INTERVIEW DSM-III-R |
| 12: | 9963    | COUNSELING                              |
| 13: | 2862    | BLACKS                                  |
| 14: | 5       | COUNSELING BLACKS                       |
| 15: | 1013    | EMERGENCY                               |
| 16: | 2332    | ASSESSMENTS                             |
| 17: | 0       | EMERGENCY ASSESSMENTS                   |
| 18: | 23838   | PSYCHIATRIC                             |
| 19: | 1013    | EMERGENCY                               |
| 20: | 2332    | ASSESSMENTS                             |
| 21: | 0       | PSYCHIATRIC EMERGENCY ASSESSMENTS       |
| 22: | 23838   | PSYCHIATRIC                             |
| 23: | 1013    | EMERGENCY                               |
| 24: | 249     | PSYCHIATRIC EMERGENCY                   |
| 25: | 23838   | PSYCHIATRIC                             |
| 26: | 1013    | EMERGENCY                               |
| 27: | 1197    | ROOM                                    |
| 28: | 46      | PSYCHIATRIC EMERGENCY ROOM              |
| 29: | 23838   | PSYCHIATRIC                             |
| 30: | 1013    | EMERGENCY                               |
| 31: | 1197    | ROOM                                    |
| 32: | 46      | PSYCHIATRIC EMERGENCY ROOM              |
| 33: | 39      | LUNAR                                   |
| 34: | 2169    | PHASES                                  |
| 35: | 23838   | PSYCHIATRIC                             |
| 36: | 1013    | EMERGENCY                               |
| 37: | 0       | LUNAR PHASES PSYCHIATRIC EMERGENCY      |
| 38: | 39      | LUNAR                                   |
| 39: | 2169    | PHASES                                  |
| 40: | 6       | LUNAR PHASES                            |
| 41: | 39      | LUNAR                                   |
| 42: | 2169    | PHASES                                  |
| 43: | 6       | LUNAR PHASES                            |

Figure 24. Sample "Satisfactory" Search

answer to the paradox. Users are given no indication that their searches are at low quality; in fact, the dozens or hundreds of citations tell them they've had highly successful outcomes.

There are similar situations in other fields. One example is student evaluation of teachers. While student evaluations are valuable for many aspects of a teacher's performance, such evaluations cannot be expected to be valid on the question of course content (McKeachie, 1986). Students simply have no standard of comparison by which to judge the course at hand vs. other similar courses or the universe of potential course material.

ERA searches are in *exactly* the same position. They know *their* search outcome only, not the outcomes that would result from alternative search strategies and certainly not the "perfect" search outcome culled from the universe of relevant documents.

The widely-recognized solution to the problem of poor search quality is user training (Allen, 1990; Harter and Jackson, 1988; Jaros, 1990; O'Leary, 1990b; Stewart and Olsen, 1988; Zink, 1990). A detailed account of the end user training experience at one university was provided recently by Jaros (1990). When the BRS AfterDark program was begun in 1984, "it quickly became apparent that ... many patrons did not fully understand the strategies of searching, and that whoever was monitoring the search area simply could not train each individual" (p. 79). Therefore, a short instructional program was devised which first-time

users were required to complete. This program evolved from a 15-minute slide/tape show to a user's manual which took about 40 minutes to read.

As CD-ROM popularity overtook online searching, "the components of prior searches that were noted several years ago ... are still present..." (p. 82).

Furthermore, since a number of different vendors/user interfaces were used, it was no longer possible to develop a single manual.

## E. List of Objectives

**B.1. Supply and Demand of ERA Stations.** For each service or database, maintain the supply of ERA stations such that: (a) single dedicated stations are in use no more than an average of 75% of the time (during ERA staffed hours), and (b) networked or multiple dedicated stations are in use no more than an average of 50% of the time, adjusted for stations out of order.

**B.2. Physical Conditions.** Comply with the appropriate national standards -- ANSI/HFS 100 - 1988, American National Standard for Human Factors Engineering of Visual Display Terminal Workstations (Human Factors Society, 1988) and accommodate all persons within the defined user population.

- C.1. Database Availability.** Maintain the topical distribution of specialized databases in approximate correspondence with (1) overall topical serials expenditures, (2) an average of graduate and undergraduate student enrollment, and (3) actual usage by patrons.
- C.2. Consistency Among User Interfaces.** Steadily reduce the number of different general-use software user interfaces to a single, integrated ERA interface by 2001, and eliminate significant hardware user interface (e.g., keyboard) differences.
- C.3. Software Usability.** Reduce the number of "obvious deficiencies" in software usability by 50% by 1993 and by 90% by 2001. An obvious deficiency is a software feature which leads to a user error in more than 10% of the searches, or which causes noticeably extra user effort and for which there is a feasible solution.
- D.1. Database Selection by Users.** Provide a system such that at least 90% of ERA users select (or have selected for them) one of the best two reference choices (hardcopy or ERA) for their specific search.

**D.2. Quality of User Searches.** Provide a system such that at least 90% of ERA users achieve at least a "satisfactory" rating when their actual ERA searches are evaluated as to "quality."

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## IV. RECOMMENDATIONS

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### A. Introduction

If this report is successful in precipitating changes and improvements in the Library's Electronic Reference Area, it will be because people inside the Library have come to have a deeper understanding of ERA issues and have become active and involved in creating the needed changes. The recommendations that follow should be taken as beginnings, not endings.

The central theme of my recommendations is for the Virginia Tech Library to take a vigorous, active role in setting the pace and direction of the library automation technology used at the Library. The ERAs at the various Virginia Tech libraries should be the focus of this effort. I hope to demonstrate that such a role can serve as an exciting catalyst for the entire staff while, at the same time, improve the service provided by the ERAs.

The recommendations illustrate ways to meet each of the objectives presented in Section III, and to achieve important improvements in other related areas.

## **B. Expand the Network: Extent and Access**

### **B.1. Eliminate Most Dedicated CD-ROM Databases**

In the early days of CD-ROM databases, many vendors bundled together the CD-ROM, CD-ROM drive, computer, monitor, and printer to create stand-alone, dedicated stations. This was fine (and still is) for smaller libraries which were reluctant to undertake the selection and maintenance of the computer hardware. Now, the CD-ROM drive is not such a mysterious technology. The VT Library has demonstrated that PC networks, including CD-ROM drives and telephone access, can be successfully launched and maintained by in-house Library staff.

All but one of the Library's dedicated databases are either available as CD-ROMs for network installation, or have equivalent CD-ROM products from other vendors. This is true for Information Access Company's Magazine Index, National Newspaper Index, LegalTrac, and General BusinessFile and for Auto-Graphics (government publications). NewsBank's coverage of local newspaper articles coupled with microfiche copies seems to be unique and could be transferred to the network only if offered by NewsBank.

When the number of CD-ROMs that should be part of the network exceeds 16, a second server PC with up to 16 CD-ROM drives will have to be added to

the network. Nevertheless, as ERA usage grows, network databases generally will be even more economical than multiple dedicated stations.

## **B.2. Eliminate Individual Dial-Access Information Services**

Similarly, consideration should be given to moving Dow Jones and WESTLAW (or similar) to the network -- assuming both services are continued. Network users could continue to dial out to the services, but would do so from any network station. The network software and hardware could limit the number of simultaneous users if this is desired to save licensing costs.

An alternate improvement (vendor contracts permitting) would be to maintain the two PCs off the network, but provide access to either service from both machines. A simple main menu would allow users to select the desired service. The two stations would continue to be located adjacent to each other, with printed materials for both Dow Jones and WESTLAW handy. Sign-up would remain as it is now, except users could sign up for either service at both stations.

## **B.3. Continue Individual Off-Network CD-ROM Databases**

The present practice of having the seldom-used CD-ROMs kept off the network is an excellent one. Careful record-keeping should continue to make sure that the CD-ROMs selected to be on the network are indeed the most popular databases. A minimum number of annual users or percentage of usage should be set to allow an individual CD-ROM to be continued for the next year. Any

individual CD-ROM which is more popular than a network database should be moved to the network. Publicity about these off-network databases should be increased. If possible, a list of the databases should be added to the network main menu program (on a separate screen).

#### **B.4. Continue Database Usage Monitoring and Implement a Network Timeout**

When all databases are part of the network, monitoring of ERA databases can be completely automated. Such monitoring is essential to:

- know when it is necessary to add another network station (see Objective B.1), and
- know the relative popularity of databases so that only the most popular ones remain on the network.

Fully automating the monitoring means not only collecting the data, as is done now, but also transferring the data directly to a database management or spreadsheet program for analysis and reporting.

As mentioned in Section II.E, the current automated tracking of network database usage is of reduced value because the system doesn't recognize when users walk away but leave the database "running." With the existing system, the time duration data should simply be ignored. However, the number of times each database is accessed can be easily obtained for statistical summary. To be able to take advantage of the time duration data, an adjustable network time-out feature

must be added to the system. The preferable way to do this would be for one of the software suppliers (probably LANtastic) to implement this feature.

Until all the databases are part of the network, usage monitoring should be taken continually as was done for a three-week period as part of this project (Section II.E). The only additional data that need to be collected are the numbers of users at the non-network stations. This survey should be done once an hour and entered directly into a PC program compatible with database management or spreadsheet analysis. This survey would be a simple task for the librarians, and the PC program could assist by giving a prominent visual -- *not* audible (Davis and Shaw, 1989) -- prompt at the scheduled observation times. As during the three-week survey, the librarians would not need to "drop everything" to do the observations exactly on time, and a skipped observation now and then would not be a serious problem. However, observations should be spaced at least an hour apart to avoid counting too many of the same people twice.

Any database which is less popular than an individual CD-ROM should be moved off-network.

#### **B.5. Add Satellite ERAs at All Libraries and at Selected Departments**

Telephone access to the Newman Library ERA has been successfully tested (with one incoming phone line). Satellite ERAs should be added to the branch libraries -- Art & Architecture, Geology, and Veterinary Medicine. Two of these

libraries already have limited electronic reference (Sweets at Art & Architecture, Medline at Veterinary Medicine). The satellite ERAs should consist of:

- One InfoTrac station (or equivalent on the network), and
- One network station (dial access to the Newman ERA network).

Together, these two stations would provide access to 74% of the total Newman ERA usage measured by the survey. (The survey excluded Sweets and Medline.)

The addition of satellite ERAs would require expansion of the dial-in capability to the Newman ERA network. Each branch library should have a dedicated dial-in phone line to ensure that network access is always available. The satellite ERA system would also require the integration of the databases now located at the Art & Architecture and Veterinary Medicine libraries (Sweets and Medline, respectively). It is probably easier to relocate these CD-ROMs to the Newman ERA network rather than having to call to multiple locations for the various databases. Another complication is that if a database's usage does not qualify it for the network (as may be the case with Sweets) then it should remain off-network. The off-network location could be at Newman Library or at a branch library, if the branch library has the need for sufficient CD-ROMs to justify having a CD-ROM drive.

A second type of satellite ERA could be established at other campus locations, such as departments. Care should be taken to provide assistance to patrons while using the network from a remote, departmental location. Any interested department should make a commitment to have on-site assistance

provided to users by departmental staff (thoroughly trained by the Library). The reasons for this suggestion are explained in Recommendation E.3. The Education Department would be a good candidate for a satellite ERA, since it already has a WESTLAW station (see Recommendation B.6). Another possibility would be the Psychology Department, which is planning to purchase its own (expensive) copy of PsycLIT.

Vendor contracts will need to be checked before implementing any dial-in capabilities to the network. Wilson, supplier of the ERA's MLA Bibliography database, has no additional charge when a CD-ROM is used in a local (single-building) network *with no remote access*. *With* remote access, there is an "additional 10% of annual fee for each potential remote simultaneous user" -- that is, each incoming phone line.

#### **B.6. Provide Identical Access to All Databases from All Network Stations**

With the expanded and integrated network, all databases should be accessible from all stations. If any database is popular enough to be put onto the network, then it should be acquired under terms that permit simultaneous users.

Assuming the dial-access information services (WESTLAW and Dow Jones) are continued, users would still have to go to Newman Library to use these services. The exception would be where vendor agreements permit additional dial-access stations, as is apparently the case for the WESTLAW station in the

Education Department (University City Office Building) and the two WESTLAW stations in University legal staff offices.

**B.7. Add an Additional InfoTrac Station or Equivalent**

Without integration into the network, the usage survey (Section II.E) reveals that current InfoTrac usage exceeds the objective of a 50% average usage rate. Another station should be added.

A better solution, as discussed in Recommendation B.1, is to integrate InfoTrac or equivalent into the network. Since the present network usage is not too heavy, transferring the four InfoTrac PCs to the network would handle all the InfoTrac demand and still keep overall usage below the 50% objective. One issue involved in the integration is that the InfoTrac PC keyboards (or certain keys) would have to be replaced in accordance with Recommendation C.4: "Standardize All PC Keyboards."

**B.8. Pursue the Network Expansion Recommendations as an Integrated Whole**

Recommendation B.1 through B.7 interact with each other, and none should be pursued independently. For example, expansion of the satellite ERAs may lessen the demand at the Newman ERA such that (1) the additional InfoTrac station recommended for Newman is no longer needed, or (2) PC equipment now in the Newman ERA could be transferred to the satellite ERAs. The other side of this possibility is that the satellite ERAs could attract additional patrons to the

branch libraries and put pressure on other branch library services such as photocopying.

## **C. Improve the Facilities and Equipment**

### **C.1. Bring the ERA Furniture into Compliance with the ANSI/HFS Standard**

One relatively easy way to modify the furniture would be to provide:

- Chairs with *easily* adjustable height, along with signage calling attention to the adjustability feature, and
- Footstools which allow shorter users to adjust the chair to a high position for a comfortable forearm angle, and then use the footstool to provide a solid foundation for their feet.

This strategy would allow continued use of the existing 30-inch tables as keyboard (and PC) supports.

### **C.2. Provide Access for Wheelchairs**

Low tables (30 inches) should be provided for at least one station of *all* ERA databases so that all services are available to wheelchair-confined users. The 40-inch high tables could be eliminated entirely. If they are retained, *the stools should definitely be replaced*. For workstations at higher-than-normal height,

excellent results have been achieved in industrial settings with "sit-stand" stools, which have forward-sloping seat pans (Yu and Keyserling, 1989).

### **C.3. Reduce Glare on the Monitors and Improve Image Quality**

The most effective (and most costly) solution would be to eliminate the glare at its source by replacing the overhead general illumination with task lighting.

Two lower-cost methods would also be effective:

- Anti-glare screens could be installed on the monitors that have the worst glare problems. As a minimum, they should be installed on the network NEC Multisync and InfoTrac imTec monitors (Nos. 4, 9, 13, and 14 in Table 4), which have highly-reflective screen surfaces. As a maximum, anti-glare screens could be installed on 12 monitors -- all except the Zenith (No. 3) and the two InfoTrac Amdek monitors (Nos. 12 and 15) which already have an anti-glare treatment. In selecting the anti-glare screens, care must be taken to select models which do not degrade image quality, as is the unfortunate case with the InfoTrac Amdek monitors. (In fact, the image quality of these two monitors is so poor, the Library should consider asking InfoTrac to replace them under the lease agreement.)
- Vertical dividers could be suspended from the 10.5-foot ceiling between the light fixtures. Extending down about 2.5 feet, these

dark-colored dividers would largely prevent the angular glare producing light from ever reaching the PC monitors. If all the PC stations were oriented facing one of two opposite directions, the dividers would only need to run along one axis. The dividers could be an attractive feature; they could, for example, be decorative banners advertising the Electronic Reference Area.

The ANSI/HFS standard includes detailed specifications regarding image quality and other aspects of VDTs. Any new monitors purchased for the ERA should comply with the standard.

#### **C.4. Standardize All PC Keyboards**

There are two general styles of keyboards in use: 84-key and 101-key. The larger keyboards have separate specialized keys between the alphabetic keys and the numeric keypad. The critical differences are not the number of keys, but the location and size of certain often-used keys -- primarily Enter, but also Control and Break. Four of the ERA PCs have the notorious "old" IBM 84-key keyboard with the small, poorly-positioned, vertically-oriented Enter key. These keyboards are indicated in Table 4 as 84 "I". This problem has been corrected with the "new" 84-key keyboards which have a reverse-L shaped Enter key. These keyboards are shown in Table 4 as 84 "J". The 101-key ERA keyboards also have two different arrangements of the Enter key. However, either the horizontally shaped ("—") or "J" layout is acceptable. The vendor-supplied

InfoTrac and NewsBank keyboards have special color-coded keys in an 84-key or 101-key layout, respectively, with a "J" shaped Enter key.

All Library-owned PC keyboards should have a reasonably standard design in order to reduce user errors. *All four 84 "J" keyboards should be replaced.* The remaining keyboards are not too dissimilar. Even though the Enter keys are different shapes, all of them are in the same location. My recommendation is that a single standard be set for all new keyboard purchases -- probably the 101 "J" or "–" design -- beginning with the four keyboards to be replaced immediately.

#### C.5. Enclose the ERA

The ERA should be enclosed with walls or partitions. Walls would be preferable if a separate air conditioning zone could be established to provide separate thermostatic control for the ERA. If a separate zone is not provided, then walls must *not* be used, as they would lead to severe comfort problems in the ERA. An enclosed ERA accomplishes a number of important goals:

- It gives the ERA more of an identity, which should lead to increased user awareness and usage.
- It allows the creation of a single entrance point to the area, which is important in enabling the librarian on duty to offer assistance to new users (see Recommendation Group E).

- Noise levels can be reduced by the sound-absorbing properties of the partitions, or by elimination of external noise if walls are installed.

### **C.6. Replace Noisy Impact Printers**

There are only five printers which are not of the quiet inkjet design (see Table 4). A policy should be established to acquire only quiet printers in the future, and to replace the more noisy impact printers as soon as possible. Perhaps there are other Library-owned quiet inkjet printers whose users would gladly trade them for the ERA's faster, more economical (but noisier) impact printers.

### **C.7. Plan for Doubling the Number of ERA Stations**

ERA usage is growing rapidly and steadily. If many of these recommendations are pursued, growth will be even faster. One possible method of arranging approximately double the number of stations without changing the location of the ERA is shown in Figure 25. This arrangement might require additional power poles and a better method of blocking light from the windows than the existing vertical blinds. There are 35 stations included, but even at this high density, four-foot spacing between users and the sides or backs of nearby computers can be maintained (as discussed in Section III.B.2).

Newman Library 2nd Floor

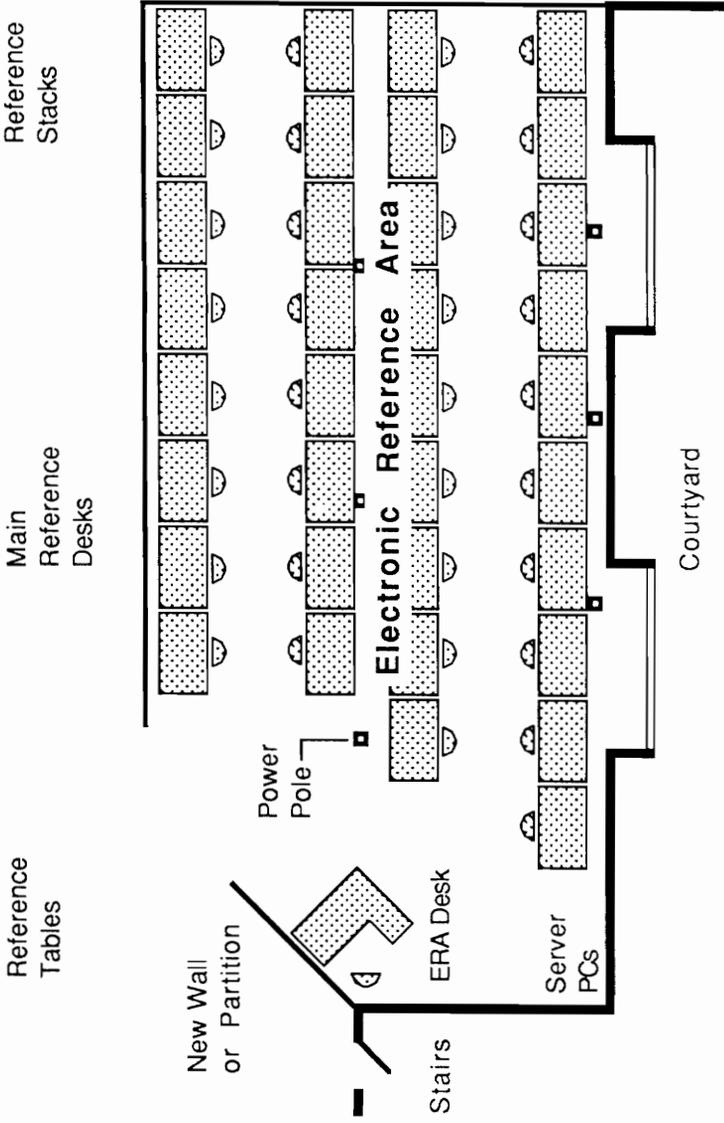


Figure 25. ERA Rearrangement

#### **D. Adopt New Procedures for Selecting Vendors and Databases**

As mentioned in Section III.C.1, the Library has no centralized system regarding CD-ROM database acquisition. The following group of recommendations form the basis of a new policy which recognizes that the Electronic Reference Area is rapidly becoming the flagship service of the Library.

##### **D.1. Build Library Staff Knowledge About User Interfaces**

The bulk of Section III has emphasized numerous user interface problems of existing electronic reference products. Of course, the content, coverage, quality, and other features of databases are important, but the user interface should be viewed as a *co-equal* criterion to that of content. There is no benefit if there is outstanding information available, but users find it too difficult to acquire. For librarians who select CD-ROM databases, it may not be necessary to *design* user interfaces, but it is *essential* to be able to *evaluate* them. Librarians who work in the ERA already have a good start at understanding and appreciating user interfaces. They know the frustration of trying to figure out some obscure feature of WESTLAW, for example. Further understanding can be aided by:

- the designation of one or more Library personnel to specialize in the area of user interfaces,
- formal or informal training,

- an awareness of fundamental principles of good user interface design,
- personal experience with user interfaces from multiple vendors,
- familiarity with an excellent user interface,
- development of the Library's own prototype or specification for an ERA or ERA/OPAC user interface, and
- participation in the usability testing of an interface, during which volunteer users attempt specified tasks using an interface which is new to them.

Additional materials on some of these subjects are provided in the appendices. Appendix C is a description of nine important principles of user interface design. These may be used as an aid and checklist when evaluating user interfaces. Appendix D describes what I believe is an excellent prototype user interface for an integrated library information retrieval system (combination OPAC and ERA). This prototype, "AutoLibrary," is a second-generation design I developed based on an earlier prototype created as part of a five-person graduate project (as part of an excellent course in Human-Computer Interaction taught by Computer Science Professor Rex Hartson). The AutoLibrary design has been refined by two rounds of usability testing conducted in Room 216 of Newman Library.

The Library should consider taking an active role in user interface development for library applications. This could be done with a full-time Library

employee or with one or two funded graduate students. Such work might result in the development of a front-end software program unifying CD-ROM databases, online information services, and the VTLS OPAC. (Front ends to VTLS have been done before, but several changes would be required in the VTLS software to support an effective system.) Such a project might be conducted in conjunction with or supported by VTLS, Inc. In any case, Library involvement with user interface design would definitely enable the Library to make the best possible choices among competing database vendors.

The Library is fortunate to have nationally-recognized user interface design expertise on campus in both the Industrial and Systems Engineering (Human Factors Engineering Option) and Computer Science departments. A productive situation would be to involve one graduate student from each department specializing, respectively, in the design and implementation aspects of library user interfaces. A location near the ERA, such as Room 216, would make an appropriate location for the students' office and laboratory space. As demonstrated by the AutoLibrary experience, the Library provides an ideal pool of potential subjects for usability testing.

## **D.2. Centralize CD-ROM Acquisition**

The present practice of a largely decentralized CD-ROM acquisition process has resulted in the current lopsided collection of databases. While subject specialist bibliographers obviously must remain involved, an overall coordinator for

CD-ROM acquisition should be appointed. The budget categories should be revised to be more closely associated with the departments and colleges of the university. Within each broad subject area, the coordinator should set a target percentage of the serials budget to be allocated to electronic databases. A good target range might be two or three percent, which would encourage additional databases in all subject areas except Business. On the other hand, a case could be made that all subject areas should be brought up to Business' level of 5% of the serials budget. Spending 5% to gain convenient access and indexing to the other 95% may not be unreasonable.

### **D.3. Make Two Changes in Databases**

The statistics make a clear case that WESTLAW should be canceled. However, only the Newman WESTLAW station was surveyed. Usage at the other stations is not included in the statistics. There are no doubt good reasons why WESTLAW became part of the ERA, but consider the numerical evidence:

- With its complicated user interface and hundreds of databases, it is one of the two most difficult services to use, generating seven times as many questions as InfoTrac, relative to usage.
- WESTLAW is the most expensive ERA database/service, consuming 25% of the total database/service expenditures while attracting only 7% of the Newman ERA usage.

- The \$13,000 spent on WESTLAW could buy half a dozen CD-ROM databases on a variety of subjects.
- ERA spending in the business/legal subject area is two-thirds of the total spending, not including general reference databases.
- If WESTLAW were canceled, the remaining business-related databases would still account for 2.3% of the business serials budget. This percentage is at least three times higher than that of any other subject area.
- Other more limited but easier-to-use legal databases are available at lower cost, such as Wilson's *Index to Legal Periodicals* (570 journals, \$1,495) and Information Access Company's *LegalTrac* (800 journals, \$3,500, single-station price).

The second recommended change is that a comprehensive engineering database should be added. As a percentage of the engineering serials budget, NTIS at 0.8% makes Engineering's percentage about the same as that of the other subject areas (except Business). The difference is that most of NTIS's government publications are not held by the Library and are not available through Inter-Library Loan. NTIS is a poor buy relative to usage: at about five percent of ERA database spending, NTIS attracts only one percent of usage. Engineering students, 27% of "50-50" enrollment, are left with no comprehensive ERA database. Considering the University's role and reputation in engineering, a high priority should be given to amending this situation.

#### D.4. Reduce the Number of Database Vendors

A critical early project of the database coordinator should be to reduce the number of vendors of the ERA's CD-ROMs and services. This strategy is the best short-term method of reducing the problem of user interface inconsistency

(Section III.C.2). Vendors to be considered include:

- Wilson,
- OCLC,
- UMI,
- SilverPlatter,
- Dialog, and
- Information Access Company (IAC).

The latest information on these companies' CD-ROM products was acquired and a sample evaluation was made. Twelve database topics were selected as being an essential core of the ERA. Nine of these are already part of the ERA, and the ERA includes a number of databases and services not selected as essential.

NewsBank, which I also consider essential, was not on the list because none of the six selected vendors offers such a database. My list of 12 database topics will serve to illustrate the process; the database coordinator's first step would be to construct a "real" list in conjunction with the subject specialists. My list is shown in Table 26, along with a matrix of database availability from each vendor and -- for comparison -- from Knowledge Index. Databases which match the topic but

Table 26: CD-ROM Vendor Comparison Matrix

| Database Topic                                       | Wilson | OCLC | UMI | S.P.* | Dialog | IAC | K.I.* |
|--|--------|------|-----|-------|--------|-----|-------|
| 0. General Reference                                 |        |      |     |       |        |     |       |
| a. National Newspapers                               | --     | --   | ●   | --    | --     | ●   | ●     |
| b. General Periodicals                               | (●)    | --   | ●   | --    | --     | ●   | ●     |
| c. Government - GPO                                  | --     | ●    | --  | ●     | --     | ●   | ●     |
| 1. Architecture, Education, Human Resources          |        |      |     |       |        |     |       |
| d. Education (ERIC=●)                                | (●)    | ●    | --  | ●     | ●      | --  | ●     |
| 2. Business  |        |      |     |       |        |     |       |
| e. Business Journals                                 | (●)    | --   | ●   | --    | --     | ●   | ●     |
| f. Legal Journals                                    | ●      | --   | --  | --    | --     | ●   | ●     |
| 3. Agriculture and Veterinary Medicine               |        |      |     |       |        |     |       |
| g. Agriculture (Agricola=●)                          | (●)    | ●    | --  | ●     | --     | --  | ●     |
| h. Medicine (Medline=●)                              | --     | --   | --  | ●     | ●      | (●) | ●     |
| 4. Arts and Sciences                                 |        |      |     |       |        |     |       |
| i. Humanities, Art, Literature                       | ●      | --   | --  | --    | --     | --  | ●     |
| j. Social Sciences and Psychology (PsycLIT=●)        | (●)    | --   | --  | ●     | --     | --  | ●     |
| k. Science   | ●      | --   | --  | ●     | --     | --  | ●     |
| 5. Engineering                                       |        |      |     |       |        |     |       |
| l. Engineering/Applied S&T* (Inspec=●, Compendex=●●) | (●)    | --   | ●   | --    | ●●     | --  | ●●    |

"●" = Vendor offers a database on this topic; "--" = Vendor does not; "(●)" = Vendor offers a database of inferior breadth on this topic.

\*S.P. = SilverPlatter, K.I. = Dialog's Knowledge Index, S&T = Science and Technology

are significantly inferior in coverage to those offered by other vendors (for example, 186 journals indexed compared to 450) are shown with a "(•)."

It is obvious from the table that no single vendor currently offers the range of databases required. If the choice (based solely on coverage of the topics) were to be restricted to a single vendor, it would have to be Wilson. But, six topics would be covered with limited databases, and three topics (national newspapers, GPO, and medicine) would not be covered at all. The best choice for two vendors would be Wilson and IAC. All the topics would now be covered, but the more limited Wilson databases might be a poor substitute for the currently-used ERIC, Agricola, Medline, and PsycLIT. Also, Wilson's Applied Science and Technology Index is no match to the well-known and extensive INSPEC or Compendex engineering databases.

With three vendors, all the topics can be satisfied with major, large-coverage databases. The three vendors (and numbers of databases) are Wilson (2-4), UMI (3-4), and SilverPlatter (5-6). The selected databases would be:

- a) *Newspaper Abstracts*: UMI, 8 national newspapers.
- b) *Periodical Abstracts*: UMI, 450 periodicals.
- c) *GPO on SilverPlatter*.
- d) *ERIC on SilverPlatter*, 775 journals.
- e) *ABI/Inform*: UMI, 800 journals; or *Business Periodicals Index*: Wilson, 344 magazines.
- f) *Index to Legal Periodicals*: Wilson, 570 journals.

- g) *Agricola on SilverPlatter.*
- h) *Medline*: SilverPlatter, 3200 journals.
- i) *MLA* or *Humanities Index* or *Art Index*, all from Wilson.
- j) *PsycLIT*: SilverPlatter, 1300 journals.
- k) *General Science Index*: Wilson, 109 periodicals; or more specialized databases from SilverPlatter.
- l) *INSPEC*: UMI, 4200 journals; with the possible addition of *Applied Science and Technology Index*: Wilson, 335 periodicals.

A decision to limit the ERA databases to those available from these three vendors (plus NewsBank) would reduce the number of major user interfaces from seven to four. It would also allow ample room for expansion with databases covering, for example:

- full text newspapers,
- books in print,
- dissertations,
- Peterson's college guides,
- architecture and civil engineering (ICONDA),
- corporate research reports (CIRR),
- numerous arts and humanities topics,
- social sciences,
- economics,

- NTIS, and
- U. S. patents.

This group of three vendors has some weakness. The chief one is that INSPEC, the engineering database, is concentrated in electrical engineering, electronics, computers, information technology, and physics, rather than broadly covering all engineering branches as does Compendex. Also, INSPEC is British, which introduces problems with British spellings and terminology.

However, it appears that cost would *not* be a problem with this selection of databases. The exact cost is uncertain because of decisions yet to be made such as remote access to the network, depth of the needed backfiles, and UMI's charge for INSPEC used in a network application. Nevertheless, the total cost is expected to be significantly less than the current ERA expenditures.

The next step for the database coordinator would be to acquire trial or purchased databases from the selected vendors in order to evaluate the user interfaces. A formal usability test should be conducted, as was carried out in the case of AutoLibrary (Appendix D). It would be hoped that the selected products would meet the Software Usability Objective (C.3). The base case for this objective should be SilverPlatter version 1.6. (Version 2.0 is scheduled to be distributed in May, 1991, and contains many long-awaited improvements, such as the ability to mark records for printing.)

Usability testing may reveal that a particular mix of vendors satisfies the topical requirements but not the ease of use requirement. In particular,

substituting the UMI newspaper and periodical indices for InfoTrac would need to be carefully examined because InfoTrac is one of the easiest to use of any existing ERA software. If, for usability reasons, InfoTrac (network products) were selected rather than UMI, then a fourth vendor, Dialog, would be required to provide the essential engineering database, Compendex. With its current database selection, Dialog OnDisc has little of unique interest to offer other than Compendex.

Knowledge Index (a service of Dialog) is shown in Table 26 to illustrate how limited the existing CD-ROM offerings are compared to a large, end-user online service. The number of CD-ROMs is growing rapidly -- some vendors have doubled their selection since last year. Soon, one or more of these six vendors may offer all 12 products. For example, Dialog could take the same databases available through Knowledge Index and package them as CD-ROMs.

Another important point to consider when selecting vendors is the availability and cost of online updates. Such updates are a significant advantage considering that the newest CD-ROM data may be several months old. SilverPlatter, UMI and IAC are not in the online business and do not offer updates. OCLC has a completely separate online service with a different user interface, but the next CD-ROM software update is scheduled to provide access to online versions of the databases. Dialog provides online access software with its CD-ROM products; Wilson does the same and does so *at no extra cost* except for telecommunication charges. (This feature is currently not being taken advantage of with the ERA's

Wilson database, but it should be. There would be no technical problems expected in doing so.)

In summary, this recommendation to reduce the number of database vendors will not be easy to implement. It will have to be carried out in conjunction with the other recommendations in Section IV.D. Where it involves discontinuing an existing database or service in favor of a replacement from one of the selected vendors, it will disappoint the established user base for the discontinued products. It is therefore important to implement this policy *soon* before the ERA selection further proliferates to additional vendors. The rewards from this policy are important: A manageable number of vendors -- less interface confusion from the user's viewpoint and simplified training needs from the librarian's viewpoint -- and a firm foundation on which to build the future growth of the ERA in a rapidly-changing environment.

It is disappointing that a single vendor, with a single user interface, cannot provide the required databases. This difficulty underscores the importance of Recommendation D.1, and the fact that the Library may need to seek its own solution to providing a single user interface.

#### **D.5. Add an Online Newspaper Index**

CD-ROMs do not by themselves meet all of the Library user's electronic information needs. The main deficiency, as mentioned several times in this report, is that CD-ROMs are weeks or months out of date the moment they arrive. In

the future, this will no doubt be resolved with more advanced integration of online and local databases.

In the meantime, an online national newspaper index would at least provide the ability to retrieve nationally prominent news in all subject areas. To implement this service, options include the Wall Street Journal through Dow Jones, or any of the other national newspapers available through Dialog, Knowledge Index, BRS, etc. The disadvantages to this recommendation are that it might be expensive and that yet another user interface might be added.

### **E. Expand User Assistance and Training**

This group of recommendations addresses the user task problems of database selection and search quality (Section III.D). In the long-term, these problems will no doubt be addressed by improved software. In the short-term, the answer is training.

#### **E.1. Help Users with Database Selection**

One of the reasons for enclosing the ERA is to provide a single entrance where patrons have the opportunity to get valuable initial guidance from a Library employee. The problems with database selection will increase, since the number of CD-ROM databases in the ERA will probably double before too long. The Library will have to work out the best procedure for offering this assistance in a

way that respects the patrons' privacy. It is probably *not* acceptable with Library staff to *require* patrons to "sign in and state what they are looking for."

One less intrusive method would be to have users "check in" at the ERA Desk before proceeding on to a workstation. The librarian would then have the opportunity to ask if this is the user's first time and if help is need to select which database to use (and how to use it). The check-in could also be used to gather anonymous statistical data and eliminate the need for the hourly survey. Users could put check marks on a pre-printed form indicating graduate/undergraduate status, major, and other information. This data gathering would not need to operate continuously and it would be most efficient (and appropriate) to automate the process.

A second way to assist users entering the ERA would be a special computer to help with database selection. This would be similar in concept to the Macintosh computer in the Newman Library entrance which presents a physical guide to the library. Perhaps even more convenient would be to have this feature on all the network PCs. The "Electronic Reference Guide" could present a menu hierarchy of databases (with main categories of business, engineering, etc,) leading to increasingly detailed information on each database. Similar menu systems are used in all end-user online information retrieval services. The amount of information stored for each database could be fairly detailed, down to the level of the list of journals covered. (It could even include each database's descriptor list, with the number of "hits" for each term.) An Electronic Reference Guide system

could be programmed by in-house Library personnel, using a package such as HyperCard for the Macintosh. A simple version of the computerized guide could be implemented as a large sign at the ERA entrance.

With or without the Electronic Reference Guide, the main menu presented on the network stations should be expanded to show descriptive titles of the databases. Preferably, the databases would be grouped by broad subject area. The acronym or database name should also be included. Examples:

- Agriculture: 1985 to March 1991 ("Agricola"),
- Education: 1983 to February 1991 ("ERIC"),
- Government research reports: 1983 to December 1990 ("NTIS"),  
and
- Psychology and behavioral sciences: 1974 to April 1991  
("PsycLIT").

## **E.2. Provide Additional Training for ERA Users**

With present software and user interfaces, all inexperienced users need initial training in order to use the databases efficiently. Minimization of the number of different user interfaces will be a great help here. Still, growing ERA usage will overwhelm the ability of a single ERA librarian to provide the needed training. An automated training program could be used, and an effective system would use computers with an audio commentary delivered via headphones. The instruction

session should take no more than 20 minutes or be divided into 20-minute modules because of attention span considerations.

As with the Electronic Reference Guide, the Electronic Reference Tutorial could be offered at dedicated stations adjacent to the ERA desk or at each network station. If such initial training is not automated, growth of the ERA could soon require a second staff person assigned to the ERA. This person -- perhaps a student -- would do nothing but conduct continuous introductory training sessions.

Whether automated or not, the training sessions should contain two parts of approximately equal length. First, an explanation of ERA searches in the context of the entire information retrieval process as described in Sections II.D.2 and 3 should be presented. Particular emphasis should be placed on the non-ERA strategies the instructor has found effective, such as Journal Run and Footnote Search. Second, the session should introduce the key concepts of the mechanics of ERA searching. Concepts such as selecting terms by consulting the on-line thesaurus of descriptors should be emphasized. The main ideas of both parts of the training program should be displayed on prominent posters inside the ERA and the availability of the training sessions should be widely publicized.

A third part should also be considered for the training program. The case has been made that the affective domain (feelings and attitudes) should not be overlooked when designing training programs for information retrieval (Jakobovitz and Nahl-Jakobovitz, 1990). As mentioned in Section II.D.2, users can become

frustrated during the search process or can approach it with unrealistic expectations.

The test of the training program will come from periodic surveys of user search quality. As mentioned in Section III.D.2, the ERA survey found that only 36% of the sampled Newman ERA searches were "satisfactory." If the recommended 90% satisfactory level cannot be achieved by expanded optional training, then consideration should be given to some type of required training program. This would be a major effort, requiring such messy details as either "taking users' word for it" that they have completed the training or doing the necessary record-keeping. The objective of 90% may be too high and have to be adjusted. *But if the Library agrees with the recommendation to set an objective for the percentage of "satisfactory" searches, there may be no other choice but to adopt some type of mandatory training until the search software is improved in usability.*

### **E.3. Do Not Provide Unrestricted Dial-Access to the ERA Until the Search Quality Objective Is Met.**

Other libraries have been overwhelmed by the great increase in calls to the reference desks from remote users of second-generation OPACs to which keyword searching and locally mounted bibliographic databases have been added (Jaros, 1990). Of course, usability and training problems exist with such systems even *without* remote users (Bokowski and Moeckel, 1990). Even if such an increase in calls and questions is accommodated by increased staffing, the problem remains of

the remote users who do *not* call for help and who conduct poor quality searches unknowingly.

Unrestricted phone access to the network would produce a mushrooming demand which would require frequent increases in the number of incoming phone lines. As discussed in Recommendation B.6, this would lead to increased database costs from the vendors.

We are presently in an awkward situation in which the availability of automated searching is threatening to outrun its usability. As software usability improves or as training effectiveness is increased, the 90% satisfactory search quality objective will be met and access to the ERA can be extended confidently.

#### **F. Manage the ERA Using Performance Objectives**

The systems engineering approach taken in this study means that the recommendations are driven by the objectives established in Section III. Before any recommendations are considered, it is essential that the relevant objectives be discussed, modified, and agreed to by the involved Library staff. Systems for monitoring achievement of the objectives should then be put into place before the relevant recommendations are implemented. Once this type of objective-driven process is in place, decisions on how far to go with the recommendations will become easier. Of course, reality is not *quite* that simple in that there may have

to be an iterative process if the defined objectives are unachievable by any means. The objectives (summarized in Section III.E) require seven corresponding measures of effectiveness, which are listed in Table 27.

Table 27: Measures of Effectiveness

| Measure of Effectiveness  | Recommended Frequency | Related Objectives (Section III) | Related Recommendations (Section IV) |
|---|-----------------------|----------------------------------|--------------------------------------|
| Database and workstation usage  | Continually (hourly)  | B1, C3                           | B4<br>also B7, C7, E3                |
| ANSI/HFS standard on workstations                                       | As changes are made   | B2                               | C1<br>also C2, C3, C6                |
| Database selection by topic: Cost as a percentage of the serials budget | Semiannual            | C1                               | D2                                   |
| Number of different user interfaces                                     | Semiannual            | C2                               | C4, D4<br>also B1, B2, B5            |
| Software usability  | Semiannual            | C3                               | D4                                   |
| Database selection by users   | Semiannual            | D1                               | E1<br>also D1, D3, D4                |
| Quality of user searches  | Semiannual            | D2                               | E2<br>also E3                        |

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## V. CONCLUSION: A VIEW OF THE FUTURE

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### A. A Future Scenario

A first-year student walks into the Newman Library through the right-hand entrance doors. She ignores the person in the information booth and proceeds directly to one of the new wedge-shaped computers she has heard about. As she sits down, the top of the wedge comes to life showing her a color picture of the outside of the Library. A few words on the computer screen welcome her and invite her to "come in" by touching the door. When she does so, the computer quickly takes her on a motion-picture ride through the door and to a large directory like the one she had barely noticed on her way through the lobby. The pictures and words on the directory make her choice easy.

Still seated at the computer, an hour later, she has in her hand full-color copies of 11 journal articles to use for her paper that is due next week. One of the articles came out just two days ago and she particularly likes the comments that her professor has written in the margins of that article. She appreciates also getting electronic copies of the articles so she can pull out quotes and the reference list without having to re-type them. The student has also received a copy of another student's paper done on the same subject five years ago and a video of a visiting lecturer who spoke on the subject last year. The student was a

bit surprised when the computer suggested she contact a graduate student in another department who is doing research in her area of interest -- after all, it's just a paper for one of her courses. She *did* appreciate getting her professor's lecture notes and previous exam questions on her subject. The only problem is that the book she picked out -- after browsing through its table of contents, charts, and final chapter -- hasn't been purchased yet by the Library. She now has some time to kill, so she goes to the newspaper room to read her hometown paper. No copies have been printed yet, so she gets one from the self-service newsprinter. After an hour, she drops the paper off into the sorter, walks to the circulation desk, and checks out her freshly-printed book. "Not a bad first visit to the Library," she concludes.

## B. Future Developments

The above scenario is simply an extension of the computer and user interface developments of the last few decades: increasing processing speed, higher memory densities and storage capacities, faster electronic transmission, greater emphasis on high-fidelity graphics, advances in flat-screen displays, the rise of object-oriented programming and direct manipulation user interfaces, and the creation of hypertext/hypermedia. Specific components of this future scenario are as follows.

## **B.1. Truly Friendly User Interfaces**

Gone are the days of command language queries, Boolean operators, and never-ending usability problems. The predominant search system begins with a natural language query and proceeds through a hypertext-linked index/thesaurus step to focus the query. With realistic graphics and hypertext links, effective information retrieval strategies such as the Journal Run, Area Scan, Footnote Search, and Citation Search can all be conducted completely within the automated system. The object-oriented, direct manipulation interaction style of the Xerox Star/Apple Macintosh has come of age.

## **B.2. Truly Personal Computers**

Each person who so chooses can receive personal treatment from the automation system simply by typing in his or her name (not number!). The ensuing interaction is subtly tailored by the history of past use and by specific user requests. The user can read a "personal newspaper" of the daily news (with a few random articles included to keep serendipity alive). Newly published books and articles in the user's areas of interest are announced. The system will even suggest personal contact with another user who has been or is now researching a similar area -- but only if both users agree.

### **B.3. Distributed Local Database**

A coordinated database consists of a large central database in conjunction with smaller PC-based databases distributed around the campus at departments and individual offices. The distributed databases contain exact duplicates of portions of the main database, updated once a day. Library users visiting or accessing the satellite mini-libraries conduct their restricted-topic searches strictly with the satellite PC until up-to-the-minute circulation or other data are needed from the central database. Considerable locally generated data -- such as faculty-prepared lecture notes, exams, and student papers -- are entered into the departmental databases and indexed in the main database.

### **B.4. Fully Integrated, Up-to-date Databases**

At least from the user's perspective, the distinctions between OPACs, ERAs, CD-ROMs, locally-mounted tapes, and online information services are gone. Multiple information sources are tapped by the user's PC workstation as needed, and presented as a unified whole. No longer is a patron's computerized search six months out of date because the CD-ROM is updated only quarterly. Local data are automatically supplemented by more recent or more specialized online updates where needed.

## **B.5. PC-Level User Interfaces**

The system of personal computers connected to the central computer/database allows each part of the system to excel. While the PC contains no complete records before a search begins, it does contain the complete matrix of search terms and matching hits for each of the hundreds of databases seamlessly integrated into the system. Such tasks as processing the user's natural language query, selecting the best databases, eliminating redundant hits, incorporating user feedback, and presenting the items in order of relevance are easy for the PC. The central computer receives a specific list of requested records from the PC and transmits them in their entirety. All post-processing, such as automatic generation of a list of references, is then done at the PC level.

## **B.6. Enhanced Records of Library Holdings**

Book records, for example, include accurate graphical images (in color as applicable) of: the cover; introductory pages; table of contents; first chapter, last chapter, and the first page of each chapter in between; all figures, tables, and pictures; references and bibliographies; index; book reviews; comments "in the margin" by local readers (Koenig, 1990); and citation lists. These expanded records allow patrons to use library automation system's "virtual reality" to view the book on the shelf, pick it up, thumb through it, and read what others say about it -- all from the convenience of a library PC workstation.

## **B.7. New Technology**

Modern distributed information storage technology has far outpaced CD-ROMs, the phenomenon of the 90s.

A new keyboard design is beginning to replace the old QWERTY models, after an epidemic of carpal tunnel syndrome cases, costs, disabilities, and lawsuits.

Large, color, flat-screen displays are popular and cost-effective. With a touchscreen option, these displays combine user input and system output into one sleek package. For light keyboard activity, a touch-sensitive keyboard appears at the bottom of the display.

## **B.8. Electronic Photocopying**

Many people continue to use the paper versions of the Library's books and journals. Other people take advantage of the automation system's graphic fidelity for both displayed and printed images. They select a journal, browse through it, and read a few interesting articles. If they find an article of which they would like a printed copy, they simply press a button. Electronic copies are also available, transferred to portable storage medium or directly to the user's networked computer.

## **B.9. Local Electronic Publishing**

Most books and journals acquired by the Library are now printed by the electronic publishing department of the Library. Through the computer system, a patron can select an item to check out. If the Library does not yet own a printed copy, the patron is advised there will be a delay of, say, 60 minutes. A graphic image of the book -- complete with color -- is accessed from the VT database or received from a remotely located database. The book or journal is printed, bound, and delivered to the patron within 60 minutes.

## **C. A Final Word**

The future scenario and developments presented in this section are a personal view of the way the future may and should proceed. The Library should develop its own personal viewpoint. The "library without walls" concept should be developed by people throughout the Library into a complete, detailed scenario like the one presented in this section. With this shared mission understood and agreed upon, individual ERA and automation decisions will become easier. If the shared vision is to eventually have a single user interface to a combined ERA/OPAC automation system, then a proliferation of separate CD-ROM user interfaces in the interim will not be the chosen path. If there is shared recognition that the ERA is indeed the flagship service of the Library, then the ERA will

deserve and will receive the special budgeting, management, and physical attention recommended in this report. Finally, if the shared mission of the Library continues to be centered on service to the user, then user-centered styles of computer software will be rapidly accepted and will be evaluated based on the actual ease of use and results obtained by users.

Many of these themes were addressed in University Librarian Paul Gherman's one-page "vision statement" (Gherman, 1990). He stresses the need to be responsive to the users, although he may not have been thinking of "one-hour publishing." He says, "The library is first and foremost a service organization which is driven by the needs and expectations of its clientele.... Our acquisition of information will shift toward being more current-demand driven than anticipatory."

Gherman recognizes the training and mediation impacts of today's complex information technology: "The new role of the library must be one of direct interaction with patrons, ... instructing users in the means of accessing information. [Librarians] must [become] pathfinders of information, ... more assertive and involved in the actual process of scholarship and research."

He implies special management attention to the ERA when he says that "a balance [must be] found as we allocate resources between the new electronic information and traditional paper books and journals." He predicts the continued growth (and perhaps complexity) of electronic information when he says: "We may

spend ... more time helping the patron negotiate through interactive, non-traditional (non-print) resources, ... as the traditional structure of information becomes more ambiguous."

Finally, Gherman is committed to keeping the Virginia Tech Library moving in stride with the evolving electronic developments. In the current Library promotional brochure, he says, "The new 'library without walls' -- a library in which access to information will be unhampered by its location -- will offer our [users] unparalleled access to electronic information."

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## Appendix A

### Database Summaries

Attached are the "database guides" produced by the Library and available to patrons. The guides cover

- Electronic Reference Area,
- Agricola,
- CIRR,
- Dow Jones News/Retrieval,
- ERIC,
- InfoTrac,
- MLA,
- NewsBank,
- NTIS,
- PsycLIT, and
- WESTLAW.

No guides are available for:

- Auto-Graphics or
- Any of the individual CD-ROM databases.



## ELECTRONIC REFERENCE AREA

The Electronic Reference Area (ERA) provides access to information in computerized databases. The Library subscribes to two online databases as well as several CD-ROM (Compact Disc - Read Only Memory) databases. CD-ROM discs are similar to CD audio discs, except that the content is textual rather than musical. Assistance in using all the computerized databases can be received from staff at the ERA or Reference desks.

### ONLINE DATABASES

#### Dow Jones News/Retrieval Service

Online access is provided to over 40 databases covering business and economic news and detailed financial reports on companies, industries and the economy. Many databases are updated daily and some even more frequently.

#### Westlaw

Online access is provided to the full text of hundreds of legal and business databases covering statutes, codes, regulations, rules, court decisions and legal periodicals.

### CD-ROM DATABASES Bibliographic Databases

#### Agricola

This database corresponds to the printed index, Bibliography of Agriculture, and provides access to agriculture-related publications. Coverage begins in 1970 and is updated quarterly.

#### CIRR (Corporate and Industry Research Reports)

This index to company and industry reports written by securities and investment banking firms covers 1979 to the present and is updated quarterly. Documents are on microfiche in the first floor Microforms Area. Our collection is restricted to *Fortune 500* company reports from June 1988 to the present.

#### ERIC (Educational Resources Information Center)

This index corresponds to two print indexes: (1) Resources in Education, which covers recent research findings, project and technical reports, speeches, unpublished manuscripts and books in education, and (2) Current Index to Journals in Education, which covers articles on education published in over 780 education-related journals. Coverage begins in 1966 and is updated quarterly.

#### InfoTrac

Two databases are available on this system: (1) The National Newspaper Index, which indexes five national newspapers, and (2) the General Periodicals Index, which indexes over 800 popular and general-interest journals. Coverage begins in 1985 and is updated monthly.

#### MLA Bibliography

This database corresponds to the printed index, MLA International Bibliography of Books and Articles on the Modern Languages and Literature. Coverage begins in 1981 and is updated quarterly.

#### NewsBank Electronic Information System

This database provides access to newspaper articles on a wide variety of topics. The newspaper articles themselves are reproduced on microfiche. The microfiche can be found in the first floor Microforms Area.

**NTIS (National Technical Information Service)**

This database corresponds to the printed index Government Reports Announcements and Index and consists of citations to technical documents from the U.S. Department of Defense, the U.S. Department of Energy, NASA and other federal, non-federal and foreign agencies. Coverage begins in 1983 and is updated quarterly.

**PsycLit**

This database is an index to information about psychology and related fields published in international journals, technical reports, scientific documents, dissertations and books. It corresponds to the printed index, Psychological Abstracts. Coverage begins in 1974 and is updated quarterly.

**Government Documents**

**Autographics**

This index provides author, title, subject and document number access to government documents published since June 1976.

**GPO Monthly Catalog**

This database includes entries in the U.S. Government Printing Office's Monthly Catalog of United States Government Publication from July 1976 to the present.

**Non-Bibliographic and Statistics Databases**

**Compustat PC Plus**

This database is an access and screening system of financial and market data for individual corporations, business segments and industry composites for purposes of financial analysis and evaluation. The database is updated annually.

**Electronic Sweet's**

This package consists of databases for construction professionals, including SweetSearch -- product catalogs, SweetSpec -- an expert system to assist in production of project specifications, and CodeWorks -- building regulatory information.

**Census Materials**

**Census of Agriculture 1978 and 1982**

Information related to agriculture, accessed by state and county.

**Census of Retail Trade 1982**

Information related to retail trade, accessed by state and zip code.

**County and City Data 1988**

Statistical information accessed by geographic region, state, county, city or other places having a minimum population of 2500.

**SCHEDULING**

Patrons are encouraged to make appointments to use the CD-ROM databases and Westlaw. Appointments do not need to be made for InfoTrac, Autographics, NewsBank, Compustat PC Plus and Dow Jones News Retrieval. Appointments can be made at the ERA desk in the Electronic Reference Area or at the Information Desk when the ERA is not staffed. You may reserve up to 2 sessions of 30 minutes each per day, although you may stay longer if there are no pending reservations.

DG3/90-CG/AA



## AGRICOLA ON CD-ROM

AGRICOLA on compact disc (CD-ROM) contains indexing of journal articles and other materials, and cataloging done by the National Agricultural Library and FNIC. It is represented in print by the Bibliography of Agriculture. There are 3 discs: 1970; 1979-1984; 1985-present. The current disc is updated quarterly.

### 1 TO SEARCH

- A. Type **A**; press RETURN; wait for system to load and the disc menu to appear. Choose disc desired; press RETURN and wait for FIND prompt to appear.
- B. Type the words and/or phrases relevant to your topic. The AGRICOLA User's Guide contains useful searching tips and descriptions of "Category Codes". Enter each term or phrase separately. Use hyphens between multiple word descriptors and after single word descriptors. Omit hyphens when searching titles.  
Examples: dietary-proteins  
glucose-

### 2 CONNECTORS or OPERATORS:

|     |      |      |
|-----|------|------|
| AND | NOT  | WITH |
| OR  | NEAR | IN   |

Use connectors to combine sets to broaden or narrow a search:

beans OR soy

Retrieves records containing one or the other term or both terms. **OR** is used to broaden a search.

beans AND soy

Retrieves records containing both words. **AND** is used to narrow a search.

beans WITH soy

Retrieves records containing both terms when they appear in the same field (title, descriptor, etc.). **WITH** narrows a search strategy more than **AND**.

beans NEAR soy

Retrieves records containing both terms in the same sentence. **NEAR** narrows the search strategy more than **AND** or **WITH**.

beans IN TI

Retrieves records containing a word or phrase within a specified field (in this case, the **title** field).

beans NOT soy

Retrieves records containing beans but **NOT** soy. **NOT** is used to restrict undesirable words from appearing in the search results, but it may also eliminate desirable records from your retrieval. Use with caution.

### 3 FUNCTION KEYS

- |             |   |
|-------------|---|
| F1 HELP     | Explains commands   |
| F2 FIND     | Searches for words or phrases in the database   |
| F3 GUIDE    | Acts as a handbook to AGRICOLA database   |
| F4 SHOW     | Displays retrieved records on the screen; allows selection of words, phrases for searching                          |
| F5 INDEX    | Alphabetically lists indexed words in database; allows selection of entries for searching. Use for author searches. |
| F6 PRINT    | Prints retrieved records  |
| F7 RESTART  | Begins or ends a session; returns to initial screen   |
| F8 XCHANGE  | Permits exchange of compact discs   |
| F9 PREVIOUS | Shows the previous record   |
| F10 NEXT    | Shows the next record   |

### 4 TO DISPLAY YOUR RESULTS

- A. Press **F4** or **SHOW** from the COMMAND MENU (to get to the command menu press **ESC**).
- B. Press **ENTER** to view your results.
- C. Make a note of the record numbers you wish to print or download.

## 5 TO PRINT YOUR RESULTS

- A. Press **F6** or **PRINT** from the **COMMAND MENU** (to get to the command menu press **ESC**).
- B. The system defaults to **CITN** (citation).

```
PRINT FIELDS: CITN      RECORDS: ALL
```

- C. Press **ENTER** to accept the default settings and print the citation of all records retrieved or type over **CITN** to specify information to be printed (ie: **citn, de** for citation and descriptor). Use **TAB** key to move to records to be printed.

```
PRINT FIELDS: T1,ST,AB  RECORDS: 1,7,9
```

```
PRINT FIELDS: CITN,AB  RECORDS: 12-30
```

## 6 TO DOWNLOAD YOUR RESULTS

- A. Place your formatted disc in disc drive A or B.
- B. Press **ESC** to go to command screen.
- C. Press **D** for download. The download prompt will appear:

```
DOWNLOAD FIELDS: All      RECORDS: All
FILENAME: B:\Download.DOC  SEARCHING: (N)YES
```

- D. As with print mode, indicate which fields will be downloaded and then move the cursor with **TAB** to **RECORDS** to enter the numbers of the records you want downloaded. Move the cursor to **FILENAME** to change the default name of the download file (must be drive a: or b:). When downloading to an existing file, new records will be appended to the file.

## 7 FIELDS

There are several fields that may appear in an **AGRICOLA** record. The most useful fields are:

**AU:** Author  
**TI:** Title  
**SO:** Source - May be a journal citation, book or book chapter, or conference proceeding  
**PY:** Publication Year  
**LA:** Language  
**DE:** Descriptor -Subject terms assigned to the item by the **NAL**. Multi-word descriptors are considered to be sentences when using **NEAR**.  
**CC:** Category Code - See **AGRICOLA User's Guide** for descriptions of codes

## 8 SAMPLE SEARCH AND RECORD

### RESEARCH QUESTION:

What is the effect of somatotropin on milk yield?

### SAMPLE SEARCH

| SilverPlatter v1.6 |              | AGRICOLA (1984-10/88) |
|--------------------|--------------|-----------------------|
| No.                | Request      | Records               |
| #1                 | SOMATOTROPIN | 548                   |
| #2                 | MILK         | 12425                 |
| #3                 | YIELD        | 18651                 |
| #4                 | MILK YIELD   | 861                   |
| #5                 | #1 and #4    | 48                    |

**FIND:** somatotropin and milk yield

Type a search request, then press **RETURN**. To **SHOW** records found, press **F4**.

### SAMPLE RECORD RETRIEVED

```
SilverPlatter v1.6      AGRICOLA (1984-10/88)

AN:  IND 89045837
UD:   8010
AU:   De-Boer, G.; Kennelly, J.J.
TI:   Effect of somatotropin injection and dietary protein concentration on milk
      yield, and kinetics of hormones in dairy cows
SO:   J-Dairy-Sci. Champaign, Ill. : American Dairy Science Association. Feb
      1989. v. 72 (2) p. 419-426.
CN:   DNAL 44.5-J622
PA:   Other-US
PY:   1989
LA:   English
CO:   JDSCAE
IS:   ISSN: 0022-0302
NT:   Includes references.
PT:   Article
DE:   dairy-cows. somatotropin-. injections-. dietary-proteins. milk-yield.
      glucagon-. insulin-. glucose-. blood-plasma. kinetics-. digestibility-.
CC:   L600; L500
```

## 9 TO END THE SEARCH

Press **ESC Q**

## 10 FOR HELP ASK A LIBRARIAN OR THE PERSON STAFFING THE ELECTRONIC REFERENCE AREA



# CIRR

## CIRR on Disc Corporate and Industry Research Reports

### QUICK REFERENCE GUIDE

CIRR on DISC contains indexing and abstracting to over 100,000 analytical research reports prepared by analysts and economists from international securities and investment banking firms

#### 1. TO SEARCH

- A. Press F2 or FIND from the COMMAND MENU. Type in the word, phrase or company name that best describes your topic.
- B. Combine your topic with other terms by using connectors (operators) to broaden or narrow your search. For Example:
  - market share and beer
  - beer or wine
  - Delta with Eastern
  - management near strategy
  - Xerox not Digital

#### 2. TO DISPLAY YOUR RESULTS

- A. Press F4 or Show from the COMMAND MENU
- B. Then press RETURN to view your results

#### 3. TO PRINT YOUR RESULTS

- A. Press F6 or PRINT from the COMMAND MENU
- B. The system defaults to CITN (citation as follows)

|                    |              |
|--------------------|--------------|
| PRINT FIELDS: CITN | RECORDS: ALL |
|--------------------|--------------|

- C. Press RETURN to accept the default settings above or use the TAB key to type the fields and records you wish to print

|                   |                |
|-------------------|----------------|
| PRINT FIELDS: ALL | RECORDS: 1,7,9 |
|-------------------|----------------|

|                        |                |
|------------------------|----------------|
| PRINT FIELDS: TI,ST,AB | RECORDS: 12,24 |
|------------------------|----------------|

#### 4. FUNCTION KEYS

- |     |          |   |
|-----|----------|---|
| F1  | HELP     | Explains commands and other general topics  |
| F2  | FIND     | Searches for words or phrases in the database   |
| F3  | GUIDE    | Acts as handbook to the CIRR database   |
| F4  | SHOW     | Displays retrieved records on the screen; allows selection of words/phrases for searching     |
| F5  | INDEX    | Alphabetically lists indexed words in the database; allows selection of entries for searching |
| F6  | PRINT    | Prints retrieved records  |
| F7  | RESTART  | Begins or ends a session; returns to initial screen   |
| F8  | XCHANGE  | Permits exchange of compact discs   |
| F9  | PREVIOUS | SHOWS the previous record   |
| F10 | NEXT     | SHOWS the next record   |

#### 5. CONNECTORS or OPERATORS:

|     |      |      |
|-----|------|------|
| AND | NOT  | WITH |
| OR  | NEAR | IN   |

Following are additional ways to focus your search with the use of connectors.

- |                |  |
|----------------|--|
| Beer AND Wine  | Retrieves records containing both words. AND is used to NARROW a search strategy.  |
| Beer OR Wine   | Retrieves records containing one or the other term or both terms. OR is used to BROADEN a search strategy.   |
| Beer NOT Wine  | Retrieves records containing BEER but NOT WINE. NOT is used to RESTRICT undesirable words from appearing in your search results but it may also eliminate desirable records from your retrieval. Use with caution. |
| Beer NEAR Wine | Retrieves records containing both terms in the same sentence. NEAR NARROWS a search strategy.  |
| Beer WITH Wine | Retrieves records containing both terms when they appear in the same field. WITH NARROWS a search strategy.  |
| Beer IN AB     | Retrieves records containing a word or phrase within a specified FIELD (in this case, the ABSTRACT FIELD).   |

#### 6. FIELDS

The following is a list of all possible fields that can appear in a record along with a brief explanation. Not all fields appear on all records.

- |       |  |
|-------|--|
| FN:   | Fiche Number (directs you to full-text report)   |
| TI:   | Title (Name of Company, Industry, etc.)  |
| TS:   | Ticker Symbol (if company in TI)   |
| EX:   | Stock Exchange (if company in TI)  |
| AI:   | Author of the report (analyst or economist at investment firm)   |
| PB:   | Publisher of report (investment firm)  |
| PD:   | Publication Date   |
| PG:   | Number of pages, length of report  |
| ST:   | Statistics or numerical data which will appear in the report   |
| SU:   | Subject/SIC/Industry   |
| SIC:  | Standard Industrial Classification   |
| NC:   | Named Companies within the report (up to 5 most prominent)   |
| PC:   | Products   |
| AB:   | Abstract   |
| TR:   | Type of Report (Speeches, Conferences, etc.)   |
| DT:   | Document Type (e.g., company, industry, periodical contents, economic trends)                                    |
| SB:   | Subject (limits to editions or parts of the database, e.g. Abridged Editions (sb-A), foreign companies (sb-rus)) |
| F500: | Fortune 500 - yes/no (identifies Fortune 500 Companies)  |
| HQ:   | Headquarters location (of company in TI)   |
| AN:   | Accession Number   |
| UD:   | Update Code  |

#### 7. SAMPLE SEARCH AND RECORD

QUESTION: Find comparative information on two companies in the airline industry.

SEARCH 1

| SilverPlatter v1.4 CIRR (1/79 - 9/88) |                    |         |
|---------------------------------------|--------------------|---------|
| No.                                   | Request            | Records |
| #1:                                   | DELTA              | 448     |
| #2:                                   | EASTERN            | 584     |
| #3:                                   | DELTA near EASTERN | 9       |

Find:  
Type a search request, then press RETURN. To SHOW records found, press F4.

RECORD 1

| SilverPlatter v1.4 CIRR (1/79 - 9/88) |   |
|---------------------------------------|---|
| FN:                                   | SLBC-25 (88-516) G  |
| TI:                                   | Delta Air Lines, Inc  |
| TS:                                   | DAL   |
| EX:                                   | NYSE  |
| AU:                                   | Backer, H.  |
| PB:                                   | Shearson Lehman Hutton, 3 p. 03-03-88   |
| PD:                                   | 8803  |
| PG:                                   | 3   |
| ST:                                   | Capitalization as of Sept 30, 1987  |
| SU:                                   | Air-Transportation, Certified-Carriers (4511)   |
| SIC:                                  | 4511  |
| NC:                                   | Eastern Air Lines, Inc; Western Air Lines, Inc  |
| AB:                                   | Delta Air Lines has benefited from labor problems at Eastern Air Lines plus the shrinkage in Eastern's operations has opened more possibilities for gains by Delta. Once the same size, Delta now has 85 million available seat miles to Eastern's 50 million. Delta's acquisition of Western Air Lines has helped reduce the seasonality of the company's earnings & has opened service to western ski areas. Delta has 374 craft in its fleet, 211 of which are owned & the rest leased. The company has 70 new planes on order & has options on 93 others. The company appears to be well positioned for domestic & foreign expansion. |
| DT:                                   | Company   |
| F500:                                 | NO  |
| HQ:                                   | Georgia   |
| AN:                                   | 096519  |
| UD:                                   | 8807  |

For more detailed information about CIRR on Disc, please refer to A GUIDE TO CIRR on DISC published by JA micropublishing, inc., Eastchester, New York

**DOW JONES NEWS/RETRIEVAL SERVICE**

//MENU: Menu of Dow Jones Databases

**BUSINESS AND WORLD NEWSWIRES**

- //MRES - Dow Jones Business Newswires
- //DJNEWS - Dow Jones News on Companies and Industries
- //DJINS - International Dow Jones News
- //RELEASE - Press Releases
- //PIR - News, Trading Alerts, and Statistics
- //FEDFILES - Real Time Significant SEC Filings
- //CMR - Credit Markets and Financial Futures News
- //BUSINESS - Top Business, Financial and Economic News
- //NEWS - National and World News
- //KYODO - Japanese Business News

**DOW JONES TEXT LIBRARY**

The Wall Street Journal and Other National, Regional and Business Publications

- //TEXT \*Command Version \*See Note 1
- //TEXTM \*Menu Version \*See Note 1
- //QUEST \* Current Business Articles Retrieved with Everyday Language \*See Note 2

**COMPANY/INDUSTRY INFORMATION**

- //CANADA - Canadian Corporate Reports
- //DB \* Dun and Bradstreet Reports \*See Note 2
- //DSCLO - SEC Filing Extracts
- //EPS - Earnings Forecasts
- //INVEST \* Analysts' Company/Industry Reports \*See Note 2
- //MG - Statistical Comparisons of Companies & Industries
- //QUICK - Comprehensive Company Reports
- //SP - Standard & Poor's Earnings and Income Estimates
- //WATCH - Insider Trading Filings
- //WORLD - Worldwide Corporate Reports

**QUOTES, STATISTICS AND COMMENTARY**

- //CQE - Current Quotes
- //RTQ \* Real-Time Quotes \*See Note 2
- //HQ - Historical Quotes
- //TRADELINE \* Up to 15 Years of Pricing on Securities & Indexes \*See Note 2
- //FUNDS - Mutual Funds Reports
- //FUTURES - Futures and Index Quotes
- //DJA - Historical Dow Jones Averages
- //INNOVEST - Technical Analysis Reports
- //MMS - Weekly Analysis of Markets
- //WSW - Wall Street Week Transcripts

**GENERAL SERVICES**

- //BOOKS - Book Reviews
- //ENCYC - Encyclopedia
- //FIDELITY - Online Brokerage
- //MCI - Electronic Mail and Communications
- //MOVIES - Movie Reviews
- //OAG - Comprehensive Travel Services
- //SCHOOL - College Selection Service
- //SPORTS - Sports Report
- //STORE - Shopping Service
- //WTHR - Weather Report

**CUSTOMIZED INFORMATION**

- //TRACK - Company and Industry Tracking Service
- //CODE HELP - Help for Individual Databases eg. //CQE HELP

NOTE 1: These databases are available on a charge basis; i.e., YOU PAY. Costs range from 25¢/minute to 65¢/minute.

NOTE 2: These databases are UNAVAILABLE to academic accounts like ours.

Contact Lane Rasmussen (1-4645; RASMUSSE@VTVM1) or Dave Beagle (1-4118; BEAGLE@VTVM1) with any questions or comments about the Dow Jones Service.



## DOW JONES NEWS/RETRIEVAL SERVICE

### DOWNLOADING USING SMARTCOM SOFTWARE

- (1) If you want to download information to a diskette, you must place your own formatted diskette in the B drive.
- (2) Once connected to the Dow Jones service, hit the F1 key to return to the Smartcom main menu. From the *Enter Selection* choice, type B to change the default drive from A to B.
- (3) Hit the F1 key to return on-line to Dow Jones.
- (4) Once connected to Dow Jones, hitting the F4 key will download all subsequent information to disk. Downloaded information is placed in a file called *TEMP*. When you invoke downloading by hitting the F4 key, you will see the following message displayed at the bottom of the screen:

*B: TEMP 0% Receive File: Press F1 to Complete, F4 to Suspend.*

As information is downloaded, the % figure increases until, at 100%, it is dumped out of the buffer and written to disk.

- (5) Hitting the F4 key a second time will discontinue the downloading process. The *B: TEMP %* message remains on the screen, although the *Receive File...* message disappears. The % figure will remain the same until you invoke downloading again by striking the F4 key.
- (6) After downloading your information, which may have involved frequent toggling of the F4 key to capture information selectively or a single keystroke to capture everything that appeared on the screen, hit the F1 key. You see the message *Receive Complete* and are asked to *Rename File Received*. You are allowed 8 characters for the filename and three characters for the extension.
- (7) The downloaded information is in ASCII format and can be edited by your word processing software package.

#### PRINTING USING SMARTCOM SOFTWARE

The F3 key will change the printer status. If the Printer status is *On*, the word *Printer* displays at the bottom left of the screen. You can change printer status by hitting the F3 key, which simply toggles between turning the printer on and turning the printer off.

Another way to print the screen is to depress the *Shift* and *PrtSc* keys simultaneously.

To obtain the printout, hit the *LF* button to scroll the paper one line at a time or *FF* to scroll one page at a time. Be sure the red *PWR* light on the printer is illuminated.



## ERIC ON CD-ROM

ERIC on compact disc (CD-ROM) contains indexing and abstracting of journal articles and ERIC documents printed in Current Index to Journals in Education and Resources in Education. There are 3 discs: 1966-1975; 1976-1982; and 1983-present. The current disc is updated quarterly.

### 1 TO SEARCH

- A. Type E; wait for system to load and the disc menu appear. Choose disc desired; press RETURN and wait for FIND prompt to appear.
- B. Type the words and/or phrases relevant to your topic. The Thesaurus of ERIC Descriptors is helpful in determining appropriate search terms. Enter each search term or phrase separately, using hyphens between multiple word descriptors and after single word descriptors.  
Examples: vocational-education  
achievement-

### 2 CONNECTORS or OPERATORS:

|     |      |      |
|-----|------|------|
| AND | NOT  | WITH |
| OR  | NEAR | IN   |

Use connectors to combine sets to broaden or narrow a search:

#### teachers OR students

Retrieves records containing one or the other term or both terms. OR is used to broaden a search.

#### teachers AND students

Retrieves records containing both words. AND is used to narrow a search.

#### teachers NOT students

Retrieves records containing teachers but NOT students. NOT is used to restrict undesirable words from appearing in the search results, but it may also eliminate desirable records from your retrieval. Use with caution.

#### teachers NEAR students

Retrieves records containing both terms in the same sentence. NEAR narrows the search strategy.

DB5/89-CG

teachers WITH students  
Retrieves records containing both terms when they appear in the same field. WITH narrows a search strategy.

teachers IN AB  
Retrieves records containing a word or phrase within a specified field (in this case, the abstract field).

### 3 FUNCTION KEYS

- |     |          |   |
|-----|----------|---|
| F1  | HELP     | Explains commands   |
| F2  | FIND     | Searches for words or phrases in the database   |
| F3  | GUIDE    | Acts as a handbook to ERIC database   |
| F4  | SHOW     | Displays retrieved records on the screen; allows selection of words, phrases for searching                          |
| F5  | INDEX    | Alphabetically lists indexed words in database; allows selection of entries for searching. Use for author searches. |
| F6  | PRINT    | Prints retrieved records  |
| F7  | RESTART  | Begins or ends a session; returns to initial screen   |
| F8  | XCHANGE  | Permits exchange of compact discs   |
| F9  | PREVIOUS | Shows the previous record   |
| F10 | NEXT     | Shows the next record   |

### 4 TO DISPLAY YOUR RESULTS

- A. Press F4 or SHOW from the COMMAND MENU (to get to the command menu press ESC).
- B. Press ENTER to view your results.
- C. Make a note of the record numbers you wish to print.

## 5 TO PRINT YOUR RESULTS

- A. Press **F6** or **PRINT** from the COMMAND MENU (to get to the command menu press **ESC**).
- B. The system defaults to **CITN** (citation).

```
PRINT FIELDS: CITN      RECORDS: ALL
```

- C. Press **ENTER** to accept the default settings and print the citation of all records retrieved or type over **CITN** to specify information to be printed (ie: **citn, ab** for citation and abstract). Use **Tab** key to move to records to be printed.

```
PRINT FIELDS: T,ST,AB   RECORDS: 1,7,9
```

```
PRINT FIELDS: CITN,AB   RECORDS: 12-30
```

## 6 TO DOWNLOAD YOUR RESULTS

- A. Place your formatted disc in disc drive B.
- B. Press **ESC** to go to command screen.
- C. Press **D** for download. The download prompt will appear:

```
DOWNLOAD FIELDS: All    RECORDS: All
FILENAME: B:\Download.DOC  SEARCHING: (NO)YES
```

- D. As with print mode, indicate which fields will be downloaded and then move the cursor to records to indicate which records will be downloaded. Move the cursor to filename to name the file, then press **ENTER** to begin downloading.

## 7 FIELDS

There are several fields that can appear in a ERIC record. The most useful fields are:

- AN:** Accession Number  
The accession number field is the first field listed in each record. The accession number helps you identify the type of record you have retrieved and, in the case of ERIC documents, will help you locate the document. The accession number for ERIC documents begins with **ED** and is followed by numerals (example: **ED274915**). The accession number is used to locate the document in the ERIC microfiche collection in the Microforms Area of Newman Library. The accession number for ERIC journal articles begins with **EJ** and is followed by numerals (example: **EJ327512**). To locate these articles, look for the **JN** (journal name) field of the record to determine what journal contains the article.
- AU:** Author  
**TI:** Titles  
**PY:** Publication Year  
**JN:** Journal Citation  
**LA:** Language  
**DE:** Descriptors (Minor & Major)  
**AB:** Abstract

## 8 SAMPLE SEARCH AND RECORD

### RESEARCH QUESTION:

What is the relationship between teaching load and burnout?

### SAMPLE SEARCH

| SilverPlatter v1.8 |               | ERIC (1/83-9/89) |         |
|--------------------|---------------|------------------|---------|
| No.                | Request       |                  | Records |
| #1                 | teaching-load |                  | 108     |
| #2                 | BURNOUT-      |                  | 190     |
| #3                 | #1 and #2     |                  | 1       |

**FIND:** teaching-load and burnout

Type a search request, then press **RETURN**. To **SHOW** records found, press **F4**.

### SAMPLE RECORD RETRIEVED

```
SilverPlatter v1.8      ERIC (1/83-9/89)
AN: ED275062
CHN: EA01892
AU: Parkas, James-P.; Mistein, Mike
TI: Educator Stress: Myth or Reality
PY: 1968
NT: 38 p. Paper presented at the Annual Meeting of the American Educational Research Association (67th, San Francisco, CA, April 16-20, 1968).
PR: EDRS Price - MF01/PC02 Plus Postage.
DT: Information Analyses - General (070); Speeches/Meeting Papers (150)
CP: U.S.
TA: Researchers; Practitioners
LA: English
PG: 38
DE: *Burnout; *Educational-Theories; *Stress-Variables; *Teaching-Conditions
IS: REIMar87
AB: Although many researchers conclude that education is a profession marked by high levels of stress or experience of "burnout," this paper contends that educators are more adaptable and hence less stressed than the literature would indicate. The paper surveys literature on educator stress, presents studies indicating low educator stress, and explores reasons why stress is overstated. Studies supporting high educator job stress focus on four categories: (1) lack of control with which to handle assigned responsibilities; (2) role conflict; (3) poor interpersonal workplace relations; and (4) time management difficulties. Results of three New York studies call these findings into question. In a literature review, 70 percent of articles on teacher stress are classified as anecdotal. Most studies are narrow in scope and inconclusive. A "job-related tension index" indicates that educators exhibit low stress characteristics, including role clarity, ability to plan workload, and ability to obtain needed information. Three factors relate to educators' durability: (1) Stress is not new in education; (2) educators may be a hardy group; (3) as a senior work force, educators may have come to terms with their situation. Policymakers should reconsider resources being funneled into stress reduction efforts unless funds are targeted to specific goals such as improvement of classroom situations. Fifty-nine references are included. [CJH]
LV: 1
CH: EA
FI: ED
DIN: 070; 150
```

## 9 TO END THE SEARCH

Press **ESC Q**

## 10 FOR HELP ASK A LIBRARIAN OR THE PERSON STAFFING THE ELECTRONIC REFERENCE AREA.



# INFOTRAC

InfoTrac is an index to articles published during the last three years in five national newspapers and hundreds of periodicals (magazines). It is especially good for finding information on general current events as well as up-to-date information on business, law, technology and the social sciences.

Information is found by typing in the subject of your research: for example, the name of a person, company, location or topic. You may print the citations to articles you think will be helpful. Once you have the print-out of citations, follow the instructions below to find the articles.

## FINDING NEWSPAPER ARTICLES

Back issues of the five national newspaper indexes by InfoTrac are kept in one of these places:

- (1) The most current issues (usually the last 2 months or so) are shelved in alphabetical order at the beginning of the Current Periodicals Area on the 3rd floor. The only exception is the Wall Street Journal which is stacked on the shelves on Aisle B in the 2nd floor Reference Room.
- (2) Issues older than 2 months are available on microfilm, filed according to the call numbers which follow. Microfilm is kept in the Microforms Area on the 1st floor.

|  |         |
|--|---------|
| <u>Christian Science Monitor</u> . . . . . | AN C49  |
| <u>Los Angeles Times</u> . . . . .         | AN L6   |
| <u>New York Times</u> . . . . .            | AN N47  |
| <u>Wall Street Journal</u> . . . . .       | HG1 W26 |
| <u>Washington Post</u> . . . . .           | AN W37  |

## FINDING PERIODICAL ARTICLES

Most issues of periodicals are kept in one of the places listed below. You will need to know the call number of the periodical in order to find it. Call numbers are available in the black Periodical Notebooks placed on tables throughout the Reference Rooms.

- (1) The most current issues (usually part of all of the current year) are shelved in call number order in the Current Periodicals Area on the 3rd floor.
- (2) Older issues are bound into books and shelved with regular books in call number order. To find the floor a specific call number is on, check the location charts posted near

## MLA on WILSONDISC

### LOGON/LOGOFF

1. From the Directory Screen, select the MLA bibliography from the screen of CD-ROM options.
2. Note the **flashing**, "eye-catching" display and the instruction: "**Press any key ...**".
3. "Welcome to WILSONDISC" -- "Press any key"
4. WILSONDISC Main Menu:
  1. DISC SEARCH
  2. ONLINE SEARCH
  3. END WILSONDISC SESSION.
5. Select disc search; wait as disc loads, leading to:
6. WILSONDISC - DISC SEARCH MENU Screen:
  1. BROWSE SEARCH
  2. WILSEARCH
  3. WILSONLINE
  4. EXPERT WILSONLINE
  5. MAIN MENU
7. There are several ways to initiate **LOGOFF**. The best is to hit **ESC** repeatedly from the WILSONDISC MAIN MENU until:
8. Window appears, asking for **PASSWORD** to be entered in **XXXXX** slot. Type **PASSW** and hit return.
9. Directory Screen reappears.

## DOWNLOADING MLA

Records may be downloaded from the MLA CD-ROM to a formatted floppy disc.

### **DOWNLOADING**

The steps for downloading are:

- 1) Place a formatted floppy disc in Drive A.
- 2) Press **F4** to get the Print command window (F4 will download one record at a time).
- 3) Press **P** to change Print command (another window will appear).
- 4) Backspace over **PRN** message and type **A** followed by colon (:) and the name selected for the file (ie: A: Whitman).
- 5) Press **ENTER** (↵) twice.
- 6) To download current record, press **F4** and **ENTER** (↵).
- 7) To download all retrieved records, press **F6**.
- 8) A command window will appear; the default is to download 10 records. Change by pressing **N** and backspacing over number in box. Type in the total number of records desired (ie: 132). Press **ENTER** (↵). Press **P** to change (see #3-4).
- 9) Press **ENTER** (↵) twice.

### **ENDING DOWNLOADING**

The steps for ending downloading are:

- 1) When downloading is completed, press **F4** or **F6** (depending on command used).
- 2) Press **P** to change.
- 3) Backspace over filename and replace with **PRN**.
- 4) Press **ENTER** (↵).

4/90-CG



## NEWSBANK ELECTRONIC INDEX

The NewsBank Electronic Index provides access to newspaper articles on a wide variety of topics. The Electronic Index incorporates several paper NewsBank indexes on one CD-ROM disc. The newspaper articles themselves are reproduced on microfiche. CD-ROM stands for Compact Disc - Read Only Memory and incorporates the same technology as the CD audio disc except the information recorded on the disc is text rather than music.

### LOCATION

Each NewsBank paper index is a separate database on the disc. The paper indexes are located in Newman Library in the Reference Room [2nd floor] and the microfiche articles are located in the Microforms Area [1st floor]. The paper indexes are arranged by call number. The NewsBank microfiche occupy several cabinets at the far end [Squires end] of the Microforms Area.

### NEWSBANK INDEXES & DATABASES

NewsBank Index; *Paper Index Call No.: AP2 N6768a*

Microfiche holdings begin with Jan. 1976 and the disc indexing begins with Jan. 1981. There are 15 different categories included in this collection:

SCOPE: Current Events:

|     |    |  |
|-----|----|--|
| BUS | -- | Business and Economic Development      |
| CON | -- | Consumer Affairs                       |
| EDU | -- | Education                              |
| EMP | -- | Employment                             |
| ENV | -- | Environment                            |
| GOV | -- | Government Structure                   |
| HEA | -- | Health                                 |
| HSG | -- | Housing and Land Development           |
| INT | -- | International Affairs and Defense      |
| LAW | -- | Law and Legal Systems or Law and Order |
| PEO | -- | People                                 |
| POL | -- | Political Development                  |
| SOC | -- | Social Relations                       |
| TRA | -- | Transportation                         |
| WEL | -- | Welfare and Social Problems            |

Business NewsBank; *Paper Index Call No.: HG4001 B87 Ref Room*

Microfiche holdings and disc indexing begin with Jan. 1985. SCOPE: Companies, industries and executives. The focus is on specific companies [see also the NewsBank Index database for broad industry overviews.]

Names in the News; *Paper Index Call No.: AP2 N6768p Ref Room*

Microfiche holdings begin with Aug. 1979 and the Disc indexing begins with Aug. 1981. SCOPE: Biographical articles about people and groups who are in the news on a regional, national or international level.

Film and Television Index; *Paper Index Call No.: PN1993 N49 Ref Room*

Microfiche holdings begin with Jan. 1975 and the Disc indexing begins with Jan. 1980. SCOPE: Reviews, interviews and news reports of movies and television programs.

Literature Index; *Paper Index Call No.: PN2 N49 Ref Room*

Microfiche holdings begin with Jan. 1975 and the Disc indexing begins with July 1980. SCOPE: Book reviews, interviews with authors and news reports about authors. Access is by personal name, book title, subject (e.g., westerns) or literary form (e.g., poetry).

Performing Arts Index; Paper Index Call No.: PN1560 N49 Ref Room

Microfiche holdings begin with Jan. 1975 and the Disc indexing begins with July 1980. SCOPE: Reviews, interviews and news reports about musical groups, music forms, dance, theater, opera and other forms of entertainment from the stage. Access is by title of work, performer (individual name or group) and type of performance.

Fine Arts & Architecture Index; Paper Index Call No.: N1 N45 Art & Arch

Microfiche holdings begin with Jan. 1975 and the Disc indexing begins with July 1980. SCOPE: Art exhibits, artists, crafts, historic buildings and other related subjects. Access is by medium, artist name, nationality and museum name.

#### SEARCHING

Hit the white <STOP/START> key until the "Select Database" Menu of databases is displayed, then choose the desired database by moving the orange highlight bar to that selection and press the red <SEARCH> key.

Enter a word, name or phrase and then hit the red <SEARCH> key. If there is not an exact match with your search term, then you are placed at the nearest place in the Index. Use the movement arrow keys to browse through the entries.

Use the yellow <HEADINGS> key to view sub-headings when the No. of Articles exceeds one. Use the black <BACK-TRACK> key to return to an earlier screen.

Use the green <PRINT REF> & <PRINT SCREEN> keys to print your citations.

#### FINDING THE ARTICLE

When you have finished, tear off the printout and take it to the Microforms Area. In order to find your citation, you need to know the database collection, the year, the category, the fiche number (sometimes called the card number) and grid coordinates. The "Microfiche Locator Code" section of the citation lists the year, category, fiche number and grid coordinates.

Each citation includes a 3-letter category code, which represents either a separate NewsBank microfiche collection or a subcategory within a single microfiche collection [NewsBank Index & Business NewsBank]. This same 3-letter category code also displays on the fiche itself (1982-; earlier fiche have the name of the collection spelled out in its entirety).

The following category codes are use:

NIN -- Names in the News  
FTV -- Film and Television  
LIT -- Literature  
PER -- Performing Arts  
FAA -- Fine Arts & Architecture

The NewsBank Index and Business NewsBank Index databases use a multiple category identification scheme.

#### CITATION FORMAT

YEAR - DATABASE IDENTIFIER - FICHE NUMBER : GRID COORDINATES

Example: 1987 LIT 17:C3-4

This is a citation from the Literature database. The document can be obtained in the Microforms Area in the 1987 collection, fiche number 17, grid coordinates C3 and C4. The database identifier (LIT), year (1987) and fiche number (17) are displayed at the top of the fiche. The grid coordinates (C3-4) are displayed at the bottom left of each fiche image; ie., on the fiche itself and not readable without the use of a fiche reader.

NOTE: Although the overall CD-ROM disc is called NewsBank, there is also a file called NewsBank and it is the most general of the 7 databases.

#### HELP

IF YOU NEED HELP finding the microfiche, please ask at the Microforms Desk on the 1st floor.  
IF YOU NEED HELP using the CD-ROM Index, please ask at the Reference Desk on the 2nd floor.

DG11/90-DB



## NTIS ON CD-ROM

The NTIS CD-ROM database covers U.S. Government-sponsored research, development and engineering reports. The database contains bibliographic citations and summaries of technical reports, software packages and data files. The database is on two discs: 1983-1985 (#1-13) and 1985(#14-26) to present. The current disc is updated quarterly.

### 1 TO SEARCH

- A. Type **N**; press RETURN; wait for system to load and the disc menu to appear. Choose disc desired; press RETURN and wait for **FIND** prompt to appear.
- B. Type the words and/or phrases relevant to your topic. Several thesauri are used to assign descriptors to documents in the NTIS database, therefore, it is best to consult the database index (F5) for the appropriate term(s). Terms can be selected from the index or enter each search term or phrase separately. Use hyphens between multiple word descriptors and alter single word descriptors.

Examples: aircraft  
air-flow

### 2 CONNECTORS or OPERATORS:

|     |      |      |
|-----|------|------|
| AND | NOT  | WITH |
| OR  | NEAR | IN   |

Use connectors to combine sets to broaden or narrow a search:

#### flight OR aircraft

Retrieves records containing one or the other term or both terms. **OR** is used to broaden a search.

#### flight AND aircraft

Retrieves records containing both words. **AND** is used to narrow a search.

#### flight NOT aircraft

Retrieves records containing flight but **NOT** aircraft. **NOT** is used to restrict undesirable words from appearing in the search results, but it may also eliminate desirable records from your retrieval. Use with caution.

DB7'90-CG

#### flight NEAR aircraft

Retrieves records containing both terms in the same sentence. **NEAR** narrows the search strategy.

#### flight WITH aircraft

Retrieves records containing both terms when they appear in the same field. **WITH** narrows a search strategy.

#### flight IN AB

Retrieves records containing a word or phrase within a specified field (in this case, the **abstract** field).

### 3 FUNCTION KEYS

- |     |          |  |
|-----|----------|--|
| F1  | HELP     | Explains commands  |
| F2  | FIND     | Searches for words or phrases in the database  |
| F3  | GUIDE    | Acts as a handbook to the NTIS database  |
| F4  | SHOW     | Displays retrieved records on the screen; allows selection of words, phrases for searching |
| F5  | INDEX    | Alphabetically lists indexed words in database; allows selection of entries for searching  |
| F6  | PRINT    | Prints retrieved records   |
| F7  | RESTART  | Begins or ends a session; returns to initial screen  |
| F8  | XCHANGE  | Permits exchange of compact discs  |
| F9  | PREVIOUS | Shows the previous record  |
| F10 | NEXT     | Shows the next record  |

### 4 TO DISPLAY YOUR RESULTS

- A Press **F4** or **SHOW** from the COMMAND MENU (to get to the command menu press ESC).
- B Press **ENTER** to view your results.
- C Make a note of the record numbers you wish to print.

## 5 TO PRINT YOUR RESULTS

A. Press **F6** or **PRINT** from the **COMMAND MENU** (to get to the command menu press **ESC**).

B. The system defaults to **CITN** (citation).

```
PRINT FIELDS: CITN          RECORDS: ALL
```

C. Press **ENTER** to accept the default settings and print the citation of all records retrieved or type over **CITN** to specify information to be printed (ie: **citn, ab** for citation and abstract). Use **Tab** key to move to records to be printed.

```
PRINT FIELDS: TL,ST,AB     RECORDS: 1 7 9
```

```
PRINT FIELDS: CITN,AB     RECORDS: 12-30
```

## 6 TO DOWNLOAD YOUR RESULTS

A. Place your formatted disc in disc drive B.

B. Press **ESC** to go to command screen.

C. Press **D** for download. The download prompt will appear:

```
DOWNLOAD FIELDS: All      RECORDS: A
FILENAME: B:\Download.DOC  SEARCHING: INC,YES
```

D. As with print mode, indicate which fields will be downloaded and then move the cursor to records to indicate which records will be downloaded. Move the cursor to filename to name the file, then press **ENTER** to begin downloading.

## 7 FIELDS

There are several fields that can appear in a NTIS record. The most useful fields are:

- TI: Title
- \* AN: NTIS Accession number
- AU: Personal author/s
- CS: Corporate Source
- PY: Publication Year
- ID: Identifiers
- AB: Abstract
- LA: Language
- \* PR: NTIS Price Codes
- \* AV: Availability Note
- DE: Descriptors

\* These fields contain information needed to obtain a full document. Consult a Science Librarian for further information.

## 8 SAMPLE SEARCH AND RECORD

### RESEARCH QUESTION:

How can artificial intelligence systems be used in aircraft navigation systems?

### SAMPLE SEARCH

| SilverPlatter v1.6 |         | NTIS 1985 (#14-28), 1986-1989 (-#21) |  |
|--------------------|---------|--------------------------------------|--|
| No.                | Records | Request                              |  |
| #1                 | 1930    | ARTIFICIAL-INTELLIGENCE              |  |
| #2                 | 1870    | ARTIFICIAL-INTELLIGENCE IN DE        |  |
| #3                 | 1825    | EXPERT-SYSTEMS                       |  |
| #4                 | 918     | EXPERT-SYSTEMS IN DE                 |  |
| #5                 | 2472    | #2 or #4                             |  |
| #6                 | 120     | NAVIGATION-GUIDANCE-AND-             |  |
|                    |         | CONTROL-GUIDANCE-SYSTEMS*            |  |
| #7                 | 8       | #5 and #6                            |  |

\* Selected from the database index (F5)

### FIND:

Type a search request, then press **RETURN**. To **SHOW** records found, press **F4**.

### SAMPLE RECORD RETRIEVED

| SilverPlatter v1.6 |   | NTIS 1985 (#14-28), 1986-1989 (-#21) |  |
|--------------------|---|--------------------------------------|--|
| TI:                | Knowledge Based Concepts and Artificial Intelligence: Applications to Guidance and Control  |                                      |  |
| AN:                | N86108063XSP  |                                      |  |
| CS:                | Performer: Advisory Group for Aerospace Research and Development, Neuilly-sur-Seine (France).   |                                      |  |
| Funder:            | National Aeronautics and Space Administration, Washington, D C  |                                      |  |
| RD:                | c1987, 145p.  |                                      |  |
| PY:                | 1987  |                                      |  |
| NT:                | Lectures held in Ottawa, Ontario, September 10-11, in Monterey, CA, September 14-1, in Delft, Netherlands, October 12-13, and in Lisbon, Portugal, October 15-16, 1987. |                                      |  |
| CI:                | FRANCE  |                                      |  |
| LA:                | ENGLISH   |                                      |  |
| PR:                | PC A07/MF A01   |                                      |  |
| DE:                | Automatic-pilots; Circuits; Computer-programs; Hierarchies; Maintenance; Man-machine-systems; Trajectories.   |                                      |  |
| DE:                | *Air-traffic-control; *Aircraft-control; *Aircraft-guidance; *Computer-programming; *Conferences; *Expert-systems.  |                                      |  |
| ID:                | Knowledge-based-systems.  |                                      |  |
| ID:                | *Foreign-technology.  |                                      |  |
| SC:                | Aeronautics-and-aerodynamics-Avionics (51E); Transportation-Air-transportation (85A); Navigation-guidance-and-control-Guidance-systems (76B).                           |                                      |  |
| CC:                | 51E, 85A, 76B, 51, 76, 85   |                                      |  |
| AB:                | No abstract available.  |                                      |  |
| AG:                | NASAE   |                                      |  |
| CA:                | 056102000, AD455458   |                                      |  |
| RN:                | AGARDLS155, ISBN9283515687  |                                      |  |
| LD:                | 8804  |                                      |  |

## 9 TO END THE SEARCH

Press **ESC** Q

## 10 FOR HELP ASK A LIBRARIAN OR THE PERSON STAFFING THE ELECTRONIC REFERENCE AREA.



# PSYCLIT ON CD-ROM

The PsycLIT CD-ROM database covers the world's literature in psychology and related areas as published in Psychology Abstracts and entered in the PsycINFO database. PsycLIT accesses information in approximately 1400 journals. The database is on two discs: 1974-82 and 1983-present. The current disc is updated quarterly.

## 1 TO SEARCH

- A. Type **P**; press RETURN; wait for system to load and the disc menu to appear. Choose disc desired; press RETURN and wait for **FIND** prompt to appear.
- B. Type the words and/or phrases relevant to your topic. The Thesaurus of Psychological Index Terms is helpful in determining appropriate search terms. Enter each search term or phrase separately, using hyphens between multiple word descriptors and after single word descriptors.  
Examples:   employee-attitudes  
                  personnel-

## 2 CONNECTORS or OPERATORS:

|     |      |      |
|-----|------|------|
| AND | NOT  | WITH |
| OR  | NEAR | IN   |

Use connectors to combine sets to broaden or narrow a search:

### violence OR crime

Retrieves records containing one or the other term or both terms. **OR** is used to broaden a search.

### violence AND crime

Retrieves records containing both words. **AND** is used to narrow a search.

### violence NOT crime

Retrieves records containing violence but **NOT** crime. **NOT** is used to restrict undesirable words from appearing in the search results, but it may also eliminate desirable records from your retrieval. Use with caution.

### violence NEAR crime

Retrieves records containing both terms in the same sentence. **NEAR** narrows the search strategy.

### violence WITH crime

Retrieves records containing both terms when they appear in the same field. **WITH** narrows a search strategy.

### violence IN AB

Retrieves records containing a word or phrase within a specified field (in this case, the **abstract** field).

## 3 FUNCTION KEYS

- |     |          |  |
|-----|----------|--|
| F1  | HELP     | Explains commands  |
| F2  | FIND     | Searches for words or phrases in the database  |
| F3  | GUIDE    | Acts as a handbook to PsycLIT database   |
| F4  | SHOW     | Displays retrieved records on the screen; allows selection of words, phrases for searching |
| F5  | INDEX    | Alphabetically lists indexed words in database; allows selection of entries for searching  |
| F6  | PRINT    | Prints retrieved records   |
| F7  | RESTART  | Begins or ends a session; returns to initial screen  |
| F8  | XCHANGE  | Permits exchange of compact discs  |
| F9  | PREVIOUS | Shows the previous record  |
| F10 | NEXT     | Shows the next record  |

## 4 TO DISPLAY YOUR RESULTS

- A. Press **F4** or **SHOW** from the **COMMAND MENU** (to get to the command menu press **ESC**).
- B. Press **ENTER** to view your results.
- C. Make a note of the record numbers you wish to print.

## 5 TO PRINT YOUR RESULTS

- A. Press **F6** or **PRINT** from the **COMMAND MENU** (to get to the command menu press **ESC**).
- B. The system defaults to **CITN** (citation).

```
PRINT FIELDS: CITN          RECORDS: ALL
```

- C. Press **ENTER** to accept the default settings and print the citation of all records retrieved or type over **CITN** to specify information to be printed (ie: **citn, ab** for citation and abstract). Use **Tab** key to move to records to be printed.

```
PRINT FIELDS: TI,ST,AP      RECORDS: 1,7,9
```

```
PRINT FIELDS: CITN,AB      RECORDS: 12,30
```

## 6 TO DOWNLOAD YOUR RESULTS

- A. Place your formatted disc in disc drive B.
- B. Press **ESC** to go to command screen.
- C. Press **D** for download. The download prompt will appear:

```
DOWNLOAD FIELDS: All       RECORDS: All
FILENAME: B:\Download.DOC  SEARCHING: (NO)YES
```

- D. As with print mode, indicate which fields will be downloaded and then move the cursor to records to indicate which records will be downloaded. Move the cursor to filename to name the file, then press **ENTER** to begin downloading.

## 7 FIELDS

There are several fields that can appear in a PsycLit record. The most useful fields are:

**TI:** Document title  
**AU:** Author/s of document  
**IN:** Institutional affiliation of first author  
**JN:** Journal Citation  
**LA:** Language  
**PY:** Publication year  
**AB:** Abstract of article  
**DE:** Descriptors

## 8 SAMPLE SEARCH AND RECORD

### RESEARCH QUESTION:

What is the effect of television violence or crime on children?

### SAMPLE SEARCH

| SilverPlatter v1.8 |         | PsycLit Disc 2 (1/83-9/88) |                    |
|--------------------|---------|----------------------------|--------------------|
| No.                | Records |                            | Request            |
| #1                 | 314     |                            | TELEVISION-        |
| #2                 | 1222    |                            | TV-                |
| #3                 | 1243    |                            | TELEVISION- or TV- |
| #4                 | 983     |                            | VOLENCE-           |
| #5                 | 1917    |                            | CRIME-             |
| #6                 | 2742    |                            | VOLENCE- or CRIME- |
| #7                 | 4183    |                            | CHILDREN-          |
| #8                 | 5       |                            | #3 and #6 and #7   |

### FIND:

Type a search request, then press **RETURN**. To **SHOW** records found, press **F4**.

### SAMPLE RECORD RETRIEVED

```
SilverPlatter v1.8          PsycLit Disc 2 (1/83-9/88)

TI: Television as a source of maltreatment of children
AU: Eron, Leonard-D.; Hussmann, L-Rowell
IN: U Illinois, Chicago
JN: School-Psychology-Review; 1987 Vol 16(2) 195-202
CO: SPOID7
IS: 02798015
LA: English
PY: 1987
AB: Discusses the effect of TV on children's behavior, especially on
aggressive and prosocial behavior. It is maintained that heavy exposure
to TV violence is one of the causes of aggressive behavior, crime, and
violence in society. Research findings that have established relations
between viewing and the subsequent attitudes and behaviors of viewers
are reviewed. Implications and remedies for public policy, society,
parents, and educators are identified. (PsycLit Database Copyright 1987
American Psychological Assn, all rights reserved)
KP: TV viewing; social development & aggressive & prosocial behavior;
children; implications for public policy & parental & societal responsibility
DE: TELEVISION-VIEWING; PSYCHOSOCIAL-DEVELOPMENT; AGGRESSIVE-
BEHAVIOR; PROSOCIAL-BEHAVIOR; CHILDREN-; RESPONSIBILITY-;
GOVERNMENT-POLICY-MAKING
CC: 2840
PC: Human
UD: 8710
AN: 74-27836
JC: 1740
```

## 9 TO END THE SEARCH

Press **ESC Q**

## 10 FOR HELP ASK A LIBRARIAN OR THE PERSON STAFFING THE ELECTRONIC REFERENCE AREA.

## WESTLAW USE GUIDELINES

### Printing

- \* The Library encourages users to bring in their own diskettes to DOWNLOAD searches. Since the WESTLAW microcomputer has 5.25" disk drives, we will "loan" you a 5.25" diskette if your computer uses 3.5" diskettes and then copy the saved results from the larger diskette to your 3.5" one.
- \* Printing is primarily for the listing of citations.
- \* Documents owned by the Library should be photocopied rather than printed whenever possible.
- \* Documents not owned by the Library may be printed, but users are ENCOURAGED to print only those pages they really need; please do not print frivolously.
- \* Documents owned by the Library but which are not readily available -- off the shelf, at CHEDS, pages missing, etc. -- may be printed. Again, please be selective in what you print.
- \* Documents located at CHEDS may be printed IF there is a pressing need for the information that cannot be served by waiting for the off-site delivery of the paper copy.

### Reserving Time

- \* WESTLAW may be scheduled for 30-minute blocks of time.
- \* You may schedule a maximum of TWO 30-minute slots per day, except during periods of heavy usage (e.g., several classes having assignments due at the same time), when we ask that you limit yourself to ONE 30-minute slot per day.
- \* If WESTLAW is not scheduled, you may stay on and search the system as long as others are not waiting. We are, in fact, anxious that the system be used as much as possible.
- \* Scheduled users may be bumped from their slots for class instruction and other demonstrations if alternative times can not be arranged.
- \* You may schedule time by calling 231-6170.
- \* Non-University attorneys must fill out a WESTLAW Public Terminal User Agreement (Schedule D) and submit this form to WESTLAW BEFORE using the system. They will be billed by WESTLAW for their access.

March 16, 1990  
Dave Beagle  
Databases Coordinator

## WESTLAW LOGON INSTRUCTIONS

1. The C:\MENU> prompt should be displayed. If the C:\MENU> prompt is NOT showing on the screen, either:
  - A. Hit the <Alt> & <F1> keys to return to DOS; or,
  - B. Type **done** and hit the <Enter> key.
2. A MENU displays 2 choices: WESTLAW and WESTRAIN.
3. Type **W** and then hit the Enter key to log into WESTLAW. You are then placed at the WESTLAW ACCESS MENU screen.
4. Type **WL** at the **\_=>** prompt and then hit <Enter> to initiate logon procedures. **WAIT**.
5. After you see the WESTLAW logo display in asterisks, wait a few seconds. The password will be automatically entered for you.
6. You are next asked to identify your Research Session. Type in your last name followed by your University affiliation (department or major) and then hit <Enter>. Example, McComas-President's Office; Smith-History.
7. You are now in the WESTLAW system. There are 2 options that you MAY change at this point. If you do nothing, the DEFAULT settings will be in effect. Type **OPTIONS** (or simply **OPT**) and then choose the feature you wish to change:
  - A. Display explanatory messages: There are 2 options -- Prompts or NoPrompts. If you choose Prompts, you will retrieve searching assistance prompts when documents have been retrieved (Listing citations, Editing query, Expanding search, Restricting search, etc.). If you are an experienced searcher, you will not need to see Prompts. The default setting is **NOPROMPTS**, which means you will be placed at the first page of the first document retrieved.
  - B. Change the rank order of your search result: There are 2 options -- Age or Terms. If you choose Terms, documents are presented so that the one containing the greatest number of different search terms is displayed first. The default setting is **AGE**, which means documents will display in reverse chronological order; i.e., the most recent documents will display first.
8. Type **OFF** and then hit <Enter> to logoff WESTLAW.
9. Hit the <Alt> and <F1> keys to return to DOS or <Shift> and <F1> to return to the WESTLAW ACCESS MENU.

Dave Beagle  
November 13, 1990  
File: LOGON.WST

## WESTLAW INSTRUCTIONS

## DOWNLOADING Using WESTMATE Software

You may download information from Westlaw to your own diskette using the MENU features of the WESTMATE software. The Westlaw workstation currently has two 5.25" disk drives but no 3.5" disk drive, so users with the smaller size diskettes will need to borrow one of the Library's 5.25" diskettes for the downloading process, which we will then use to copy the downloaded files to your diskette.

- (0) Place a formatted 5.25" diskette in the A: drive.
- (1) Before you can save information to a disk, you must create a file name. This can be done before logging in from the WESTMATE ACCESS MENU [this is where you type WL to call Westlaw] or after you have connected with the Westlaw system.
- (2) Hit the <F10> key. You see the following choices displayed across the top of the screen:

File/Accessing Print Search Browse Services Help

- (3) Type F to choose File/Accessing. You see the following choices displayed on the screen:

Store Screen to Disk  
Log Screens to Disk  
Print or Download Offline  
File Management ...  
Change Active File or Path  
Sign Off WESTLAW  
Restart WESTMATE  
Quit WESTMATE  
WESTLAW Options  
WESTMATE Setup

- (4) Type C to choose Change Active File or Path. You are asked to Enter Path and File name. Enter a File name, which can be up to 8 characters; note that you are not given room to enter a file name extension because all downloaded files are assigned the file extension .WL. Use the arrow keys to move from File Name to Path and then type A:\ and hit the <Enter> key. The path and file name are now displayed on the bottom right of the screen. NOTE: Be sure there is a diskette in the A: drive.
- (5) When you have identified a document to download, hit <F10> and then type F to choose File/Accessing. Now type L to choose Log Screens to Disk. [While the Print or Download Offline option appears to be the logical selection, this option is not available to non-law school academic accounts like ours. As a result, our "downloading" is not a file transfer but simply a screen saving function, which can be very tedious for long documents.] The message LOG: DISK appears at the bottom of the screen. To save selected screens, type S to Store Screen to Disk, which will capture only the displayed screen. The L option, on the other hand, stores the displayed screen and all subsequent screens.
- (6) To discontinue logging screens to disk, hit <F10>, type F to choose File/Accessing and then type L to Stop Disk Logging. Note that the LOG: DISK message disappears from the bottom of the screen.
- (7) Use a word processor to read and/or edit and print your file. To print your file using WESTMATE software, return to the WESTMATE ACCESS MENU [depress the <Shift> & <F1> keys] and follow steps (2) - (3) above. Next type F to choose File Management ... and then type P to Print a File. The file name you selected in step (4) is displayed; hit <Enter> to select this file and initiate the printing process or choose from the Directory of file names [only files with the extension .WL are displayed].

## PRINTING

These instructions pertain to printing a saved file; you can print any screen while on-line by depressing the Shift and Prt Scr keys simultaneously.

- (1) Hit the shifted F2 key to reach the WESTMATE Plus Features Menu. You see the following choices:

STORE the displayed screen to disk  
LOG all displayed screens to disk  
CHANGE active disk file and/or disk drive  
FILE Management (print, browse, rename a file, etc.)  
PRINT or DOWNLOAD at end of session

Note: The PRINT option can not be selected; the pertains to printing offline at the site of the WESTLAW computer, which is not available to us as an academic account. All printing must be done locally.

- (2) Type F to get the File Management Menu:

PRINT a file  
BROWSE a file  
RENAME a file  
DELETE a file  
CHANGE a file

- (3) Type P to PRINT a file. The files on the default disk are displayed at the top of the screen and you are prompted to "Enter file name." Type in the name of the file to be printed and hit the Enter key. Be sure the printer is in the READY state (green LED should be illuminated) and that the paper is properly aligned.
- (4) After printing your file; hit the Esc key to return to the WESTLAW ACCESS MENU.
- (5) If you are finished with WESTLAW, be sure the WESTLAW ACCESS MENU displays so that the system is ready for the next user.
- (6) If you need to exit to DOS, depress the Alt and F1 keys.

## WESTLAW INSTRUCTIONS

## CASE CITATION ABBREVIATIONS

Standard abbreviations of other legal sources and legal terms are in the back of Black's Dictionary, Ref KF 156 B53 Ref Room

| <u>Abbreviation</u> | <u>Title and Call Number</u>                                  | <u>Vols at Cheds</u>   |
|---------------------|---|------------------------|
| <b>A.</b>           | Atlantic Reporter. <b>KF135 A7</b>                            | v. 1-200               |
| <b>A.2d</b>         | Atlantic Reporter, 2nd series.<br><b>KF 135 A7 Ser. 2</b>     | v.1-256                |
| <b>B.R.</b>         | Bankruptcy Reporter<br><b>KF 1515.A2 W47</b>                  | All vols. in<br>Newman |
| <b>Cal. Rptr.</b>   | California Reporter. <b>KFC47 C32</b>                         | All vols. in<br>Newman |
| <b>F.</b>           | Federal Reporter <b>KF 105 F416</b>                           | v. 1-300               |
| <b>F.2d</b>         | Federal Reporter, 2d series.<br><b>KF 105 F42x Ser. 2</b>     | v.1-412                |
| <b>F.R.</b>         | Federal Register. <b>J 1 A2</b>                               | (Fiche)                |
| <b>F. Supp.</b>     | Federal Supplement. <b>KF 105 F47x</b>                        | v.1-301                |
| <b>N.E.</b>         | Northeastern Reporter. <b>KF 135 N6x</b>                      | v.1-200                |
| <b>N.E. 2d</b>      | Northeastern Reporter, 2d series.<br><b>KF 135 N6x Ser. 2</b> | v.1-250                |
| <b>N.W.</b>         | Northwestern Reporter. <b>KF 135 N7</b>                       | v.1-300                |
| <b>N.W. 2d</b>      | Northwestern Reporter, 2d series.<br><b>KF 135 N7 Ser. 2</b>  | v.1-169                |
| <b>N.Y.S. 2d</b>    | New York Supplement, 2d series.<br><b>KFN 5045 N4</b>         | v.1-302                |
| <b>Pac.</b>         | Pacific Reporter. <b>KF 135 P2</b>                            | v.1-300                |
| <b>P. 2d</b>        | Pacific Reporter, 2d series.<br><b>KF 135 P2 Ser. 2</b>       | v.1-456                |
| <b>S.Ct.</b>        | Supreme Court Reporter.<br><b>KF 101 S85x</b>                 | All vols. in<br>Newman |
| <b>S.E.</b>         | Southeastern Reporter. <b>KF 135 S6x</b>                      | v.1-200                |

| <u>Abbreviation</u> | <u>Title and Call Number</u>                           | <u>Vols at Cheds</u>     |
|---------------------|--|--------------------------|
| S.E. 2d             | Southeastern Reporter, 2d series.<br>KF 135 S6x Ser. 2 | All vols. in<br>Newman   |
| S.W.                | Southwestern Reporter. KF 135 S7                       | v.1-300                  |
| S.W. 2d             | Southwestern Reporter, 2d series.<br>KF 135 S7 Ser. 2  | v.1-443                  |
| So.                 | Southern Reporter. KF 135 S8                           | v.1-200                  |
| So. 2d              | Southern Reporter, 2d series.<br>KF 135 S8 Ser. 2      | v.1-225                  |
| Stat.               | U.S. Statutes at Large<br>KF 50 and film               | All vols. in<br>Ref Room |
| U.S.                | United States Reports.<br>KF 101 A15x & film           | All vols. in<br>Newman   |
| U.S.C.              | United States Code.<br>KF 62 (date) A1                 | All vols. in<br>Newman   |
| U.S.C.A.            | United States Code Annotated.<br>KF 62 1927 U5x        | All vols. in<br>Ref Room |

## RETRIEVING LAW REVIEW ARTICLES USING WESTLAW

If you have a citation to a law review or bar journal article, the full-text may be available in WESTLAW. Please note that coverage of publications included in the WESTLAW system is **selective**.

1. Check the "Texts and Periodicals" section of the most recent Database List or enter the name of the publication in the IDEN database to obtain the database identifier (e.g., UCHILR is the database identifier for the University of Chicago Law Review).
2. Enter the database identifier and then hit the F10 key to select that database. Alternatively, type DB followed by the database identifier and hit the Enter key.
3. Once in the correct database, you have several ways to retrieve the article.  
Example: 54 UCHILR 334

"54 UCHILR 334"  
CI(54 & 334)  
ci(54 +5 334)  
54 +5 334

NOTE: CI(54) will retrieve all articles from volume 54

WESTLAW

## Finding Revenue Rulings Using WESTLAW

**FIND Command:** The easiest way to retrieve revenue rulings is by using the FIND command. FIND lets you retrieve certain documents within the WESTLAW system without having to enter the proper database first. FIND works for the following types of documents: Case Law, United States Code, Code of Federal Regulations, Federal Register, Revenue Rulings, Revenue Procedures, and BNA Materials. The format varies depending on the document type. To find revenue rulings, the format is: **fi rev rul yy-*nn*** (where *yy* represents the year and *nn* represents the ruling number) or **rev rul yy-*nn*** (then press the shifted F5 key). The FIND command can be issued directly by typing (FIND, FI, find, or fi) or by hitting the FIND function key, shifted F5. Revenue rulings are abbreviated and can be entered with or without periods and in upper or lower case (REV. RUL., REV RUL, rev. rul., rev rul)

Examples: fi rev rul 88-52  
FIND rev. rul. 88-52  
rev.rul. 88-52 (hit the shifted F5 key)

**Phrase Searching:** Another way to retrieve revenue rulings is by using the quotation marks to "phrase search." Unlike FIND, you must first be in the proper database. From the WESTLAW Directory, simply type **ftx-rr** and then hit the Enter key. If you are elsewhere in the system, type **ftx-rr** and then hit the F10 key to type **db ftx-rr** and then hit the Enter key to change to the Federal Taxation - Revenue Rulings database. Once in the right database, you can get a known revenue ruling by placing the ruling number in quotes:

"88-52" (hit the Enter key)  
"rev rul 88-52" (hit the Enter key)  
"REV. RUL. 88-52" (hit the Enter key)

As in the FIND examples above, there is some flexibility in how the ruling is entered, although the simplest way is to use the year and number without specifying rev rul or rev. rul. (since this is a database of revenue rulings).

If you get more than one match to your search query, type L or hit the F7 key to list the citations and then choose the number of the document you wish to view.

To search for recent rulings use one of the data restrictions to narrow your search to a given period of time. Here you must specify some search term in addition to the data restriction, so use "rev rul" or "rev.rul." with the & connector.

Examples: "rev rul" & date (after 6/1/88)  
"REV. RUL." & DATE (AFTER July 1, 1988)

[See the WESTLAW User Guide for entering date restrictions]

Type L or hit the F7 key to list the documents retrieved and then choose the number of the document you wish to view.

WESTLAW

## Finding Private Letter Rulings on WESTLAW

A Private Letter Ruling interprets and applies the tax laws to a taxpayer's specific set of facts. Private Letter Rulings are available on WESTLAW in 4 databases:

- FTX-WD Federal Taxation-Written Determinations
- FTX-CBWD Federal Taxation-Cumulative Bulletins, News Releases and Written Determinations
- FTX-RELS Federal Taxation-Cumulative Bulletins, News Releases, Written Determinations, General Counsel Memoranda, Actions on Decisions and Technical Memoranda
- FTX-ALL Federal Taxation-Combined Taxation Materials

Each ruling is identified by a unique 7-digit number of the form YYWWNNN where YY represents the year, WW represents the week issued and NNN represents the number of the ruling issued during a particular week. For example, the 5th letter ruling issued during the 12th week of 1989 would be assigned the number 8912005.

To retrieve a private letter ruling, enter one of the above databases by typing DB followed by the database name (DB FTX-WD) or type the database name and then hit the <F10> key. Then type CI followed by the ruling's citation in parentheses; e.g., CI(8812005). You can also simply enter the citation without the CI qualifier -- this pulls up the desired ruling plus any other documents in the database where that number is mentioned.

To retrieve all documents issued by the I.R.S. during a particular week, you can use the truncation symbol !. For example, CI(8915!) will retrieve all rulings issued in the 15th week of 1989.

Another strategy for retrieving private letter rulings is to simply type out that phrase (be sure the phrase is enclosed in quotes) and add a date restriction if desired. As an example, to retrieve rulings issued in the first 6 months of 1988, enter the following: "PRIVATE LETTER RULING" & DATE(after 12/31/87 & before 7/1/88).

## WESTLAW

File: PRIVLETT.RUL  
20 September 1989  
Dave Beagle

## SECURITIES AND EXCHANGE COMMISSION CORPORATE FILINGS

Database Name: SEC-ONLINE

Online Vendor: WESTLAW

The SEC-ONLINE database is provided through an agreement between West Publishing Company and SEC Online, Inc. and contains documents filed with the Securities and Exchange Commission (SEC) by public corporations listed on the New York and American Stock Exchanges. A document may be a 10K filing, a 10Q filing, an annual report or proxy statement filed with the SEC. A document may also be a company resume, prepared by SEC Online, Inc. that lists basic corporate information. Coverage begins with July 1, 1987 and includes new documents filed with the SEC, updated weekly.

**PAGINATION:** The SEC-ONLINE database contains both source page and electronic page notations. The source pages follow the original document and are displayed within parentheses [e.g.,(Source Page 5)]. The Source page can be retrieved by using the locate command to skip ahead to a source page reference (e.g., locate "source page 5"). Electronic pages represent electronic paging format developed by SEC Online, Inc. Electronic pages are displayed only when the WESTLAW STAR PAGING command is activated. Electronic pages are preceded by an asterisk (e.g., \*8) and are highlighted.

The electronic page notation is available to directly access pages noted in a document's Table of Contents provided to SEC Online, Inc. Use the STAR PAGING command, star #, to go directly to a page noted in the table of contents (e.g. star 8). STAR PAGING commands available for this database are:

star or st -- Displays electronic page number provided by SEC Online, Inc.

st # -- Displays the WESTLAW screen containing the text beginning on electronic page #.

xstar or xst -- Cancels STAR and removes electronic page references.

**FIELDS** in the database are abbreviated as follows:

NA for NAME -- Ticker symbol and company name. Examples: NA(IBM) or NA(CYR).

IN for INDEX -- Document type, i.e., 10Q, 10K, Annual Report, Proxy Statement or Company Resume. Examples: IN(proxy) or IN(10Q).

YE for YEAR -- Document date and filing date. Examples: YE(89) or YE(88).

SO for SOURCE -- Securities & Exchange Commission. Not available on Company Resume documents.

TC for TABLE OF CONTENTS -- Table of Contents and Index to Tables. Not available on Company Resume documents. Example: TC("management discussion").

ST for STATE -- Company address and state of incorporation. Examples: ST(VA) or ST(HI).

PR for PRELIM -- Includes cross references, exchange, SIC Codes, industry classification, Forbes and Fortune rankings, CUSIPS number, DUNS number, Commission file number and IRS employer I.D. Also includes legal counsel stock transfer agent, auditor and investor contacts, if available. Examples: PR(4931) or PR(Fortune /s 4).

TE for TEXT -- Text of document. Example: TE(market /5 share /s "personal computer").

**TIP:** A Date restriction may be used to retrieve documents dated on a specific date or during a range of dates. Examples: DA(AFT 12/31/88 & BEF 1/24/89) or DATE(1989).

**TIP:** To retrieve the company resume for a corporate filing document you are viewing when the resume is not part of your search result, type GM and press <ENTER>. The company resume contains general corporate information.

WESTVIEW

## Appendix B

### Auxiliary Problem Areas

#### Faculty Involvement with the ERA

The week-long hourly survey of Virginia Tech ERA users reported in Section II.D.1 found that only 1 of the 213 respondents was a faculty member. (He uses the ERA -- Dow Jones -- once a day to check his personal investments.)

The problem as perceived by ERA Manager Alan Armstrong is that a low level of faculty involvement leads to:

- inappropriate ERA-related assignments by faculty,
- inability of faculty to advise students about the ERA,
- failure of faculty to take advantage of existing library services such as training classes on the ERA or on a particular database such as ERIC, and
- duplication of ERA services by departments, such as the Psychology Department's current plans to purchase the PsycLIT CD-ROM database.

This faculty involvement issue is not covered in detail because it transcends the ERA activities. Faculty involvement with the Library as a whole is low. A year-long survey taken inside Newman Library during the 1989-1990 year found only

6.7% faculty -- with 30% graduate students, 56% undergraduates, and 7.3% other (KPMG, 1990). This lack of faculty involvement is not unique to Virginia Tech. In a recent study of 45 CD-ROM ERA users at Texas A&M University (Charles and Clark, 1990), the distribution was:

- 58% graduate students,
- 35% undergraduates,
- 7% staff or community members, and
- not a single faculty member.

Faculty typically use graduate students to conduct needed library activities and thus remain isolated from hands-on library experience. Most faculty/departments also have considerable mini-libraries with which the Virginia Tech Library's collection in that area is usually smaller and redundant. This is, of course, largely unavoidable in the case of journals used in a timely manner by a significant number of faculty within a department.

However, a potential objective for this issue would be to save total dollars expended by the university. The theory would be that closer faculty involvement with the Library (not just the ERA) would lead to a reduction in redundant purchases of all types of library materials (not just databases). If this were to become an objective of the Library, there are many activities which could be undertaken, such as:

- "No questions asked" fulfillment of faculty book order requests,
- automatic fulfillment of faculty serial order requests with submission of evidence that the cost of the Library's new subscription would be more than offset by departmental cancellations,
- faculty remote access to all databases and information services of the ERA (but note the training implications of this policy),
- document delivery to faculty offices, and
- integration of department holdings and databases within an expanded library automation system.

Increased Library funding would be needed for some of these expanded services -- but such funding should be readily forthcoming from the University or from departments benefitting from these high-profile activities.

### **Usage of Paper and Ink.**

Recently, Library staff were surprised when paper and ink consumption increased sharply after the CD-ROM network was installed in the fall of 1990. The number of specialized CD-ROM stations grew from three in the fall of 1989 to seven a year later.

A library committee formed to investigate this issue was reluctant to arbitrarily limit paper and ink usage, since ERA printing is providing a needed user service. This paper and ink problem is not covered in detail in this report

because it was not possible to formulate an acceptable objective. (Objectives proposed but rejected were: "Reduce consumption by 25%" and "eliminate waste.")

There are many reasons for potential overuse of ERA printing.

- ERA database software does not eliminate duplicate records from the retrieval set. If a user searches more than one database from a network station, the same document record can occur in both databases. With InfoTrac, duplicate records are retrieved numerous times under multiple subject headings. If a user has been doing a lengthy search, he or she may not remember if a record has already been printed, and may print it again.
- ERA database software could be much improved to reduce paper and ink consumption. With InfoTrac, the printed records are only 4.5 inches wide (on 8.5 inch wide paper) and extra lines are used for the subject heading (three lines) and to print the message "LIBRARY SUBSCRIBES TO JOURNAL" for every library holding. With the SilverPlatter software, the default print format is "CITN," but since this format omits the abstract, which users often want, they change to a longer format. The only other word on the screen giving users a clue to other format names is "ALL."

- Printing is an effective method of deferring until later a final decision on whether to select a document for acquisition. When users are in a hurry, or when other users are waiting, they may adopt the philosophy: "When in doubt, print."

Without reducing the level of service, several actions could reduce consumption:

- Software modifications to eliminate the problems cited above and to encourage paper and ink conservation.
- Training to make sure users are aware of how to use the software's printing features.
- An increase in the number or comfort of the ERA stations, or the readability of the screens (such as glare reduction). These changes would encourage users to stay longer, but print less.
- Encouragement of the use of floppy disks to store document records. Such encouragement would include, for example, downloading capability and both 5.25 and 3.5 inch floppy disk drives at all stations. There should also be several PCs with word processing and database software (and ProCite?) for patrons to use to manipulate and print their downloaded files. Finally, some facilities should be provided for the significant minority of ERA users who use Macintosh Computers.

Several actions would reduce paper and ink consumption by raising the price or lowering the convenience of printing. These include:

- charging a penny a page for printing,
- making the printers operate more slowly,
- supplying single sheet paper that users must feed in one sheet at a time, and/or
- having users supply their own paper.

### **User Acquisition of Documents**

As implied in Information Retrieval Task 8 (Section II.D.3), physical document acquisition can be time-consuming and can involve significant delays. It has been well documented that as ERA and OPAC users adjust to the speed and convenience of the automated systems, they acquire increased expectations for the non-automated portions of the tasks (Lipow, 1989; O'Leary, 1990b; Taylor, 1989; Zink, 1990). An objective for this issue could be easily formed and monitored with a periodic random sample survey. A sample objective is: "Steadily increase the percentage of user-selected documents which can be acquired with no more than 15 minutes effort and which are delivered within 48 hours, achieving a rate 90% by 2001." The 15-minute period is intended to allow for locating and photocopying a document available at the library (Task 8a), or for submitting a search or inter-library loan request (Tasks 8c and 8d). The 48-hour period allows for reshelving or for inter-library loan fulfillment using electronic or facsimile

transmission. Note that this objective makes no explicit demands on the local collection. In fact, possible solutions include

- increasing the percentage of ERA-indexed journals held by the library,
- *decreasing* journal subscriptions while emphasizing more efficient electronic access to documents and full-text databases, or
- reducing reshelving and bindery delays.

This issue is not covered in detail because its solutions transcend ERA activities.

## Appendix C

### User-System Interface Design Principles

#### INTRODUCTION

##### *Background*

The computer revolution continues to expand into new fields such as library "electronic reference areas" based on CD-ROM databases. Even the terminology is proliferating along with the applications. Man-Machine Interface (MMI) has been enlarged to become User-System Interface (USI) with particular attention on Human-Computer Interaction (HCI). A key development is that people are interacting with computers not just at home or at work, but also at the bank, the department store, and the library. The issue examined in this paper is: "What design principles can be extracted from available information in order to aid the designer or evaluator of user-system interfaces?"

Consistent with the general practice, the word "principles" refers to more global, abstract, and universal concepts. The word "guidelines" denotes more targeted, practical, and design-specific recommendations or standards. Thus, there may be hundreds of guidelines for a given design area, but there should be relatively few principles.

## ***User-System Interfaces***

***Importance.*** A hallmark of automation technology is that the rush to embed computers in every possible product has produced some very poor USIs (such as VCRs that are very difficult for some people to learn to program). It is sometimes still true that

the user is often placed in the position of an absolute master over an awesomely powerful slave, who speaks a strange and awkward tongue, whose obedience is immediate and complete but woefully thoughtless, ... rigid to the point of being psychotic, lacking sense, memory, compassion, and -- worst of all -- consistency (Miller and Thomas, 1976, as quoted in Cakir, 1986, p. 65).

However well it is executed, USI software represents a significant portion of the total software effort for a computerized product or system. In a survey of information systems in general, Smith and Mosier (1984) found that designers estimated this to be 30 to 35 per cent of the total operational software effort. As USIs have become increasingly complex, this figure is no doubt larger today.

***Conceptual Model.*** "Effective human-computer interaction relies on the [user's] being able to develop an accurate mental model of the way that a system functions" (Marshall, Nelson, and Gardiner, 1987, p. 229). Carefully constructing the conceptual model of the system is a prerequisite to applying the nine principles below. A well-constructed model will improve performance and reduce learning demands. Often, a metaphor is chosen as the core of the conceptual model (desktop metaphor, etc.). If used, metaphors

should never be mixed, and any exceptions must be clearly identified to the user.

## NINE USER-SYSTEM INTERFACE DESIGN PRINCIPLES

### *Introduction*

Following are the nine USI design principles:

Principle 1: Maximize Consistency and Use of Habit  
Patterns

Principle 2: Minimize User Effort and Memorization

Principle 3: Anticipate Errors

Principle 4: Provide Maximum User Support

Principle 5: Construct a Natural Dialog

Principle 6: Keep the Dialog Channel Open and  
Responsive

Principle 7: Strive for Modeless Operation

Principle 8: Maximize User Control and System Flexibility

Principle 9: Optimize User Performance

These principles are based on human factors research, psychological research, or USI design experience. These nine principles are largely in agreement with similar lists developed previously for HCI in general. For example, see Smith, Irby, Kimball, Verplank, and Harslem (1982), Bailey (1982), Williges et al. (1987), and Shneiderman (1987).

Each of the following sections deals with one principle and includes a general discussion, a list of derivative sample guidelines, and references to the sources of ideas which have been incorporated into the principle.

There is no attempt for the guidelines to be comprehensive. (For a list of more than 500 guidelines each, see Smith and Mosier, 1986, and Williges and Williges, 1984.) Rather, designers and evaluators can build their own project- or company-specific guidelines by working from these nine principles. For many people, such a process may be the best one to follow, because it fosters significant education while building the guideline set, and the designers have an "ownership interest" in the end product, which encourages its use.

***Principle 1: Maximize Consistency and Use of Habit Patterns***

***Discussion.*** Everyone agrees that USIs should have a high degree of consistency. This helps the user form an accurate mental model of the system, lessens errors, and reduces training requirements. It may also lead to more efficient software coding.

Shneiderman (1987) calls it the most frequently violated principle and claims it is easy to avoid. Others disagree. The designers of the Xerox Star chose consistency as one of their eight main design principles, but concluded that it was "perhaps the single hardest characteristic of all to achieve" (Smith et al., 1982, p. 268). There will always be exceptions to the consistency principle, but every exception should be challenged, justified, and finally made comprehensible to the user. In particular, the principle of maximizing system flexibility (No. 8) directly conflicts with the need for consistency.

If there are special operating modes that must be somewhat inconsistent, it should be made obvious when the system is in one of these modes. Otherwise, the habit patterns developed in "normal" modes will lead to errors.

*Sample guidelines.* (a) Maintain a consistent conceptual model. (b) Create consistent dialog details: syntax, protocol, properties, visual conventions, data display formats, etc. (c) Use "muscle memory" by being consistent in key use.

*References.* Baecker and Buxton (1987b); Bailey (1982); Fried (1982); Marshall et al. (1987); Maguire (1986); Smith and Mosier (1986); Williges, Williges, and Elkerton (1987).

### *Principle 2: Minimize User Effort and Memorization*

*Discussion.* The nature of human memory is such that only a few "chunks" of information can be retained in short-term storage. USIs should require at most five to seven items to be remembered (Hitch, 1987). In a well-managed system, this is easily accomplished. In addition to memory, the task load in general (complexity, number of required keystrokes, etc.) should be reduced whenever possible.

*Sample guidelines.* (a) Select from a menu rather than enter (or re-enter) a remembered command or data. (b) Eliminate redundant data entry. Do not require the user to memorize something from one screen in order to re-enter it on another screen. (c) For items that must be remembered, use names instead of numbers, and select names that are easily understood or already in use.

*References.* Baecker and Buxton (1987b); Fried (1982); Hansen (1971); Maguire (1986); Shneiderman (1987); Smith et al. (1982); Smith and Mosier (1986); Williges et al. (1987).

### ***Principle 3: Anticipate Errors***

*Discussion.* Anticipating user and system errors means including techniques that reduce the occurrence of error, limit its effects, and allow quick and simple recovery. Many of the other principles also contribute to this effort. It is obvious that all errors should be "trapped" and not allowed to "fall through" to the operating system level or "hang up" the machine. Proper error handling has the important side benefit of increasing the user's confidence in the system.

Errors should be considered when designing the interactive sequences, especially because users will learn the standard dialog rules and many operations will become "automatic." It is important that critical tasks -- ones that have major consequences or require careful user consideration -- do *not* become automatic. Thus, the normal sequence should be disrupted in some way (Marshall et al., 1987).

*Sample guidelines.* (a) Provide prompt notification of all user and system errors. (b) User error messages should inform the user how to correct, recover, or avoid the situation. (c) System error messages should make clear that the user didn't do anything wrong. (d) Provide an "undo" function for the last user operation.

*References.* Foley and Wallace (1974); Hansen (1971); Maguire (1986); Shneiderman (1987).

#### ***Principle 4: Provide Maximum User Support***

***Discussion.*** This principle includes USI features which assist users in their tasks either on a routine basis or when extra assistance is requested. On a routine basis, the user's "place" in the underlying data structure should be apparent.

For extra assistance, "a help key or command ... is essential if only to give confidence to a casual or naive user" (Kennedy, 1979, quoted in Maguire, 1986, p. 248).

***Sample guidelines.*** (a) Make obvious to users "where they are." (b) Make obvious "where they can go from here." (c) Indicate the next logical step, where applicable. (d) Provide a help function, active at all times and specific to the task at hand. (e) Provide an on-line tutorial or training mode.

***References.*** Bailey (1982); Carroll and Campbell (1989); Fried (1982); Foley and Wallace (1974); Williges et al. (1987).

#### ***Principle 5: Construct a Natural Dialog***

***Discussion.*** "... The key to optimizing the human-computer interface is the appropriate design and management of dialog" (Williges et al., 1987, p. 1417). As a speaker of language, the user has a complex set of expectations regarding how a dialog should occur (Hampton, 1987). The artificial user-system language should be as "natural" as possible in order to benefit from these expectations. It is the underlying language structure, not the surface features necessarily, that should be natural. ("Modeless" noun-then-verb

dialog construction is one example of a natural underlying structure.) Also, proper pacing and timing may be important (Foley and Wallace, 1974).

*Sample guidelines.* (a) Pattern dialog after sentences: a continuous sequence of action with a beginning and an end. (b) Use affirmative messages for better understandability. (c) Provide user-adjustability of the timing of messages that page or scroll automatically.

*References.* Baecker and Buxton (1987a); Buxton (1987); Marshall et al. (1987); Maguire (1986); Shneiderman (1987); Smith et al. (1982); Smith and Mosier (1986); Tesler (1981).

### *Principle 6: Keep the Dialog Channel Open and Responsive*

*Discussion.* In a human-to-human conversation, there are many verbal and non-verbal cues which tell the participants how the dialog is going. Similar cues must be carefully designed into USIs. This is one of the principles that is on virtually everyone's list in one form or another. For example: "Successful communication requires ... immediate, unobtrusive feedback on the progress of communication" (Hampton, 1987, p. 215). The feedback should be rapid and predictable. For example, a proposed European standard calls for a maximum of 0.2 s from key depression to visual response, and 2.0 s from a simple user request to system response (Cakir, 1986). The variability of the response has been shown to be important. User performance and subjective satisfaction are lowered if unpredictable delays occur in the feedback response (Maguire, 1986). In many systems, different user requests take different amounts of time to process. In a bibliographic retrieval system, for example, response time is quite variable. If the worst-

case response time can be kept to a second or two, then designers should consider imposing a consistent one- or two-second delay in all search responses that result in one or more "hits," even when a faster response is possible.

*Sample guidelines.* (a) If a prompt response is not possible, provide an interim response and then a final response. If possible, give an indication (graphical or digital) of when the response will be made. (b) Be consistent in the timing of the feedback response for all like actions.

*References.* Baecker and Buxton (1987b); Bailey (1982); Fried (1982); Marshall, Nelson and Gardiner (1987); Shneiderman (1987); Smith et al. (1982); Smith and Mosier (1986); Williges et al. (1987).

### ***Principle 7: Strive for Modeless Operation***

*Discussion.* Many early personal computer programs, such as word processors, had a plethora of operating modes: text entry mode, insert mode, delete mode, etc. A mode means that the range of possible user and system actions has been intentionally limited (but usually extended in one particular area). User actions (keystrokes) may have different meanings during different modes. By entering a mode, the user is specifying an action or group of actions first, and then making a specific selection of what will be acted upon. That is, the order is verb-then-noun.

"Modeless" operation is just the opposite. The commands are noun-then-verb. First a selection is made, then an action is taken. Generally, this is the more natural sequence for most human dialog and action. It supports the consistency principle and allows command and key assignments to be

virtually universal (Smith et al., 1982). Modeless operation was one of the design principles of the Xerox Star. It is the principle behind Reverse Polish Notation (RPN) calculators where first numbers are entered (selection) and then the mathematical operation is specified (action). Modeless operation is not a panacea, and it sometimes conflicts with other principles. For example, RPN order does not agree with normally-used mathematical notation such as "2 x 2 = 4."

*Sample guidelines.* (a) Structure commands in selection-then-action (noun-then-verb) order where possible. (b) Except for critical operations, do not require command confirmation. Therefore, an "undo" operation is required. (c) Do not use the same keys or commands for different actions depending on mode.

*References.* Baecker and Buxton (1987a); Brown (1986); Foley and Wallace (1974); Shneiderman (1987); Tesler (1981).

### ***Principle 8: Maximize User Control and System Flexibility***

*Discussion.* The issue of control is one of the more important yet subtler principles. While novice system users may start out being led step-by-step by a well-designed system, it is critical that "the user should be in command of the system, not the system in command of the user" (Palme, 1981, as quoted in Malde', 1986, p. 82). As users gain experience, they will use the flexibility feature to custom-tailor the system to their preference and needs. At all experience levels, a user who feels in control will tend to work with more confidence and get more out of the system. Because of

considerable individual differences, the optimum parameters for different users will be different.

*Sample guidelines.* (a) Allow shortcut procedures for experienced users. (b) Allow users to interrupt a task, do another task, and return to the first one where they left off. (c) Modeless operation (Principle 7) gives the user maximum freedom of choice at every moment. (d) In complex systems, individual user profiles of terminology, default options, etc. could be stored. These profiles would allow automatic re-tuning of the system for each regular user. (e) Allow the "little things" to be adjusted by the user. These are items like the loudness of beeps, the timing of messages that automatically page or scroll, and perhaps the blink rate. (f) Allow multiple dialog sequences. If multiple dialog sequences do not interfere with each other, then no individual tuning by each user is necessary. A given user might never discover there are three alternate methods.

*References.* Bailey (1982); Fried (1982); Marshall, Nelson and Gardiner (1987); Maguire (1986); Shneiderman (1987); Tesler (1981); Williges et al. (1987).

### ***Principle 9: Optimize User Performance***

*Discussion.* This principle is well-documented in human factors literature and guide books for many subjects, such as attention and perception, problem solving, display design, and keypad layout. A general issue is the compatibility between the information presented by the system and the corresponding cognitive facilities of the user. Information transfer is

improved if the amount of recoding required by the user is minimized (Williges et al., 1987).

**Sample guidelines.** (a) Use lower case letters for better readability. (b) Use blink rates of 2-4 Hertz. (c) Design numeric keypads to be telephone-style (top row 1, 2, 3) or calculator-style (top row 7, 8, 9).

**References.** Human Factors Society (1988); Maguire (1986); Shneiderman (1987); Woodson (1981).

## CONCLUSION

These design principles can be used by experienced USI professionals as a starting point and checklist for the design and evaluation of USI features. From these principles, a list of project-specific guidelines can be developed which will help produce effective, successful user-system interfaces for computerized products.

A second way to use these design principles is as a framework for evaluating existing systems. Problems uncovered by usability testing will usually violate one or more of these nine principles. This knowledge may help reveal structural or fundamental flaws in the USI, or may call attention to a whole class of related problems that need attention.

A longer version of this paper was originally published in *Human Factors in Practice*, December 1990, 16-22. (Human Factors Society CSTG and CPTG.)

## Appendix D

### AutoLibrary: An Integrated Library Automation System Prototype

#### INTRODUCTION

##### *Background*

Users of library automation systems for information retrieval have difficulty both in executing the required user actions and in evaluating the results of their searches (Charles and Clark, 1990). The execution gap occurs because the process of using existing automated systems to search for relevant documents is extremely complicated. Even experienced users of automated systems have been found to *not* understand the basic concepts of searching. The evaluation gap occurs because users are often not able to accurately assess the success of their electronic searches. For example, they may be pleased with the results, but may have missed the most relevant holdings because of an inappropriate search strategy or because they were accessing the wrong system/database.

The purpose of the AutoLibrary prototype is to demonstrate an integrated library automation system which transcends the above problems, and which features an improved user-system interface (USI). The design allows for the full list of features required for a real library automation system. For example, real database records don't fit neatly on one screen: there are long titles, multiple copies of books, etc. The prototype design handles these variable size records in a standardized yet flexible way.

Multiple pages per record are allowed. The first page has standard fields no matter what type of item (book, journal article, videodisc, etc.) is involved. Subsequent pages are different for different types of items. The normal presentation format uses fixed size fields which truncate data that do not fit, but the Expand option allows each field to expand as much as necessary to show the full information. Subsequent fields are moved down on the page and/or to subsequent pages.

### ***Major System Functions***

AutoLibrary includes four major functional areas accessible to the library patron. (Many of these features are implemented only partially or omitted from the present version of AutoLibrary.)

***Search.*** Allows users to search for documents (which may or may not be in the library's holdings) by subject, author, title, call number, etc. If not in the library's collection, the document can be ordered online through the inter-library loan department. A previously conducted and stored search can be recalled, and subject searches can be entered in natural language.

***First Time.*** First time users progress through a short tutorial on searching before proceeding to the regular search procedures.

***General Info.*** A category of auxiliary functions of interest to the general user. These include:

- ***Library Training.*** A group of several 20-minute training programs on various library topics, including How to Use AutoLibrary.
- ***Library News.*** An online newsletter written by library staff.

- *Community Info.* A variety of local information on community services and events.

*Library Services.* A category of auxiliary functions related to the individual library user.

- *Circulation.* Allows users to check all personal circulation-related activity including checked-out materials, overdue items, and search/hold status.
- *Inter-Library Loan.* Allow users to request books and articles through the inter-library loan department without having to re-enter any bibliographic information.
- *Acquisitions.* Informs users of materials recently received or ordered in subject areas of specific interest to each user.

### *Hardware*

The theoretical USI hardware for the on-site implementation of AutoLibrary includes:

- Personal computer (PC) with monochrome monitor.
- Touchscreen over the full face of the monitor.
- Full QWERTY keyboard.
- One quiet printer for each PC.
- Print spooling function such that control returns to the user within 0.5 second after the user issues a print command.

AutoLibrary could be implemented in either an Apple Macintosh or an IBM PC environment. The use of graphics and icons is limited, and -- with slight modifications -- could be satisfied by IBM character graphics. In neither

the Macintosh nor the IBM case is a mouse used. The actual hardware for the AutoLibrary prototype is any Macintosh computer running HyperCard 2.0. For the prototype, the mouse is used to simulate touchscreen operation.

## AUTOLIBRARY DESIGN PROCESS

The AutoLibrary design experience serves as an example of the recommended way to design USIs. Unfortunately, the quality of many existing software products -- including "notoriously unfriendly" information retrieval software (Tenopir, 1989, p. 80) -- indicates that the recommended design process may be frequently ignored.

### *Design Process Principles*

*Principle 1. Know the user and the task.* The user must be understood fully, early in the design process, and *in person* (Gould and Lewis, 1985). Both task-related and computer-related profiles must be understood.

AutoLibrary is specifically designed for people completely inexperienced with personal computers. This approach is required because libraries serve the entire range of the general public. The AutoLibrary design also accommodates the more expert users, but the novice user is considered first.

*Principle 2. Carefully construct the conceptual model of the system.* This is an extremely important step to take before proceeding too far with the details of design. A well-constructed model will improve performance and reduce learning demands. Often, a metaphor is chosen as the core of the

conceptual model (desktop metaphor, etc.). If used, metaphors should never be mixed, and any exceptions must be clearly identified to the user.

For AutoLibrary, there are two types of conceptual models. The "what" model is a card -- much like a library catalog card. The card displays the computer's record of information on a library item. To specify the type of information for which to search, the user fills out applicable portions of a "search" card in the identical format as that of the "view" card. The "how" model is "look and touch" -- a direct-pointing paradigm. Any user action can be carried out by a touch or sequence of touches to visible objects on the screen, or by using the keyboard as one would use a normal typewriter. There is no "indirect touching," such as touching a "next line" button to scroll a field in a window.

*Principle 3. Adopt an iterative design approach based on early and frequent usability testing* (Gould and Lewis, 1985). The testing involves simulators or prototypes and actual potential users. This iterative approach is probably the most important process principle. It has been found that:

- The intuition of designers is error-prone, no matter how good or bad they are.
- The critical parts of a system should be tested on representative users, preferably of the "lowest common denominator" type.
- What is simplest along any one dimension (e.g., number of buttons) is not necessarily conceptually simplest for users ... (Smith, Irby, Kimball, Verplank, and Harslem, 1982, p. 276).

The importance of this iterative design principle was the primary lesson of the AutoLibrary experience.

### ***Usability Testing***

***Task definition.*** Usability testing involves real users who attempt to carry out carefully-specified tasks. The AutoLibrary task definitions are attached. These instructions were read verbatim to participants, and a printed version was available to them (exposed only through the current task). Tasks 1 and 3 tested "searching" -- moving through the AutoLibrary sequence to reach the individual "card" for a single item. Tasks 2 and 4 tested "browsing" -- looking through an entire list of items shown in one-line, abbreviated form, and never needing to go to the detail of the individual card. The repetition of the tasks (1 and 3, 2 and 4) tested how quickly learning was taking place.

***Testing procedure.*** For each task (most importantly for tasks 3 and 4), realistic performance objectives were set *before* the experiment. These objectives were in terms of time to complete the task, efficiency (absence of wasted touches or keystrokes), and correctness. During the usability tests, the above measures were taken, the sessions were videotaped, and "critical incidents" were noted.

***Critical Incidents.*** Following is a critical incident report I wrote after a usability test on an early version of AutoLibrary. (Compared to the current AutoLibrary version, this version had a scrolled window on the View List screen, and had larger, square-shaped screen buttons.)

The biggest problem was that none of the three subjects understood the meaning of the inverse video display of the top item on the View List screen. All participants proceeded directly to view or print an item without realizing they needed to make a selection (move the highlight bar).

Two of the three subjects: Tried to select an item by touching it; chose Quick Print (author, call number, status) when asked to record call number and *title*; got confused during scrolling or window "jumps"; and got stuck when a dialog box required them to touch the "OK" button (which doesn't look like any of the screen buttons outside the dialog boxes).

Finally, one participant took four wrong tries over a very long minute before he found the "delete" key to let him correct his typo.

### *Changes to the Prototype*

Experiences like those recounted above led directly to design changes in the program. The "look and touch" model was adopted, and therefore nothing is ever highlighted until a user touches it. Scrolling was eliminated. The printing sequence was revised to pass through an extra step the first time, during which the print options are fully explained. The "OK" button problem was addressed by making all the buttons the same size and shape, defining a "button" on the first screen, and adding a specific instruction to

"Now touch the 'OK' button." (The delete key problem was not addressed, but could be handled by the first-time tutorial and/or improved key labeling.) The next step in the iterative design process would be to test these changes in another round of usability testing.

### *Lessons Learned*

The AutoLibrary process demonstrated the extremely beneficial, practical, and specific results that can be obtained from usability testing. The experience also led me to draw conclusions about the design of user-system interfaces for reasonably complex tasks such as information retrieval:

- It is not possible to design a USI which can be used immediately, with no training, by 95% of the general population -- unless such training is built into the program's first use.
- *With* training (built-in or external) users learn very quickly. It is possible to design a USI which can be used efficiently and successfully after very brief (five minutes or less) instruction. (I believe AutoLibrary would prove to be such a program.)
- An effective way to provide this instruction is through a "First Time" option on the first screen of the program. An unresolved issue is how to get first-time users to take advantage of this feature. (After this option was added to AutoLibrary, only one of the three

participants selected it. Interestingly, he was the one who needed its help the most.)

- No user interface worth using can be designed without usability testing with real, live users. The adage, "test early, test often" is indispensable in the USI design process.

## AUTOLIBRARY USER-SYSTEM INTERFACE DESCRIPTION

### *Overall Screen Design*

All screens have certain design elements in common:

*Program name.* "AutoLibrary" at the top line, left.

*Screen name.* At the top line, center.

*Date and time.* At the top line, right.

*Screen-specific user instructions.* Appropriate text immediately below the top line.

*Working area.* Screen-specific "screen buttons," text, graphics, keyboard data entry fields, or data display area, located at the center of the screen.

*Screen button area.* Most screen buttons are located at the bottom of screen -- the location that requires the least effort to reach.

### *Sample Design Details*

A good USI design requires careful attention to details, and requires adherence to design principles and design-specific conventions. Examples

from the prototype AutoLibrary design are presented below. Refer to the screen pictures for a visual reference.

***Consistent screen titles and buttons.*** Screen titles are user-centered words or phrases that relate to the task performed on the screen, and are consistent with the button names leading to them. From the first, Beginning screen, the Search button leads to the Search screen; from the Search screen, the Find button leads to the Search Found \_\_\_ Items screen, etc.

***Consistent screen button design and placement.*** All screen buttons are the same size. The same text font size is used on all buttons. Any time a particular screen button is used, it is always in the same location.

***Combined text and icons.*** Small icons are a part of most of the often-used screen buttons. These icons were specially created using bit-mapped graphics in order to represent the button actions with appropriate, simple, and quickly-recognized symbols. Research has shown the superiority of the combination of text and icons to either alone.

***Text font meaning.*** A sans serif font is used for all messages which are part of the "template" -- that is, which are the same every time a particular type of screen is viewed. The serif fonts (more like those produced by a typewriter) are used for "live" data -- data the user types in plus the actual database records.

***User-centered terminology.*** There is no use of the word "screen" and no explanation like "return to the xxx screen." When computer-centered terminology (like "button") is first used, it is defined. Also, there is no use of "librarianese." "Monographs" are called "books" and words like "holdings," "imprint," and "bibliographic" are avoided.

**Results-sensitive sequence.** The Search Found screen only appears if the number of "hits" is 100 or more. If so, the user is encouraged to modify the search description to shorten the list. (Studies have shown that that very few users will scan 100 hits.) If there are fewer than 100 hits, the Search Found screen is skipped and the user next sees the View List screen. If there is only one hit, both the Search Found and View List screens are skipped, and the user immediately sees the View Item screen.

**Adaptive options.** On the View List and View Item screens, after the user selects the Print/Save button and then chooses any Print/Save option except Cancel, that option subsequently appears on the View List and View Item screens. For example, after the user selects a print format, printing in the chosen format is immediately available from the View List and View Item screens.

### **Screen Pictures**

A sequence of screen pictures is attached.

## AutoLibrary Benchmark Tasks

When performing the following tasks, remember that we are not testing your performance. Rather, you are helping us test the quality of the AutoLibrary interface design. In evaluating the experiment, both efficiency and correctness are important.

- I. Please perform the following tasks, in the order shown:
  1.
    - (a) Search for all library items on the subject "innovations".
    - (b) Find the number of items located by the search. Say this number out loud.
    - (c) Find the item located by the search which was published in 1986. Find the author's last name and say it out loud.
    - (d) Find the call number of this item, and its full title. Record this information for your use in getting the item from the library.
  2.
    - (a) Do another search. Search for all library items on the subject "data processing".
    - (b) Looking through the entire list of items located, find the three items which were published in 1984, and record the call number of each of these three items.
  3.
    - (a) Do another search. Search for all library items on the subject "computers".
    - (b) Find the number of items located by the search. Say this number out loud.
    - (c) Find the item located by the search which was published in 1990. Find the author's last name and say it out loud.
    - (d) Find the call number of this item, and its full title. Record this information for your use in getting the item from the library.
  4.
    - (a) Do another search. Search for all library items on the subject "information".
    - (b) Looking through the entire list of items located, find the four items which were published in 1983. Record the call number of each of these four items.
- II. Please take a few minutes to explore AutoLibrary's features. Feel free to comment on your reactions to the appearance and operation of the interface.

# AutoLibrary

## Beginning

Mon, Apr 15, 1991

"AutoLibrary" is an index to all library items and to many published materials.

Touch a "button" (  ) to select an option.

### Search

Find published items on a specific subject, title, author, etc.

### First Time

Begin here if this is your first use of AutoLibrary.

### General Info.

Library news and training, community information.

### Library Services

Circulation, Inter-Library Loan, and Acquisitions.

### ? Help ?

Help about specific parts of AutoLibrary, or answers to your questions.

### ! Options !

Your personal notebook, plus other options as appropriate.

### ↻ Restart ↻

Start over from one of several spots.

These buttons appear throughout AutoLibrary:

# AutoLibrary

# Search

Mon, Apr 15, 1991

First touch a field name (Call No., etc.) then type in or modify your description.

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|                   |       |                |       |
|-------------------|-------|----------------|-------|
| <b>Call No.:</b>  | ..... | <b>Status:</b> | ..... |
| <b>Title:</b>     | ..... |                |       |
| <b>Authors:</b>   | ..... |                |       |
| <b>Published:</b> | ..... | <b>Type:</b>   | ..... |
| <b>Subjects:</b>  | ..... |                |       |
|                   | ..... |                |       |
|                   | ..... |                |       |
|                   | ..... |                |       |
|                   | ..... |                |       |

View a filled-in description.

View a menu of terms for an area.

[? Help ?](#)

[View Sample](#)

[! Options !](#)

[Get Menu](#)

[↻ Restart ↻](#)

# AutoLibrary

## Search

Sun, Apr 14, 1991

Type in or modify your description. When you are ready, touch the "Find" button.

Page 1 of 2

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|            |       |         |       |
|------------|-------|---------|-------|
| Call No.:  | ..... | Status: | ..... |
| Title:     | ..... |         |       |
| Authors:   | ..... |         |       |
| Published: | ..... | Type:   | ..... |
| Subjects:  | ..... |         |       |
|            | ..... |         |       |
|            | ..... |         |       |
|            | ..... |         |       |
|            | ..... |         |       |
|            | ..... |         |       |
|            | ..... |         |       |
|            | ..... |         |       |

Find library items of your description.

Find  Erase

Erase the current search description.

? Help ?

View Sample

! Options !

Get Menu

↻ Restart ↻

# AutoLibrary Search Found 116 Items Sun, Apr 14, 1991

Consider modifying your description to shorten the list. First touch, then type.

→ Next Page →

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|                   |  |                |                  |
|-------------------|--|----------------|------------------|
| <b>Call No.:</b>  | .....                                    | <b>Status:</b> | Newman.....      |
| <b>Title:</b>     | .....                                    |                |                  |
| <b>Authors:</b>   | .....                                    |                |                  |
| <b>Published:</b> | 1961-.....                               | <b>Type:</b>   | book, 30+ p..... |
| <b>Subjects:</b>  | computers and<br>library automation..... |                |                  |
|                   | .....                                    |                |                  |
|                   | .....                                    |                |                  |
|                   | .....                                    |                |                  |

View the list of these 116 items. Erase the current search description.

☰ View List ☰ ☒ Erase ☒

? Help ?

! Options !

↻ Restart ↻

## AutoLibrary

### View List of 116 Items

Sun, Apr 14, 1991

Touch an item (anywhere across line No. 1,2,3, etc.) to select it for viewing in more detail, or for printing/saving. Or touch a button to select another option.

| No. | Title                    | Authors           | Pub. | Type | Status    |
|-----|--------------------------|-------------------|------|------|-----------|
| 9   | 101 microcomputer pro... | Dewey, Patrick... | 1990 | Book | On Order  |
| 10  | Hypercard, hypertext,... | Gluck, Myke       | 1989 | Book | Available |
| 11  | Expert systems: conce... | Fenly, Charles... | 1988 | Book | Due 11-14 |
| 12  | Essential guide to dB... | Beiser, Karl      | 1987 | Book | Available |
| 13  | The librarian's guide... | Burton, Paul F... | 1986 | Book | Non-circu |
| 14  | Microcomputer spreads... | Clark, Phillip... | 1985 | Book | Available |
| 15  | Microcomputers in ARL... | Association of... | 1984 | Book | Missing   |
| 16  | Computer basics for l... | Fosdick, Howard   | 1981 | Book | Available |

? Help ?

◀ Prev. Group

! Options !

▶ Next Group

↻ Restart

# AutoLibrary

## View List of 116 Items

Sun, Apr 14, 1991

For the item you have selected, touch the "View Item" button or the "Print/Save" button. Or touch another item or another button.

| No. | Title                    | Authors           | Pub. | Type | Status    |
|-----|--------------------------|-------------------|------|------|-----------|
| 9   | 101 microcomputer pro... | Dewey, Patrick... | 1990 | Book | On Order  |
| 10  | Hypercard, hypertext,... | Gluck, Myke       | 1989 | Book | Available |
| 11  | Expert systems: conce... | Fenly, Charles... | 1988 | Book | Due 11-14 |
| 12  | Essential guide to dB... | Beiser, Karl      | 1987 | Book | Available |
| 13  | The librarian's guide... | Burton, Paul F... | 1986 | Book | Non-circu |
| 14  | Microcomputer spreads... | Clark, Phillip... | 1985 | Book | Available |
| 15  | Microcomputers in ARL... | Association of... | 1984 | Book | Missing   |
| 16  | Computer basics for l... | Fosdick, Howard   | 1981 | Book | Available |

View the item's full record.

View Item

? Help ?

◀ Prev. Group

! Options !

▶ Next Group

Print or save the item.

✓ Print/Save ✓

↺ Restart ↻

# AutoLibrary

View Item No. 10 of 116

Sun, Apr 14, 1991

Touch the "Options" button to "Expand" your view of "Published" and "Type" data.

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**Call No.:** Z678.93.H94 G48 1989    **Status:** Available at Newman

**Title:** Hypercard, hypertext, and hypermedia for libraries and media centers

**Authors:** Gluck, Myke

**Published:** 1989, Apple Compute...    **Type:** Book, 274p., bibliog. Disk (...)

**Subjects:** Hypercard (Computer program)  
Libraries -- Automation  
Media programs (Education) -- Automation  
Hypertext systems -- Library applications

View the list  
of 116 items.

 **View List** 

 **Print/Save** 

Print or save  
the item.

 **Help ?**

 **Prev. Item** 

 **Options !**

 **Next Item** 

 **Restart** 