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Whose Computer Revolution Is It?

Vincent Mosco

The subject of information access is critically important because how librarians answer the question of who has access to what information will go a long way toward answering a more fundamental question. Librarians are literally on the front lines in the political dispute over who wins and who loses in the information society and play a major role in answering that question, Whose computer revolution is it?

In spring 1988 the importance of librarians was brought home to me when I woke up on a Saturday morning to a front-page headline in Canada's national newspaper, the *Toronto Globe*: "Cash-short universities ponder sale of libraries." The University of Ottawa had already sold its library on a leaseback agreement with a private information services company. Four other universities, including the University of Toronto, were in various stages of completing their deals. The universities would retain access to the collections, but ownership would shift to the banks and trust companies underwriting the deals. The deals were justified on the grounds that books are commodities and, like any commodity, can be sold and leased back to raise cash. The president of one participating university used the example of airline companies that have been selling and leasing back their fleets for years. All the stock responses came to my mind immediately: you can't do this. Libraries are not airline hangars; they are the core of our cultural heritage and must remain as public resources and not private commodities. But a librarian at the University of Calgary put it better than I ever could. Responding to a question about why Calgary turned down an offer from a private company, Alan MacDonald said, "It's the institutional equivalent of selling your daughter." Similar responses from other librarians, particularly the Canadian Association of Research Librarians, helped to overturn the Ottawa University deal, and the others are on hold.[1] Thanks in part to these librarians, universities retain full control over access to their libraries. This is enough to convince me that librarians are central to how our society answers the question, Whose computer revolution is it?

Since the subject of this article is access to information technology, it is important for me to begin by noting a significant anniversary. Just one hundred and fifty years ago Samuel Morse and Stephen Vail exchanged the first message by telegraph. We have come a long way in a relatively short time. But all of the many changes should not lead us to lose sight of how the telegraph established a pattern of development that was generally reflected in subsequent technologies, including the telephone, radio, and television. The pattern encompassed furious early competition among inventors, rapid growth of monopolized corporate control, considerable government assistance to strengthen monopoly control, and a public interest movement that forced government and business to pay at least token attention to such values as fairness and equity, alongside the dominant concern about profitability. Others have noted this

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pattern in the history of information technology. Communications historian Willard Rowland has referred to it as "the process of reification."[2] Actually, one of my childhood heroes, former baseball star and street philosopher Yogi Berra, put it best when he said, "It's like déjà vu all over again." Well, here we are in the information age, and perhaps the most important question we face, turning Yogi's statement into a query, is Will it be déjà vu all over again? History teaches us that technology alone does not guarantee access. For us to make this a revolution for everyone, we, the public—especially those of us on the front lines of the computer revolution—need to fight for the fullest possible democratic control over the production, distribution, and use of information technology.

Nowadays, everyone seems to have a catchword for the new technology. There is a veritable industry of titles to capture the spirit of this new age: we have tentative ones—the post-industrial society—and more explicit ones—the information age, microelectronics revolution, age of the computer, etc. Then there are the numerical ones—the second self, the third wave, the fifth generation. Each tends to capture some dimension of technological change; however, they also tend to glorify the technology and gloss over the problems it creates. I like to call them "pushbutton fantasies." To correct this bias, I've decided to enter this name-the-future contest with a term that better captures the spirit of computer communications today. I call it the "Pay-per Society"—I like the pun on *paper* because it unnerves my high-tech friends who, ignoring the evidence on their desks, think that paper is on the way out.[3]

We see evidence of the Pay-per Society all around us. There are pay-per-call telephones, pay-per-view televisions, and pay-per-bit, -per-minute, or -per-screenful-of-data information businesses. Advertisers refer to pay-per reader, -per viewer, or -per body when they place an ad. In the workplace, data entry and word processing clerks know about pay-per keystroke, and so on.

Basically, new technology makes it possible to measure and monitor electronic communications and information transactions and to package and repackage information and entertainment in a marketable form. Business and government see this as a means to making money and to improving organizational and social management, and the result is a Pay-per Society. A closer look at these developments is needed.

First, there are developments in technology. Principally, these involve integrating digital computers for processing information with cable, microwave, and communication satellite systems for distributing it, using high-definition screens for displaying information.

This global process of technological integration, the creation of what one analyst calls "the global grid," is primarily driven by large business, but with the assistance of government, mainly the Department of Defense in the United States.[4]

Business stands to gain simply by turning the general resource of information—information in the form of a public good—into a marketable commodity. Though information has been a commodity throughout modern history, new technology makes it easier to deepen and extend this process by reducing information to bits that can be manipulated or packaged and repackaged in an infinite variety of ways and by moving these packages at the speed of light over global communication highways. As a result, business can use information technology to transcend space and time boundaries imposed on the ability to measure and monitor information transactions and to package and repackage information products. Therefore, a newspaper story can be sold in a number of forms, including radio, TV, cable, teletext, magazines, computer databases, educational "courseware," etc. Electronically monitored transactions like credit purchases or employee performance records can be similarly packaged and resold.

The Pay-per Society has resulted in major changes in industry and major social problems. I will address these changes and problems and conclude by sketching out some principles that might guide the development of socially beneficial solutions.

As far as the industry goes, one can identify three fundamental changes: in the stakes—what is gained in the Pay-per Soci-

ety; in the players—who are the major driving forces in the industry; and in the arena—what is the industry that produces, packages, and distributes the goods in the Pay-per Society.

One of the fundamental reasons why there is so much interest in information technology is because it expands opportunities for profit and control. The financial stakes have grown in the information business. Commentators now refer to information as a strategic form of capital, but information technology is more than the raw material for expanding the sale of commodities. Information technology is also a tool for organizational control. It enables companies like Citibank or even General Motors to centralize and concentrate the flow of strategic information while decentralizing their operations to offices all over the world. Hence, information vital to the big decisions a company makes (for example, whether it should expand into a new market) can be concentrated in the hands of key managers; and far-flung operations can carry out the routine business.

Information technology is the spinal cord of transnational business. Indeed, information technology has opened the way to a truly international division of labor by enabling businesses to take advantage of the lowest cost and most easily managed sources of raw materials, capital, and workers, with fewer and fewer space and time constraints. Boeing can link engineers in Seattle and Tokyo for real-time aircraft design work. American Airlines can hire data entry workers for $1 an hour at satellite-linked remote processing centers in Barbados. Information technology expands both the financial and organizational stakes in the Pay-per Society.

It also changes the pecking order among the major players who contend for control and access to these increasingly valuable stakes. Traditionally, the field of information and communications technology was firmly controlled by a few large providers of facilities and services, chiefly AT&T, IBM, RCA, and a few others. Over the years, however, as users of the technology—the largest banks, oil companies, retail firms, etc.—came to realize that their business depended more and more vitally on the best use of the technology, they pressed for greater and greater large-user control of the Pay-per Society. National and international user lobbies representing the largest companies in the world have pressured government regulatory and policy agencies in the U.S. and abroad to eliminate regulatory constraints on their ability to take advantage of the growing stakes in information technology. The combined clout of these users has resulted in a global movement to deregulate and privatize communication and information systems worldwide. As a result, even a company as large as AT&T, once renowned for its ability to maintain tight control over the telephone network, was forced into a major breakup.

Large users want computer communications systems tailored to meet their needs for instantaneous global transmission of massive amounts of voice, data, and graphic information at the lowest possible price. They saw AT&T and other large providers as insufficiently responsive to meet these needs. They *were* unresponsive but principally because large providers were legally bound to respond to more than the needs of the largest of users. Over the years, a combination of public pressure and corporate policy led to a regulatory system that guaranteed the public universal telephone service at affordable rates. In return, the Bell System maintained its monopoly and a guaranteed return on its investment. A regulator, the FCC, and the Congress served as watchdogs over this arrangement. The system worked well until both a growth in the stakes and the rise of the large user constituency succeeded in changing the system. The upshot of the breakup and deregulation is that market power with diminishing government oversight governs the communications system. As a result, large users get their global data highways and the public gets higher phone bills. This will be covered more fully when I discuss problems, but first, I'll turn to the third and final change in the information technology arena.

It was once possible to speak about separate and distinct industries in the communications and information arena. There were, for example, the broadcasting, tele-

phone, film, print, and, later, computer industries. Each was identified with a specific configuration of technologies, and though there were overlaps, most were shaped by a different set of players. This is all changing: changing technologies, stakes, and players are altering fundamentally the information domain, turning it into one large "electronic services arena." At its technological base, the integrated electronic services arena results from the integration of telephone and computer technology. Simply put, telephones contain computer microprocessors; computers can now communicate. Moreover, since the producers are involved in creating and distributing generalized information products that flow through what used to be called discrete industries (broadcasting, print, etc.), there is no economic ground to distinguish these industries. Finally, the major players are now dominant across these industries. Old broadcasters are information providers: IBM is building a global business-telephone network; AT&T sells computers. Perhaps more importantly, a few large users, with no history of information industry activity, are now major participants across the spectrum of this arena's activities. Sears, American Express, General Motors, and Citicorp are major players in the electronic services industry.

In essence, there is no sector of the U.S. or the global economy that is not directly involved in electronic services. Some see it as the driving force of the contemporary world economy. This is heady stuff for me. I don't know if I feel any better, having gone from teacher to information services professional. It must be heady for librarians, or are you information resources managers? Whatever we are called, there is a certain exhileration in being on the front lines of a changing world economy. There is also much to worry about. As I reflect on the significance of financial and control considerations in the Pay-per Society, I can't help but wonder if Yogi Berra was right: maybe it will be déjà vu all over again, only this time with a set of powerful technologies and corporate players who can deepen and extend fundamental social problems. Two such problems are growing disparities and social control.

The American communication and information system has historically steered an uneasy course between the principles of profit and public access. Most of the system is located in the private marketplace, but over the years organized labor, educators, and other supporters of widespread access have put in place the laws, regulations, and institutions to make certain that the democratic principles of equality and participation are buttressed by citizen access to information, irrespective of ability to pay. As a result we have enjoyed public education, public libraries, a public mail service, subsidized local telephone rates, public broadcasting, and a system of broadcast regulation that provided some support for fairness and access. The Pay-per Society threatens to undermine this system of public safeguards.

First, the ability of the technology to measure and monitor information products, users, and transactions undermines the protections we have enjoyed because of the technical difficulty of subjecting every information transaction to market criteria. But now telephone companies can charge by the *second* of use and measure by seconds the number of phone calls telephone operators complete. Television companies can determine the precise demographic composition of its audience and cross-tabulate it with marketing and attitudinal profiles, promoting pay-per view programs to precisely targeted audiences. Information companies can measure the amount of usage in precise time intervals and charge accordingly. The demise of unlimited local dialing and the movement from free TV to pay-per month, pay-per channel, and now pay-per view are steps on the way to using the technology to make every information transaction a market transaction.

But there is a danger here in making the technology responsible for increasing the division between the information rich and poor. The technology does not have to be employed in this fashion. A more democratic response would include a strong political commitment to redressing these technologically induced inequities and to using the technologies to strengthen widespread access. But the general political response has been in precisely the opposite direction. Deregulation, privatization, and the cutbacks in funding for public education, pub-

lic broadcasting, public libraries, and the public mail system are making it more likely that the potential for the technology to deepen divisions will be realized. Consider these developments.

With the divestiture and telephone deregulation, local rates have increased by 40 percent, or three times the consumer price index over the past three years.[5] While businesses benefit with sophisticated intelligent telephone networks, 25 percent of households below the poverty line make do without a telephone.[6] Since divestiture, more than 200,000 telephone workers, or close to 20 percent of the work force, have lost their jobs to the cost-cutting measures and accelerated automation brought about by deregulation.[7]

In the first six months of cable TV deregulation, rates shot up by 11 percent.[8] Now one company controls over 20 percent of the market for cable subscribers; the top five control 42 percent.[9] All programming restrictions have been lifted. As a result, home shopping firms, which share a percentage of shopping revenues with cable companies, now proliferate.

Meanwhile, restrictions on advertising time have been lifted, and broadcasters no longer have to abide by the fairness rules nor program to serve community needs. In fact, radio stations can renew licenses by postcard.

In the absence of a government program to assist in the equitable distribution of computers, access divides along strict economic lines. While 37 percent of the children in families with incomes of more than $50,000 enjoy computers in their homes, only 3.4 percent of the children in households with income less than $10,000 have the same privilege. Of all white children, 17 percent use a computer at home; only 6 percent black and 5 percent Hispanic children enjoy similar use.[10]

As the gap widens, the Paperwork Reduction Act diminishes or eliminates public access to information collected with taxpayer's dollars. The Reagan Administration has dispensed with one-fourth of all government publications.[11] Moreover, it has transferred to the private sector many government information databases. The result has been that end-user charges have doubled.[12]

In addition, it has raised the specter of private censorship, keeping even those who are willing and able to pay from the information market. Not too long ago the Dunn & Bradstreet Corporation, which operates a data-retrieval service containing basic information on one million companies, cut off more than 200 subscribers, including all labor unions, from access to the service. The company took this action because it did not want unions using the information for collective bargaining and organizing. One is hard-pressed to disagree with those who conclude that this "creates a spectre of database purveyors withholding seemingly public information if there is a hint of an adversarial motive."[13]

All of this is overseen by the Office of Management and Budget (OMB), a White House agency that Orwell would recognize immediately. Even conservative legislators have turned on the infamous OMB. According to Alphonse D'Amato (R-N.Y.), "a good name for OMB would be 'the Office of Disinformation.' " He charges the OMB with "twisting the figures when they see fit, cutting the programs they may disagree with, shirking their responsibilities by failing to communicate forthrightly with the committees and the Members attempting to work something out, but really looking to see how they can sabotage those programs they are opposed to—the ideologs, OMB. They are not elected to run the country."[14]

Meanwhile, the defunding attacks continue against public broadcasting, the public mail service, and public libraries. Reflecting on these developments, I think that only the staunchest of marketplace evangelists could disagree with investment banker Felix Rohatyn when, three months before last October's market crash, he decried "a climate of deregulation pushed to dangerous extremes." In an article with the prescient title "On the Brink," this mastermind of the New York City bankruptcy case summed up his position:

> For the sake of competition we have broken up AT&T and the result has been both bad service and higher prices. We have deregulated the airlines and the resulting price wars did indeed, lower fares. However, one airline after another is on its way to bankruptcy or to being acquired by another. The result will be a few huge airlines,

with questionable financial structures, poor service with possibly higher prices, and worrisome safety factors. Deregulation of the financial markets has resulted in an explosion of private debt, unprecedented market speculation, and the sordid abuses in the financial industry that have been coming to light in recent months. Deregulation, as with most things in life, has to be done in moderation; it has been carried too far. The free market is not always right; it surely is not always fair. It should not be turned into a religion.[15]

One is tempted to respond: Amen.

Unless we begin to pay more careful attention to Rohatyn's warning (and it is striking that the market crash took place three months after he warned that we were "on the brink"), we are likely to fall victim to deepening divisions in American society. As the economist Lester Thurow put it,

> A bi-polar income distribution of rich and poor is replacing the wide expanse of the middle class. . . . From the point of view of technical economics, a shrinking middle class is of no concern. One business magazine recently noted that the growth of high-income households would be a great opportunity for companies producing high-income leisure products. They are right. . . . But it is a cause of concern for political democracy.[16]

Also of concern is the threat posed by the new technology of violating fundamental rights to privacy and creating the potential for widespread social management of our lives.[17] Buying into the Pay-per Society means more than instant shopping or dial-up videos. It also means providing private companies and governments with enormous amounts of information on how we conduct our daily lives: what we buy, what we read, how quickly we work, whom we contact, etc. Since it is increasingly essential for us to use the technology to bank, shop, or work, people are paying more and more attention to privacy issues, understandably so. In a society in which companies use card-operated washrooms to monitor break time, the laws that protect consumers and workers are like using pop guns against an elephant.

The concern about individual privacy is laudable. Nevertheless, the problem runs much deeper than this. It is not so much a question of violating individual privacy but of social management. Electronic communication and information systems—including those that measure and monitor phone transactions, bank deposits and withdrawals, credit or debit card purchases, keystroke counts in the workplace, etc.—make it possible to gather massive amounts of information about the choices of large or small, amorphous or precisely defined collectivities to more effectively manage and control their behavior. Such management and control can in fact operate with full protection for individual privacy. Indeed, it is likely that such privacy protections will be provided in order to eliminate public reticence about using electronic communication and information systems.

Major interests in social management include governments that want to determine the best means of controlling social behavior and companies eager to guarantee stable growth in consumption patterns and a cooperative workforce. Examples of social management that we should be concerned about are information systems that chart networks of contacts among telephone and computer users, irrespective of message content. Such contact networks are used to identify cliques and other informal groups that might threaten management. The mathematician who pioneered these "block modeling" techniques, overwhelmed by inquiries from government agencies, corporations, mental institutions, and prisons, now warns of misuse.[18] Such systems can be readily applied to electronic communications among consumers as well. Effective social management also means changing your behavior to conform because you know the technology *can* monitor it, whether or not it is actually doing so. Hence the greater fear may not be that we give up our individual privacy but that we keep it and live in a society in which privacy isn't worth having.

So how do we respond to these fundamental problems? The following four basic principles should guide a social policy for an information society.

First, a social policy alternative is based not on what the market makes available but rather on a determination of people's real communication and information *needs* in a society where these needs are growing and changing. Just as societies assess people's needs for housing, food, clothing, etc., we need to develop a systematic assessment

of what mix of communication and information services are vital for a citizenry sufficiently skilled to live and work in a society increasingly dependent on communication- and information-based skills.

Second, an alternative would start from a broadened conception of *literacy*. It is popular to discuss the growing problem of illiteracy in Western societies and the need to enhance reading and comprehension skills. It is also popular to talk about the need for computer literacy, though there is considerable vagueness about what this means. An alternative social policy would include a commitment to verbal, visual, and information literacy.

The commitment to literacy includes the traditional dedication to learning how to read; futurists who argue that computers make reading skills obsolete are essentially calling for deskilling society. But a renewed commitment to literacy means more than this. It means teaching people how to read and to understand the range of visual material we are exposed to regularly. This means teaching how visual material—from video to film, from posters to advertisements—is put together and presented. Visual literacy includes learning the language that video-makers use to say things with the visual. This comprises everything from how one can speak with camera angles to the different messages that different forms of editing transmit. By learning some of the language and skill of the visual, people would be in a better position to understand, question, take apart, and reassemble for themselves the messages that the visual conveys. You do not have to subscribe to a music video channel to appreciate how we would all benefit by education that makes us less taken and taken in by the lure of the video.

Finally, literacy means being able to "read" the systems of electronic communication and information. It is not necessary to learn how a computer is put together or even how to program. Rather, it is important to know what these systems can *do*. How do we communicate with them? What communication possibilities do they enhance or diminish? What information potential is opened or closed by the development of these systems? What is the relationship of these systems to the rest of society? What are the social costs and benefits of developing them in different ways (the market, the government, the community)?

The third component of a social policy for overcoming disparities in communication and information calls for a strengthened commitment to *universality*. Reliance on market principles is undermining the existing commitment to universal phone service, postal service, library service, and others. The response of those who oppose this trend is often to seek a commitment to universal access to a particular instrumentality like the telephone. One cannot quarrel with a public effort to maintain such access. However, in an age when long-dominant instrumentalities are changing and evolving in symbiosis with others, it is not enough to maintain universal access to the telephone. A useful social policy alternative would broaden the definition of *universal* to account for changes in communication and information systems and the evolving needs of people for access to such systems.

Universal access should mean access at affordable rates to telephone networks that provide a wide range of voice, information, and signalling services. These would include, in addition to local and long-distance telephone use, the availability of basic information about health care, education, and other community services; opportunities to respond electronically to verbal communication; and opportunities to signal for emergency services, information, and other vital communications. Universal service can be defined as access to a public network that provides a range of services. A basket of these services would be available to everyone at an affordable rate. Their composition would be determined by the widest possible public participation and would change with the evolution of needs in communication and information services. Such is the basic principle guiding the development of public education. This principle would serve as a useful alternative to the market in guiding the development of communication and information services.

Finally, we need a new definition of *self- and collective determination* that would restrict the gathering of information to those areas that communities and their

elected representatives determine to be in the public interest. Social management requires, and electronic systems make possible, extending surveillance in breadth across an entire society and in depth into what the philosopher Michel Foucault has aptly called the "capillary level" of society.[19] The challenge then is not how to protect individual privacy, but rather, how to reduce the threat to freedom, to a self-managed life, or to a life in which people choose their own form of collective management.

Again, reliance on the marketplace for policy remedies here is only likely to accelerate the process of social management. Current discussions about letting the market set a purchase price for individual privacy eliminates a human right and makes it a marketable commodity, a right for those who can afford it. When information on the group behavior of workers or consumers is made a commodity and marketed to advance profit and control, the fundamental right of self-determination is violated.

The protection of self-determination in a world of electronic communication and information systems is difficult, in part because of the value of individual privacy and the difficulty in seeing harm in the gathering of what appears to be anonymous data. What is the problem? is a typical response. Former Supreme Court Justice William O. Douglas, perhaps less pithy than Yogi Berra, nevertheless provided the best answer:

> As nightfall does not come at once, neither does oppression. In both instances, there is a twilight when everything remains seemingly unchanged. And it is in such twilight that we all must be most aware of change in the air—however slight—lest we become unwitting victims of the darkness.[20]

Human needs, literacy, universality, and self-determination are the building blocks for an information age social policy. They are the first steps toward avoiding the negative lessons of old technologies. They are the first steps toward avoiding a more dangerous version of déjà vu all over again. They are the first steps toward an information society in which all will be admitted, including those who lack the marketplace power that is the required price for admission today.

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Libraries and Computers: Disaster Prevention and Recovery

R. Bruce Miller

This article surveys areas of vulnerability for library databases, provides guidance to minimize the threat of disasters, and outlines recovery procedures. Topics covered include planning associated with natural catastrophes, points to consider when building a computer room, prevention of computer failure and also what to do when it does happen, vendor failure, secure physical and data environments, possibilities for continued operation even when the building falls down, and steps to follow when developing a disaster prevention and recovery plan.

My careful research indicates that the very best security system is one for which no information is made available to anyone except those who maintain the system. With that in mind, I will close my presentation here.

That was the obligatory opening joke. The humor goes down hill from here.

Seriously, there is some validity to withholding information about your system backup and your security situation. An official-looking sign in your front yard stating there is an electronic security system in operation that yields an armed response when triggered is probably as effective as a real system and certainly costs a lot less. When your automated circulation system goes down, I recommend that you swear the staff to secrecy and continue going through the motions of checking out books using the terminal even though no transaction is actually recorded. Over a short period of time, I pose that you will have as many books returned as you would have if you had actually electronically charged them out but without the aggravation of an elaborate back-up procedure.

This may seem like a curious beginning when you consider the topic: "Disaster Prevention and Recovery." However, security is the real issue here. Secure means "free from danger or risk of loss; free from fear or doubt; not likely to fail or give way; stable."[1] You can't have a system that is 100 percent secure and never fails, but you can plan contingencies to deal with as many disaster situations as possible so that you do present a secure situation to your users. The assumptions are that you cannot create a Fort Knox environment for your library computer database *and* that something will go wrong from time to time.

This article outlines some of the points of vulnerability for your library database. This information applies to all library databases from catalog to circulation to accounting to word processing. It also applies to supercomputers, mainframes, minis, micros, workstations, and all the mixes in between. Generally all of the databases and

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the hardware have the same needs, and I won't bother to differentiate unless a particular situation offers a special opportunity or a peculiar problem.

NATURAL CATASTROPHES

Let's take the first steps into our soon-to-be deepening paranoia by thinking about natural disasters and their implications. In most cases, you simply need to consider the obvious. If you live in Tornado Alley, will your computer be off to Oz with the first storm? Have you placed your machines underneath the plumbing (as in "here comes the water")? In one older library in which I worked, the chosen site for the computer room was in the basement near the loading dock, which was at the bottom of a long ramp for trucks. There was a good drainage system, but can you imagine the possibilities in the event of a blocked drain? Adding to my nervousness was the fact that normal rainfall in that part of the country is nearly sixty inches per year. An uninterrupted power supply (UPS) is an integral part of protecting your equipment and database from power surges whether they are from utility equipment problems or from a nearby blast of lightning. Big earthquakes are rare, but small ones are frequent in southern California; now that I have moved to California, I have to think about cracked pipes and things that fall over if they are not bolted down.

Thanks to smaller equipment with minimal environmental requirements, in many cases you can now set your computer just about anywhere. However, the issues associated with the design of a classic computer room can give you a laundry list to consider when selecting a site for your computer, so I will run through a few of them. My library has just completed construction of its second computer facility. We are out of the mainframe business, but we have a few pieces of communications equipment for MELVYL that require nominal air conditioning. (MELVYL is the University of California systemwide online catalog.) Since we needed a site for that equipment, we decided to also install our INNOVACQ and INNOPAC computers in the same room in order to take advantage of space planning and network connections, even though they do not require significant air conditioning. The site is a windowless room that is about twenty feet by twenty feet with a very high ceiling and very thick concrete walls in the center of the Central University Library.

So what did we do to this barren space to make it comfortable and secure for our precious computers and databases? First we installed an air conditioner. We did not create a backup system for the air conditioner, but we know from experience that we can repair or completely replace this type of unit within a short period of time. Therefore, we decided to gamble on the "heat sink" capabilities of the concrete room and an open door to keep things cool enough to keep going in the event of that type of failure. Alternatives were to connect to the building cooling system or to have another air conditioner; both options were too expensive when compared to the possible need. If we had a mainframe computer, the environmental requirements could be too restrictive for this relatively simple solution. (By the way, a special requirement for our air conditioner was copper coils because aluminum doesn't last in our salty oceanside air.)

We installed fire alarm sensors to tell us about heat, smoke, and other fire indicators, but we did not install any fire-extinguishing system other than the standard hand-operated ones. Our previous computer facility did have an automatic halon system for chemically snuffing out fires. It was considered necessary because the room contained an IBM-type mainframe computer and a lot of other heat-producing (and potentially combustible) equipment. Our new equipment produces significantly less heat, and very few items are actually combustible. The $10,000 cost to install a new halon system plus the necessary regular maintenance provided enough disincentive to forego that type of protection this time around. Also, when a halon system is used a residue is left on everything. In some cases, the residue causes more damage than an isolated small fire. In addition, there is now a health hazard question for anyone who is caught in a room in which a halon system is activated.

What we plan to do related to putting

out fires may seem crazy at first glance. Two years from now, as part of a planned building renovation, we will add a sprinkler system to the room. Not only will there be pipes that can spray water hanging above all of the computers but they will also contain water *all* of the time instead of only when the fire department fills the standpipe system during a fire. This is not as crazy as it seems because of improvements in sprinkler technology. The older dry-pipe systems have two major problems. When they are empty, a nasty black mold that grows in them is then deposited on all of your equipment when the sprinklers have to be used. (This also occurs in wet-pipe systems that do not recirculate or that are not flushed periodically.) The second problem is that they are actually more likely to develop a catastrophic leak than the newer wet-pipe systems because of engineering advances. The new wet-pipe systems can also turn themselves off when the temperature in the room drops to a safe level. As counterintuitive as it may seem, smoke can actually cause more damage in a computer room than water. All in all, the best protection for the least cost is the proper wet-pipe sprinkler system. If you have been paying attention, however, you will have noted that we will have no automatic fire-extinguishing system for at least two years. As with all disaster planning, we evaluated the risks versus the cost to protect ourselves and decided that the very low probability of losing our equipment to a fire in the computer room, plus our equipment insurance to get us started again, would put us on reasonably safe ground until the building renovation provides the sprinkler system.

We do have moisture detectors under the computer floor that are attached to alarms to tell us if the equipment is exposed to even a very small amount of moisture. Because the room is part of a mechanical space, we are exposed to a half-dozen water pipes running from floor to ceiling in one part of the room. The pipes are wrapped, and small water leaks would just drip on the floor and run out the door of the room. If there were an earthquake, however, I feel it would be possible to develop a sudden breakage that could spray water on the computers. As a result, we asked for a sheet metal shield to be erected between these pipes and the equipment. With this arrangement, the pipes can leak or spray to their hearts' content, but none of the computers will get wet.

There is one final word on water in this computer room. Because of the physical constraints on the space, the air conditioner hangs from the ceiling. Even though a special pump removes condensate, we requested another sheet metal deflector to divert any possible water accumulation away from the computers. That air conditioner hanging in the air also makes me nervous because I can envision it crashing down during an earthquake. However, it is securely attacked to flexible hangers, so it should sway but not fall during an earthquake. Further, the computer room is essentially a concrete bunker. My assumption is that any earthquake severe enough to significantly disturb equipment in that room will probably destroy the library, in which case a quick restart of the computer will be the last thing on our minds.

COMPUTER FAILURE

Your computer is safely nestled in its weatherproof home, but you still have to worry about keeping it going. The hardware itself is the first place to establish security. As I mentioned before, a UPS (uninterrupted power supply) is important. This bit of electrical technology buffers incoming electricity to make sure that your machines receive continuous, even power. Depending on how much money you can spend, you can have simple power conditioning or even a brief period of stand-alone backup power to be used while the computer system automatically shuts itself down without damage or loss of data. You can even go so far as to have a true backup power supply that keeps things going with batteries until the diesel- or gas-powered generator can kick in to provide local power.

The choice of computer design is another factor. Tandem computers were one of the first to develop nonstop systems with redundant CPUs, operating systems, and databases. Multiple processors help keep things going. There can be a failure associated with a single processor but the system

keeps running (albeit slower) because the others can pick up the load. A good multiprocessor system can have a faulty processor removed and replaced without shutting down the system. An additional nuance on this approach is to have mirrored databases, i.e., every transaction is simultaneously recorded at least one additional time, and the system software can keep going as though nothing happened even when an entire disk is taken out of operation.

You've kept power coming to your multiprocessor mirrored system, but an electrician working on the building renovation has just severed your communication lines from the computer room because he thought they were for the old telephone system and he was just getting them out of his way. It will take twenty-four hours to get the network up again. Will you lose your job or will the library manage to function in spite of losing your OPAC? At the University of California–San Diego (UCSD), we will simply shift to MELVYL for our primary catalog access because we are fortunate enough to have this alternate online catalog in place. For the near future, if we lose both MELVYL and INNOPAC, we will have the old card catalogs and microfiche access to our serial records. By the time they are removed, I hope to have another form of manual backup available, such as a CD-ROM version of our catalog that would be a by-product of another project. The circulation system can operate in a manual mode for limited periods of time, and the technical services staff will simply have to work on tasks that don't require the online system. In the final analysis, the planning task is to keep the library in business. It's up to you to develop the details of that plan so that you have a safety net that is tolerable for your local situation.

Vendor Failure

As we are discussing computer failure, it is reasonable to include vendor failure also. Rather than use precious time to thoroughly pursue this topic, I will simply give you a few ideas and let you do the research and thinking. The primary need is to have possession of the source code should your vendor default. It is relatively easy to get a contract clause that calls for a neutral third party to hold source code for delivery to the library in the event of vendor default. You should know, however, that actually getting that "neutral" third party to let go is often easier said than done. A key factor here is that the bankruptcy courts often tie up source code as a potential asset, and it may be one to two years following vendor abandonment before you actually get your hands on the source code. Then the source code is usually out of date by the time it is deposited. Finally, do you have any idea of what you will do with that code once you have it? In my current situation, a significant selection factor for our turnkey system was that the operating system and programming language of the source code are both highly standardized and well supported on campus and by the library systems staff. In other words, although we have no desire to do so, we could use the source code to stay operational even without our vendor. (For additional detail, there are a number of related articles in the fall 1987 issue of *Library Hi Tech*.)[2]

Distributed Systems

The trend toward distributed processing is having an impact on the disaster recovery situation, solving some problems but creating others. While spreading the work among various sites lessens the risk of losing it all in a disaster and provides for built-in back-up, it also makes security more difficult; there are more locations and more pieces of equipment to protect. A good communications network takes on added value and it, in turn, requires its own security and back-up.[3]

Users of distributed processing are likely to undervalue the potential loss in a disaster or failure situation and overlook the need for disaster prevention and recovery planning. Consider distributed word processing or accounting systems. There may be hundreds of reports that took weeks to prepare in a single, small system. How serious would it be to lose those reports? What will the union do to you if your library payroll is three weeks late? Distributed systems do not really need unique protection; however, they must be taken seriously and should receive the same protection that you would provide for that big IBM sitting in a locked room.

SECURITY

Viruses, Tapeworms, Trojan Horses

"Any word of this sabotage being stopped?"

"Not that I heard."

"Good. At least they didn't make that ridiculous promise. Because it can't be stopped. I guess you know all about tapeworms . . .? Good. Well what I turned loose in the net yesterday was the father and the mother . . . of all tapeworms. . . . It's of a type known as parthenogenetic. . . . It can be made to breed. . . . And—no, it *can't* be killed. It's indefinitely self-perpetuating so long as the net exists. Even if one segment of it is inactivated, a counterpart of the missing portion will remain in store at some other station and the worm will automatically subdivide and send a duplicate head to collect the spare groups and restore them to their proper place. . . . Though I say so myself, It's a neat bit of work."[4]

That quote was from John Brunner's 1975 novel *Shockwave Rider* but you can read similar accounts every day in the news media that tell of hidden and often destructive computer programs known as viruses, tapeworms, Trojan horses, and logic bombs. Last fall, patient records began disappearing from an eastern medical center's computer system thanks to a small program that had been added to the system; it ultimately destroyed 40 percent of the database. A "holiday greetings" virus was released last year that worked like a chain letter and overloaded IBM's worldwide email network.[5] These nasty little programs can be spread during the process of copying floppy disks or downloading files and software. They are usually confined to public domain software but recently have occurred in some commercial software. Some are jokes; some are destructive.

Viruses are characterized by the ability to replicate and to attach to other pieces of software with which they come into contact. A Trojan horse (or back door) hides within an otherwise normal program and carries problem-causing programs such as time bombs and logic bombs. A time bomb goes into action when triggered by the computer clock at a prearranged time. A logic bomb goes into effect when a particular key is pressed or a special state is reached. Bombs are typically destructive and reformat or erase disks and databases.[6]

What can you do to protect your database? The experts I consulted tell me that you must have the capability to create or open a file on a system in order to implant this type of program. You are most vulnerable when you import new software or databases that may already be infected, e.g., downloading from CompuServe can put you at risk. Know your source and isolate programs whenever it is functionally appropriate. Most library systems do not allow anyone except systems department staff to open or create files so they are relatively secure from this threat, but one disgruntled employee or a bright prankster on your staff or the staff of your software supplier could wreak havoc. Logic says, "Why would anyone bother to go to this much trouble to harm boring library data?" Unfortunately, logic is not necessarily at work here.

Passwords

Anytime you think that passwords are a real pain, stop and think about someone being able to read the last group of performance appraisals you wrote, about a prankster leaving colorful messages for the public to see during an OPAC search, about paying the bill for a stranger's use of your various computer accounts, or, perhaps best of all, about seeing your database and software vanish quietly as a logic bomb goes off. Passwords can be easy to use and maintain, and their value far outweighs any aggravation factor. A number of simple steps can make your passwords really useful. Much of the following is based on an article on password protection by M. D. Parker:

- Change your password as soon as you receive it.
- Change it at least once every three months.
- When a group must share a password, change it as soon as anyone leaves the group.
- Change your password whenever you feel it is necessary, e.g., following a demonstration in which someone had the opportunity to watch your keystrokes.
- Passwords should be at least six characters in length; otherwise, they are too easy to guess. Use letters; numbers are too hard to remember and comprise a limited set that is easy for codebreaker programs to use.
- Choose passwords composed of two unrelated words that are easy for you to remember. Passwords composed of

random streams of characters are too hard to remember.

- *Do not* choose passwords that are associated with yourself. Avoid names of relatives, addresses, birthdays, license plates, zip codes, and account numbers.
- Memorize your passwords. If you must write them down, do not leave them near your terminal or identify what they are (that's sort of like attaching your name and address to your house key in case it gets lost). Floppies and hard disks are not safe places. Batch log-on files can be read with very simple commands by anyone.
- Enter passwords only at a system prompt that does not display the password on the screen. If a system does not have this feature, your password is easily accessible and you may be vulnerable. If you are unsure about the use of utilities provided by other users, remember that a request for your password in an odd place may be a Trojan horse program that is lying in wait to steal your account.
- Finally, keep track of your use of any system and compare it to what your regular statements of usage say. Your level of responsibility is not really any different from what you have with your credit cards.[7]

Building Security and Hardware Theft

In the early days of library automation, the computer center staff took care of physical security for the computer. Now that the machines are in the library, the responsibility is ours to make sure they are protected. At Indiana University, the computer and data storage for the library word processing system is in a room near the main library loading dock. One day before I went to work there, someone backed a truck up to the dock, said that they were from the service company, and asked for directions to the computer room. When they discovered that it was locked, they waited while library staff scurried around trying to find the key. Fortunately, they got tired and drove off before the key was located. Would your library still have its computer in this situation?

At UCSD, we have a security system that provides remote alarms with police response in the event of perimeter penetration (that's breaking and entering to us laypersons). The system has card key access for selected staff. The beauty of the card system is that you can set selected hours during which a given card will work, and you can immediately deactivate a card that is lost or stolen or that was taken by an ex-employee. The computer room has its own perimeter protection system with a motion detector alarm that must be turned off with a coded password when you enter the room. Undetected unauthorized access to the computers is pretty unlikely. The security system has additional features that we use such as individual motion detectors on microcomputers and other equipment in secluded spots; anyone can use the machines, and we can repair them, but just don't try to head for the door with one.

We have one final bit on security on some small equipment: we put 3M Tattletape security strips on removable pieces and inside small items like Thinkjet printers.

RECOVERY

Backup Procedures

The simplest backup procedure is to remember to save your word processor file every few minutes while you are working. The capabilities and complexity escalate from there. The better microcomputer software systems can be set to automatically backup your files at predetermined intervals so that you don't even have to remember to press the save key. It is still up to you to make multiple copies so that you are prepared to deal with the disk that works today but won't let you near your data tomorrow. If you work in a network situation, you must have someone who regularly backs up the network file server data files and software. By the way, *regularly* varies with the situation, but it is much more likely to mean once or twice a day than once a month. Whether you make the backup copies on floppy disks or on tapes, you still need to store them in a secure place. Pick your own horror story—fire, vandalism, theft. You may say, "No one would bother to steal my disks; there is nothing confidential, interesting, or valuable on any of them." This

may be the case, but in my library we have lost a number of disks that were apparently stolen by student workers who simply needed disks for class work, i.e., they erased the data and saved themselves the cost of a new disk. Regardless of cause, lost data is lost data. A fireproof "media" safe is also a good idea.

OCLC has long recognized that the on-line union catalog is its primary asset. An indication of that recognition is seen in the following quote from an *OCLC Newsletter* article more than ten years old:

> OCLC has the capability to recreate all bibliographic records that were in the on-line catalog or used by participating libraries from the first day of operation of the on-line system up to the microsecond that an untoward event or system failure occurred.
>
> During normal hours of operation of the on-line system, OCLC maintains on tape and disk two separate copies of bibliographic records used by libraries. In addition to backing up ongoing daily events, OCLC also makes two copies of the entire on-line union catalog at least three times a week. Copies of the entire on-line catalog are run against the on-line catalog on a regular basis for comparison and verification as well as back-up.
>
> The total number of copies of the on-line catalog is five. Three copies are maintained at OCLC for emergency back-up; one copy is on tape in the computer room, another copy is on disk storage, and a third copy on tape is stored in a fireproof vault. Off-site OCLC maintains copies of the on-line catalog in a fireproof warehouse and also in an underground storage site outside Ohio. Procedures for creating and storing these back-up copies are well-defined, elaborate and in compliance with dataprocessing industry standards.
>
> OCLC also stores software necessary to run the on-line system on tape and disk on-site and also at an off-site location.[8]

I can't give you current information about OCLC procedures because they wisely prefer no longer to advertise that type of information. However, you can be sure that advances in technology (e.g., optical disc data storage) and increased sophistication have undoubtedly led to even more secure backup procedures during the last ten years. There are many variations on these routines, but the essence is frequent multiple copies of your database stored in a variety of sites. This can be a lot of trouble, but the effort is nowhere near what it would take to manually re-create an entire database.

I think that many libraries regard OCLC as the ultimate backup for their catalog database. This is legitimate in principle, but don't be lulled into a false sense of security. It costs to have OCLC re-create a copy of your transaction tapes, and you will still have to go through complete regeneration and cleanup of your database. These significant monetary and time expenses must be considered when doing risk analysis and recovery planning.

At the University of California, MELVYL is often regarded as a backup database source. This is somewhat more useful than OCLC because there is a concerted effort to synchronize the data in local systems and in MELVYL. Regardless, this would not be the easiest way to rebuild a destroyed local database.

In the library at UCSD we have long maintained multiple copies of all of our databases that reside on magnetic media. We have routines for backing up the data frequently, and we keep copies at various sites on campus. Most often we store data within the library and in another computer center on campus. Recently we expanded this backup to include off-campus storage. We contracted a pick-up and storage service with a local firm. We weekly load our tapes and disks into a special carrying case that the company takes to its special storage vault, a service costing $105 per month. Here's a related anecdote to add to your paranoia file: this company has reported to us that one of their customers fired an employee who was authorized to retrieve directly from the storage site in the event of an emergency. However, the customer did not notify the storage company that this person was no longer authorized to pick up the stored materials. You guessed it. His parting shot was to retrieve and steal the database backups.

There is a final lesson regarding data backup. I'll spare you the excruciating details, but the essence of the story is that a piece of hardware failed on a library system. The operator systematically installed all copies of the database one at a time in an effort to reload and restart the system. He did this without understanding that the

faulty hardware was destroying each copy as he installed it. The punch line is that the entire library database was destroyed and had to be manually re-created.

Microcomputer File Restoration

As long as I am relating stories, I should balance things with a success tale. There is a terrific story from Mankato State University about a water disaster in the technical services department. A pipe burst above a complete run—fifty-five issues—of the microcomputer software serial, *SoftDisk*. Disks that were only damp were carefully dried with a hand-held hair dryer. Soaked disks were removed from their plastic sleeves and liners and wiped dry with a clean, soft, lint-free cloth. Blank disks were then sacrificed to obtain usable sleeves and liners. All disks were then copied onto new blank disks. The miracle is that everything was copied successfully and no data was lost![9]

A variety of file recovery utility programs for microcomputers can be used to recover most and sometimes all of a damaged or accidentally erased file. The most famous of this software is the Norton Utilities. The operating premise is that, unless a disk is actually reformatted, the file is still in place and only its address has been removed. The utility program can locate the start of the file and reconstruct it. The important thing for the user to remember when this situation is encountered is to stop using the disk immediately—the original data stay on the disk *only* as long as new data are not written in those disk locations.

I have found that regular backup of data is a lot less trouble than trying to recover a lost file. On the rare instance that I have lost a file, it has been so small that it was easier to rewrite the original text. For really lengthy, difficult texts, I wear a "belt and suspenders" and retain multiple files of copies on multiple media in multiple sites. For example, while writing this speech, I made two online copies of the text file and a paper copy every time that I worked on it even though the network software automatically updated its backup copy every three minutes and there was tape backup at the network level. For a truly significant document, I would also personally make a floppy disk copy of the file each work session. This effort is a lot less trouble than trying to find the file recovery utility and then hoping that it will work on short notice for my special situation. It only seems like overkill until the first time you lose a major amount of work.

Hot Sites and Empty Shells

One approach to recovery is to maintain a "hot site" for backup. (Most of this section is based on the previously cited article by David Rames.)[10] The concept is very simple. Develop and maintain a complete computer facility at a separate site. When your main system is destroyed or significantly damaged in a catastrophe, you simply grab your backup database and software, race to the hot site, and restart the system where you left off. For a monthly fee somewhere between $2,000 and $6,000, you can guarantee access to a hot site that is owned and maintained by a company specializing in such services. Other possibilities include time-sharing on another computer using remote terminals or mutual aid agreements with organizations that have similar operations. The "empty shell" approach is a variation on the hot site theme. You simply maintain a fully prepared computer room for emergency use, complete with power, communications, facilities, storage, and office space—everything but the hardware. Then you arrange with your computer vendor for quick delivery of replacement equipment in the event of a disaster. Tests for big IBM systems have resulted in delivery of less than four hours. Of course, it then took several days to get started following delivery.

Both the hot site and the empty shell superficially may offer a lot of comfort, but they carry more overhead than just the monthly fees. Their usefulness boils down to an analysis of how hard it is to restart a system on different hardware. No matter how similar two hardware setups are, it still will be pretty hard to get going again. Don't forget that you have to reestablish your network connections. Don't forget that your data security and integrity issues may be even more troublesome in these environments. I conclude that the cost and the effort for either approach is beyond the

means of most libraries. Nevertheless, there are still useful ideas here. Small systems tend to be more generic than very large processing systems. Therefore, for your simple operations, consider no-cost situations that might save the day for a short period of time: e.g., you may indeed find a hot site on campus for your accounting system in the form of a student microcomputer lab that can be commandeered in an emergency. Your empty shell might be nothing more than a room used for old furniture storage. Add an insurance policy to replace your hardware in a disaster and you could get started again reasonably quickly. As always, creativity can often be far more productive than merely throwing dollars at a problem.

Insurance

Insurance is a good idea that can be surprisingly inexpensive because of the very protected environment in which computer systems tend to operate. As an example, at UCSD the insurance cost to provide hardware replacement for approximately $750,000 worth of equipment is less than $2,000 per year. The better your protection and recovery plans are, the lower your insurance rates will be. It is in your best interest to have a terrific disaster prevention plan with low-cost, high-deductible insurance.

PLANNING

Planning is the only hedge you have against a catastrophe. I am sometimes accused of being a Cassandra because of my ability to conjure up every imaginable type of disaster for the library computer system. The way I see it, however, if my library's database is lost or if a million dollars worth of computer equipment is destroyed and can't be replaced, there is a good chance that I and my family will join the ranks of the nation's homeless. I figure that it's worth the doom and gloom reputation and a little healthy paranoia to maintain a steady income and the southern California life-style.

Perhaps, the best place to start a discussion about planning for disaster prevention and recovery is to stop and think about the following statement: Forget about the computer; the goal is to keep the library running. To me this says two things: an incomplete plan is probably little better than no plan at all, and recovery of the computer or the database is only part of such a plan. Up to this point, I have mostly covered different tricks to make a situation more secure or about how to re-create lost data. Now I would like to shift the emphasis to the mechanics of actually developing a disaster plan.

You can use any planning process with which you are familiar, but you must follow an organized procedure that is thorough and that yields structured guidelines. The following is my version of a process developed by Kenneth N. Myers.[11]

Step 1: organize your planning process. Charge a group to develop the plan. Do not rely solely on your computer personnel. They do have crucial technical information, but the actual users of the system may be more sensitive to operational requirements and options for alternatives. Early in the planning process it would be useful to go to the business and computer industry literature to get ideas, but be sure to remember that ultimately it is up to you to plan for any possible catastrophe. Also remember that, in most cases, your library budget is significantly less than that of businesses relying on large, sophisticated computer systems; lack of money removes many of your options to develop a perfect, fail-safe environment. You'll have to rely on creativity instead of cash. Finally, set a deadline for the group to report. Sooner or later, contingency planning can become a "black hole" that can trap your potential plan in the group development process forever.

Step 2: perform a risk assessment. This is the foundation of your plan and where you review the operating practices and system requirements. Document existing computer operational procedures. What are the backup procedures? Do you have adequate or relevant insurance? Document hardware and network configurations. Identify *all* users; you may be surprised at the results here, e.g., it's easy to list your dedicated OPAC sites, but did you remember that the chancellor's secretary uses the university LAN once every few months to connect to

the library LAN to connect to the OPAC to do literature searches for speeches? (Will there be a significant problem if such access is unavailable without warning?) Document your physical and data-security environment. Make a list of as many disasters (including the absurd) as you can possibly conceive. Determine which operations are critical. Some operations may be so critical that they must continue immediately on an alternate computer. Others can be suspended briefly, and you can use catch-up procedures later. Some processes can be supported temporarily with manual procedures and will require no catching up. Surprisingly, some processes can be suspended with no alternate support and will require no catch-up later. With all of this in front of you, you are now ready to assess the impact and risk associated with the various disaster situations. In summary, read several Dostoevsky novels, work on your income tax, or do anything else that makes you really depressed and then sit down and try to think of everything awful that could possibly happen to your system.

Step 3: develop disaster prevention strategies. This is easy to say and hard to do. Much of what I previously covered focused on disaster prevention, so I won't reiterate here. A key point to remember is that, in most situations, it is a lot easier to prevent a disaster than it is to recover from one.

Step 4: develop interim (survival) strategies. The disaster has happened. What are your options to keep the library in business?

Step 5: develop recovery (return to normal) strategies. You survived the disaster, you kept the doors open, and your users were able to find and use library materials. What do you have to do to return to a predisaster environment? As with disaster prevention, I discussed recovery earlier. The onus is on you to be thorough and creative. About the only sure thing is the unlikelihood of having vast amounts of money to simply buy your way back to normal.

Step 6: document the procedural guidelines, including individuals and their responsibilities. Identify the resources needed to implement new procedures. Write the plan down and be certain that anyone can use it. A plan that resides only in someone's head is not much better than no plan at all.

CONCLUSION

Like most paranoid individuals, once I have someone's attention it is hard to shut me up. I at least mentioned as many aspects of the topic as I could, but I still had to leave a lot out to reasonably control the length of this article. Now it's up to you to ferret out all of the details and to truly protect your library database and the system that makes it useful. You may not be able to predict or control the future, but careful contingency planning can certainly help you sleep better at night when you know that no matter what happens, you can keep the library running.

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11. Kenneth N. Myers, "Avoiding a Crisis," *Datamation* 32:81–84 (Feb. 1, 1986). ■■

A Comparative Study of Subject Searching in an OPAC among Branch Libraries of a University Library System

Neal K. Kaske

The degree of variability in the percentage of subject searching in an online public access catalog (OPAC) among branch libraries of one university was studied. A full semester's worth of transactions was analyzed, not sampled. The time units used were hour of the day, day of the week, and week of the semester. The findings show that subject searching varies from a low of 22% to a high of 74% over the hours of the day. Variability for the days of the week ranged from 17% to 64%, and for the weeks of the semester variability ranged from 12% to 70%. Valuable management information on the utilization of the OPAC within each branch library and among all the branch libraries is provided through numerous charts and graphs. A call is made for replication of this type of analysis (all patron-generated transactions) in other libraries with OPACs to better understand how patrons are using online catalogs.

The goal of this research was to learn if the use of subject searching by patrons in an online public access catalog (OPAC) varied over time among four branch libraries within the same library system. The first general null hypothesis tested was H_o: the percentage of subject searching for a given time unit (hour of day, day of week, and week of term) will not differ more than 5 percentage points across the branch libraries studied. The second general null hypothesis tested was H_o: the percentage of subject searching for a given time unit (hour of day, day of week, and week of term) will not differ more than 20 percentage points within each branch library studied.

The transactions studied took place from January 8, 1987, through May 8, 1987. These dates cover the entire spring 1987 semester from the first day of classes through the last day of finals.

This research took place at the University of Alabama. The data collected are for transactions recorded during the spring semester via the branch libraries public access terminals. At the time of this study, spring semester 1987, an estimated 13,000 undergraduates and 2,500 graduate students were enrolled. Faculty numbered more than 700, and the library was employing more than 40 professional and 60 classified staff and about 43 FTE student assistants.

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The library system at the University of Alabama is composed of the main library and four branches (business, education, engineering, and science), all of which report to the dean of libraries. Additional libraries adjacent to the campus (law and health sciences) were not yet using the OPAC at the time of this research. The holdings in the main library and the four branches exceed 1.5 million cataloged volumes plus more than 1.2 million microform units. More than 90% of the collection was represented in the OPAC at the time of data collection.

Each branch library selected for this study—business, education, engineering, and science—had two terminals available for public use. Comparative data about these branches as to size of collections and staff are given in table 1. This data reflected the status of these libraries as of October 1987: the larger libraries are business and education; engineering and science are smaller except for bound periodicals.[1] The research reported here will mainly use percentages to minimize the size-of-library factor.

The OPAC in use was the Virginia Tech Library System (VTLS). The time units selected for analysis of variability between the branches were time of day, day of week, and week of term. The data for this study were generated by patrons searching on any one of eight public access terminals. This VTLS system at the time of the data collection supported an additional fifteen public access terminals in the main library and three dial-in (telecommunications) ports, for a total of twenty-six public access points.

Patrons were able to search by author, title, subject, and call number. Boolean searching is supported by the VTLS system, but that function was not active at this site during the time of this research.

DEFINITION OF TERMS

Subject, author, title, and call number searches used the following commands: S/, A/, T/, and C/. The percentage of subject searching was calculated by dividing the number of subject searches by the sum of author, subject, and title searches.

Call number searches were omitted from this study to provide a clearer picture of the percentage of subject searching and because a call number search could be for a subject or for a known item. The percentage of call number searching was found to be very low (2% to 4%).

The word *term* is used interchangeably with the word *semester* in this paper.

RELATED RESEARCH

Little research with regard to subject searching by patrons in an OPAC using a population of data has been reported. One research effort did report that the variability of subject searching (in an OPAC for a full university library system, branches, and the main library) varied from 35% to 52% over the weeks of a semester.[2] The same project reported a variability of subject searching over days to be between 44% and 64%; the variability for hours was between 40% and 55%.[3] The research reported in this paper used data specific to the four branch libraries from the above-mentioned study.

Other research efforts reporting on the percentage of subject searching via an

Table 1. Comparative Data on the Branch Libraries

	Business	Education	Engineering	Science
Collections:				
Books	84,672	133,971	53,422	39,636
Bound Periodicals	43,733	13,508	20,826	64,148
Microforms	223,900	479,404	66,490	7,429
Total	352,305	626,883	140,738	111,213
Square Footage	13,411	23,387	7,300	10,000
Staff:				
Librarians	2.0	1.5	2.0	1.0
Classified	3.5	4.0	2.0	2.0
Total	5.5	5.5	4.0	3.0

OPAC have been reviewed by Karen Markey in *Subject Searching in Library Catalogs*.[4] Markey details the findings of eight studies in her book; each study used sample data for a few days or one or two weeks. These studies were conducted in the libraries of West Valley Community College, University of California, Dallas Public Library, Mankato State University, Syracuse University, Northwestern University, and Ohio State University. The studies reviewed by Markey report a percentage for subject searching but not its variability over time. The values for subject searching ranged from 34% to 65%.[5]

METHODOLOGY

The source of data for this study comes from a VTLS statistical report, *Alphabetic Searches*. This report in a machine-readable format was processed by programs that reformatted the values for the variables into a structure that was then used to analyze the data via SAS programs on a mainframe computer. The results of the SAS analysis were used directly or transferred, reformatted, and displayed on a microcomputer via Lotus programs. This last step provided uniform tables and graphs for analysis and display. For a detailed description of how the data were extracted and reformatted see the methodology section of the related paper by this author.[6]

The independent variables for this research were the time units (hour of day, day of week, and week of term) and locations. The dependent variables were the percentage of subject searches conducted per location per time unit. The data were tabulated and graphed in many different ways to learn if there were patterns in the use of subject searching over the selected time units and to explore the variations among and within the four branch libraries.

Two general null hypotheses and two alternative hypotheses were stated and then tested for each time unit studied. The first general hypothesis is H_o: the percentage of subject searching for a given time unit (hour of day, day of week, and week of term) will not differ more than 5 percentage points across the branch libraries studied. The first general alternative hypothesis is H_o: the percentage of subject searching for a given time unit (hour of day, day of week, and week of term) will differ more than 5 percentage points across the branch libraries studied. The second general null hypothesis is H_o: the percentage of subject searching for a given time unit (hour of day, day of week, and week of term) will not differ more than 20 percentage points within each branch library studied. The second general alternative hypothesis is H_o: the percentage of subject searching for a given time unit (hour of day, day of week, and week of term) will differ more than 20 percentage points within each branch library studied.

Statistical tests for significant differences among branch libraries and within the time units researched were not used because an entire population of searches (all searches from all four branches for a full semester) was available. When additional data are available (for other semesters) a two-way analysis of variance with interaction will be run.

RESULTS

There were 165,083 searches conducted on all the public terminals connected to this OPAC from the first day of classes (January 8, 1987) through the last day of final exams (May 8, 1987). The totals and percentages for each type of search are displayed in table 2, as are the percentage of author, title, and subject searches. These percentages were obtained by dividing the number of author, subject, and title searches by the adjusted total number of searches. This was done to omit the call number searches from this part of the analysis. Call number searches could be for known items or for subjects.

The differences among the branch libraries as to subject searching for the full semester vary only from a low of 44.2% in education to a high of 47.74% in engineering. There is only 3.54 percentage points difference among the branches when the semester is viewed as one time unit. However, this research will examine the differences in subject searching by location and across three time frames: hours of the day, days of the week, and weeks of the term.

The use of the OPAC in the four branch

libraries was first measured by the number of hours when the public terminals were active (someone keyed one or more searches during an hour). This information, along with the mean number of searches per hour for each branch, is reported in table 3. The last two lines of table 3 report the percent of total hours active and the percent of total searching on the system (main library and branches) for each of the branches. Note that the rank order from top (most active) to bottom is as follows: business, engineering, education, and then science for all three measures (hours active, percent of total hours active, and percent of total searching). The results for each of the three time units studied will be reported in the following sections.

Hours of the Day

The branch libraries were open each day of the week (except for holidays) during the 1987 spring semester. Their basic schedule of open times are noted below.

Monday through Friday	7:45 a.m. to 12:00 midnight
Saturday	8:00 a.m. to 5:00 p.m.
Sunday	2:00 p.m. to 12:00 midnight

The time from 7:45 to 8:00 a.m. was not analyzed because this fifteen minutes was not an active time and all the other data recorded were for a full hour. In table 4 the high (H) and low (L) values for each branch are noted. When the high or low values within a branch are nearly equal, a second high and/or low value may be given. For all but one hour (2:00 to 3:00 p.m.) the difference between the high and low value for subject searching per hour is more than 5 percentage points (note last column in table 4). In four cases (26.6%) the difference in percentage points is more than 20, and in six cases (40%) the difference was more than 15 percentage points. For 10 (66.6%) of the hours the difference was more than 10 percentage points, and in 14 (93.3%) cases the difference is more than 5 percentage points. There is only one hour when the difference between the highest and lowest subject searching in branches is less than 5 percentage points: between 2:00 and 3:00 p.m.

Table 2. Total Searches

	All	Business	Education	Engineering	Science
Search Type					
Author	38,453	2,876	2,010	1,904	1,325
Subject	75,629	5,994	3,322	4,594	2,209
Title	45,499	3,575	2,183	3,124	1,456
Call Number	5,512	373	164	411	170
Total	165,093	12,818	7,679	10,033	5,160
Adjusted Total	159,581	12,445	7,515	9,622	4,990
Percentage					
Subject	47.39	48.16	44.20	47.74	44.27
Author	24.10	23.11	26.75	19.79	26.55
Title	28.51	28.73	29.05	32.47	29.18

Table 3. Mean Number of Searches per Hour over the Full Term

Search Types	Business	Education	Engineering	Science
Author	1.86	2.07	1.43	1.55
Subject	3.88	3.42	3.44	2.59
Title	2.31	2.25	2.34	1.70
Call Number	0.24	0.27	0.31	0.20
Total	8.29	8.01	7.52	6.04
Hours Active	1,546	971	1,335	854
Percent of Total Hours Active	9.04	5.68	7.81	4.99
Percent of Total Searching	7.76	4.65	6.08	3.13

In table 5 the times and percentages are displayed along with the differences within each branch library. This table shows that the education library has the largest variability within itself with 53.15 percentage points. The next highest is business with 34.59 percentage points variability within itself, followed by engineering with 33.3 percentage points. The science library has the least variability within itself with only 15.08 percentage points variability across the hours of the day.

These results for the hour of the day analysis show we must reject our first null hypothesis (H_o: the percentage of subject searching for each hour of the day will not differ more than 5 percentage points across the branch libraries studied) in all but one case: 2:00 p.m. to 3:00 p.m. We can then accept our alternative hypothesis (H_o: the percentage of subject searching for each hour of the day will differ more than 5 percentage points across the branch libraries studied) in all but one case: 2:00 p.m. to 3:00 p.m.

We also find we have to reject our second null hypothesis (H_o: the percentage of subject searching for each hour of the day will not differ more than 20 percentage points within each branch library studied) in all but one case, the science branch library, but can accept our second alternative hypothesis (H_o: the percentage of subject searching for each hour of the day will differ more than 20 percentage points within each branch library studied) in all but one case, the science branch library.

The percentage of subject searching in all four branches for each hour of the day is presented in figure 1, which indicates no pattern of subject searching for the hours of the day. There is, however, a trend: the percentage of subject searching is higher in the later afternoons and evenings for all branches.

When the four branches are divided into two groups (business/education and engineering/science) it becomes clear that these branches do have similar patterns of subject searching per hour of the day (note figure 2 and figure 3). Readers should take care in comparing graphs in this paper because the scale for the *y* axis may change with each graph.

Table 4. Percentage of Subject Searching per Hour of the Day

Hour	Business		Education		Engineering		Science		Difference High/Low
7	59.26		0.00		19.05		0.00		0.00
8	32.63	L	23.08		41.02		46.00		22.92
9	42.55		21.69	L	45.09		43.04		23.40
10	39.90		35.77		47.86		39.95	L	12.90
11	43.67		39.19		29.85	L	41.16		13.82
12	53.46		41.32		43.95		46.94		12.14
13	42.00		33.64		47.47		41.55		13.83
14	42.13		42.66		46.83		43.86		4.70
15	45.93		42.82		47.00		39.22		7.78
16	42.21		48.48		47.20		48.44		6.27
17	53.76		66.82		51.60		48.41		18.41
18	67.21	H	41.00		51.82		46.38		26.21
19	54.97		46.22		61.50		46.28		15.28
20	59.32		54.86		63.15	H	43.52		19.63
21	60.95		52.92		57.87		55.03	H	8.30
22	61.70		74.84	H	47.87		46.40		28.44

Table 5. High and Low Percentages for Subject Searching per Hour

	Business		Education		Engineering		Science	
High	67.21	6 p.m.	74.84	10 p.m.	63.15	8 p.m.	55.03	9 p.m.
Low	32.62	8 a.m.	21.69	9 a.m.	29.85	11 a.m.	39.95	3 p.m.
Difference	34.59		53.15		33.3		15.08	

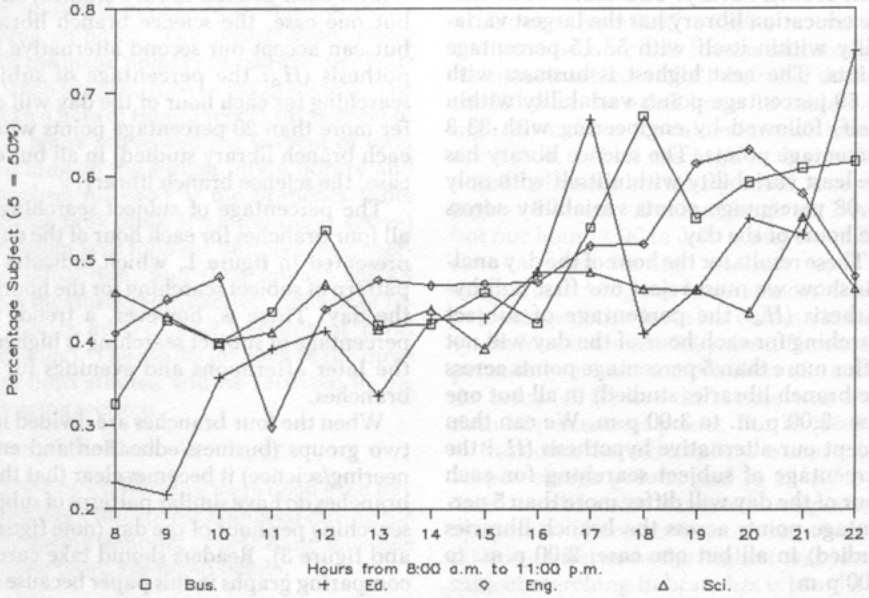

Fig. 1. Percentage of Subject Searches per Hour.

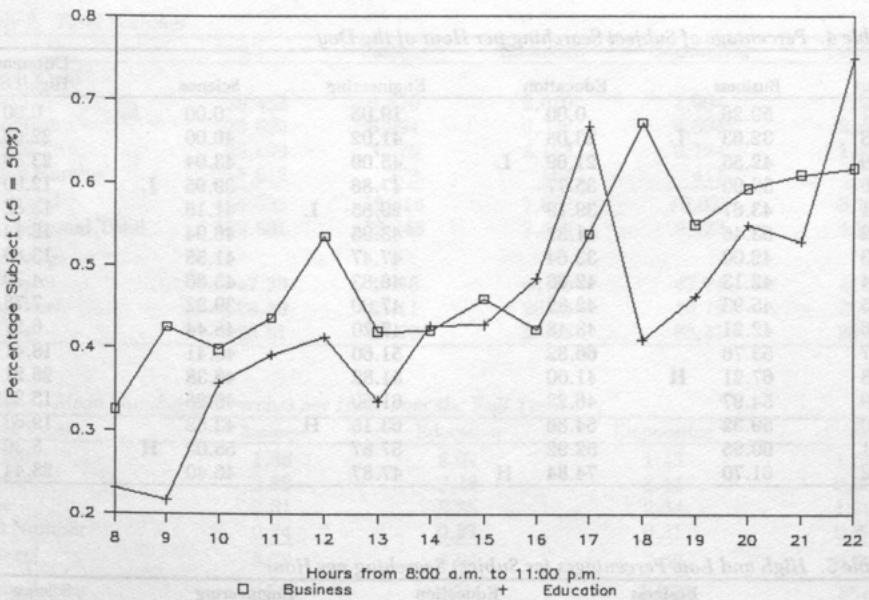

Fig. 2. Bus./Ed. Percentage of Subject Searches per Hour.

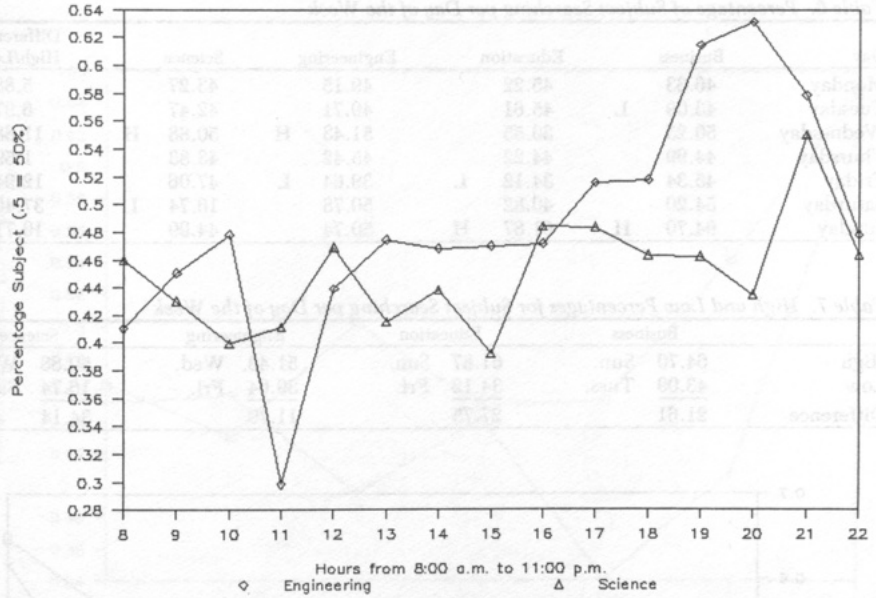

Fig. 3. Eng./Sci. Percentage of Subject Searches per Hour.

Days of Week

The branch libraries were open each day of the week and for the same number of hours. The hours open differ across the days of the week, but this will not effect the current analysis because percentages (not the number of searches) are used for subject searching. Table 6 reports the daily percentage of subject searching for each branch and the difference between the high and low values across the four branches.

In testing the first null hypothesis (H_o: the percentage of subject searching for the days of the week will not differ more than 5 percentage points across the branch libraries studied) we find it must be rejected for all days except Thursday. On Thursdays the difference between the branches is only 1.59 percentage points, while for the other days of the week the difference ranges from a low of 5.88 percentage points (Mondays) to a high of 37.46 percentage points (Saturdays).

As a result of rejecting the null hypothesis for the days of the week, we accept the alternative hypothesis (H_o: the percentage of subject searching for the days of the week will differ more than 5 percentage points across the branch libraries studied) except on Thursdays.

Table 7 clearly shows that the second null hypothesis (H_o: the percentage of subject searching for the days of the week will not differ more than 20 percentage points within each branch library studied) must be rejected for all branches except engineering, where the differences across the days of the week are only 11.79 percentage points. Therefore, we accept the second alternative hypothesis (H_o: the percentage of subject searching for the days of the week will differ more than 20 percentage points within each branch library studied) except for the case of the engineering library.

The percentage of subject searching for each day of the week is presented in figure 4, wherein the small change for Thursday and the large difference among the branch libraries on Saturday are clearly depicted. All four lines come together on Thursday, and on Saturday the science library goes below 20%.

Note that Sunday is the top subject searching day in both the business and the education libraries, that subject searching in the engineering and science libraries peaks on Wednesdays, and that there is a

Table 6. Percentage of Subject Searching per Day of the Week

Day	Business		Education		Engineering		Science		Difference High/Low
Monday	46.33		45.22		49.15		43.27		5.88
Tuesday	43.09	L	45.61		49.71		42.47		6.97
Wednesday	50.25		39.55		51.43	H	50.88	H	11.88
Thursday	44.99		44.22		45.42		43.83		1.59
Friday	45.34		34.12	L	39.64	L	47.06		12.94
Saturday	54.20		40.82		50.78		16.74	L	37.46
Sunday	64.70	H	61.87	H	50.74		44.99		19.71

Table 7. High and Low Percentages for Subject Searching per Day of the Week

	Business		Education		Engineering		Science	
High	64.70	Sun.	61.87	Sun.	51.43	Wed.	50.88	Wed.
Low	43.09	Tues.	34.12	Fri.	39.64	Fri.	16.74	Sat.
Difference	21.61		27.75		11.79		34.14	

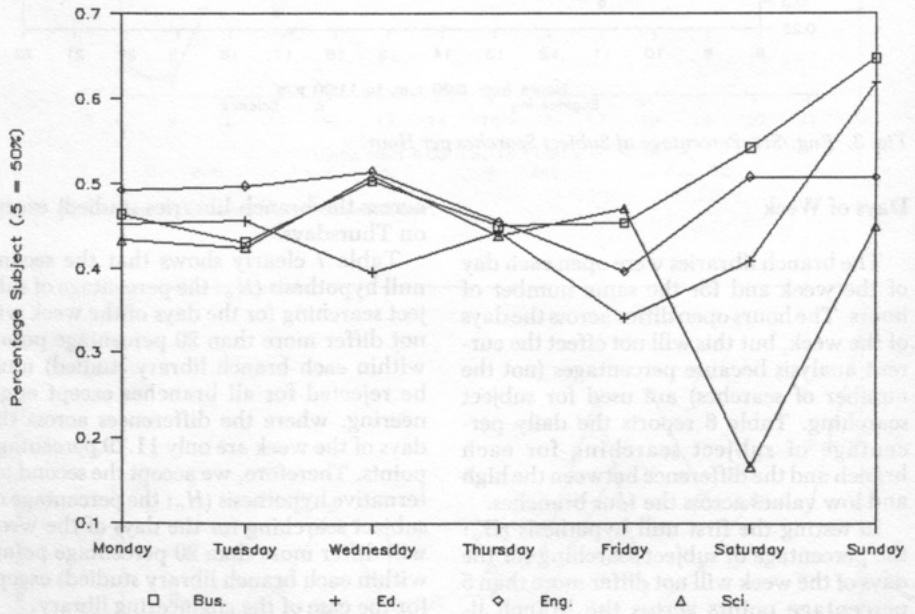

Fig. 4. Percentage of Subject Searches per Day.

small amount of variation over the days of the week in the engineering library (see figures 5 and 6).

Weeks of Term

The data were divided into eighteen calendar weeks as opposed to the fifteen academic weeks. The fact that some of the weeks are less than seven days is not a problem because the analysis is done on the percentages for subject searching. The libraries were closed the week of spring break, the tenth week of the term. In order not to skew the graphs and tables with zeros, subject searching for the tenth week of all four branches was set at 33.33%.

In table 8 the lowest point (12.34%) for subject searching was in the business library during the first week of the semester. The first week of the term was found to be

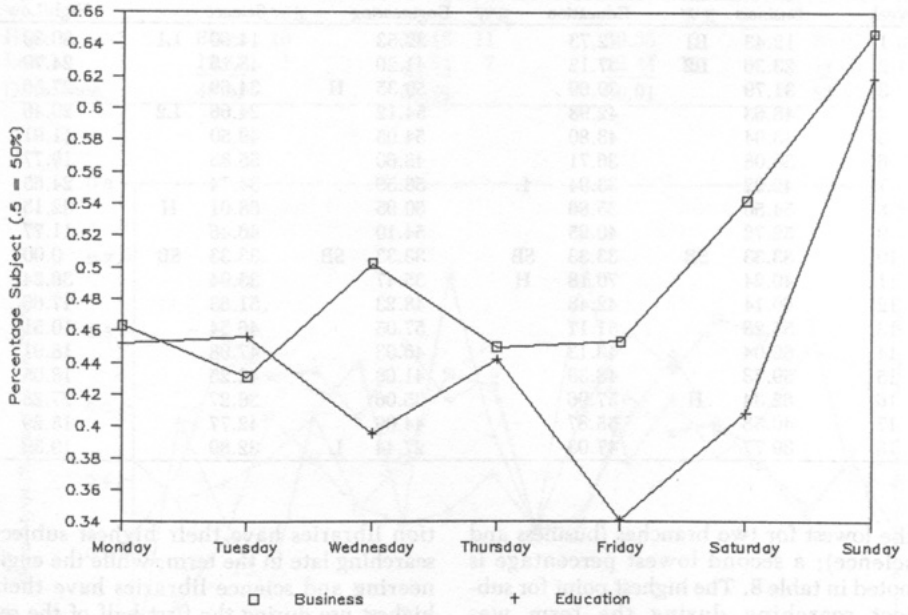

Fig. 5. Bus./Ed. Percentage of Subject Searches per Day.

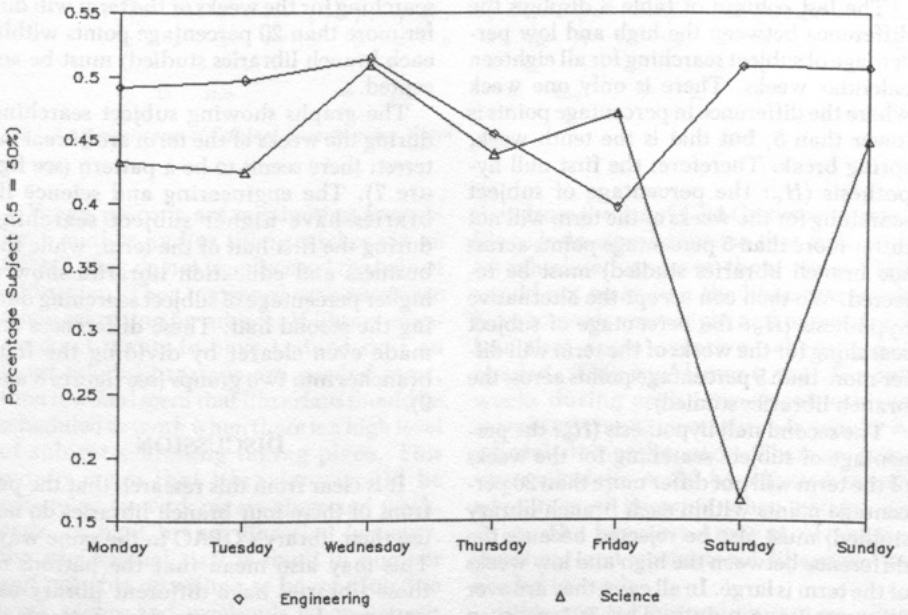

Fig. 6. Eng./Sci. Percentage of Subject Searches per Day.

Table 8. Percentage of Subject Searching per Week of the Term

Week	Business		Education		Engineering		Science		Difference High/Low
1	12.43	L1	42.73		32.53		14.60	L1	30.30
2	23.36	L2	37.12		41.20		48.15		24.79
3	31.79		39.69		59.35	H	34.69		27.56
4	48.63		42.98		54.12		24.66	L2	29.46
5	43.04		48.80		54.95		49.50		11.91
6	36.08		36.71		48.60		55.85		19.77
7	42.92		33.94	L	58.59		34.74		24.65
8	54.50		35.86		50.95		68.01	H	32.15
9	52.72		40.95		54.10		46.46		11.77
10	33.33	SB	33.33	SB	33.33	SB	33.33	SB	0.00
11	49.24		70.18	H	35.47		33.94		36.24
12	60.14		42.48		48.23		51.63		17.66
13	55.28		51.17		57.05		46.54		10.51
14	62.04		43.13		46.93		47.98		18.91
15	59.73		48.39		41.68		42.25		18.05
16	62.34	H	57.96		35.06		36.27		27.28
17	40.58		55.87		44.09		42.77		15.29
18	39.77		47.03		27.44	L	32.89		19.59

the lowest for two branches (business and science); a second lowest percentage is noted in table 8. The highest point for subject searching during the term was 70.18%, which was recorded in the education library during the eleventh week.

The last column of table 8 displays the difference between the high and low percentage of subject searching for all eighteen calendar weeks. There is only one week where the difference in percentage points is lower than 5, but that is the tenth week, spring break. Therefore, the first null hypothesis (H_o: the percentage of subject searching for the weeks of the term will not differ more than 5 percentage points across the branch libraries studied) must be rejected. We then can accept the alternative hypothesis (H_o: the percentage of subject searching for the weeks of the term will differ more than 5 percentage points across the branch libraries studied).

The second null hypothesis (H_o: the percentage of subject searching for the weeks of the term will not differ more than 20 percentage points within each branch library studied) must also be rejected because the difference between the high and low weeks of the term is large. In all cases they are over 36 percentage points. This is true even when the second lowest week is used for both the business and science libraries (see table 9). Clearly, the business and education libraries have their highest subject searching late in the term, while the engineering and science libraries have their highest use during the first half of the semester. Therefore, the second alternative hypothesis (H_o: the percentage of subject searching for the weeks of the term will differ more than 20 percentage points within each branch libraries studied) must be accepted.

The graphs showing subject searching during the weeks of the term are of real interest: there seems to be a pattern (see figure 7). The engineering and science libraries have higher subject searching during the first half of the term, while the business and education libraries show a higher percentage of subject searching during the second half. These differences are made even clearer by dividing the four branches into two groups (see figures 8 and 9).

DISCUSSION

It is clear from this research that the patrons of these four branch libraries do not use their library's OPAC in the same way. This may also mean that the patrons of these libraries have different library-use patterns. In any event, their patterns of subject searching should be examined from the three perspectives of staffing, bibliographic instruction, and system use.

Table 9. High and Low Percentages for Subject Searching per Week of the Term

	Business		Education		Engineering		Science	
		WK		WK		WK		WK
High	62.34	16	70.18	11	59.35	3	68.01	8
Low	12.43	1	33.94	7	22.44	18	14.60	1
Difference	49.91		36.24		36.91		53.41	

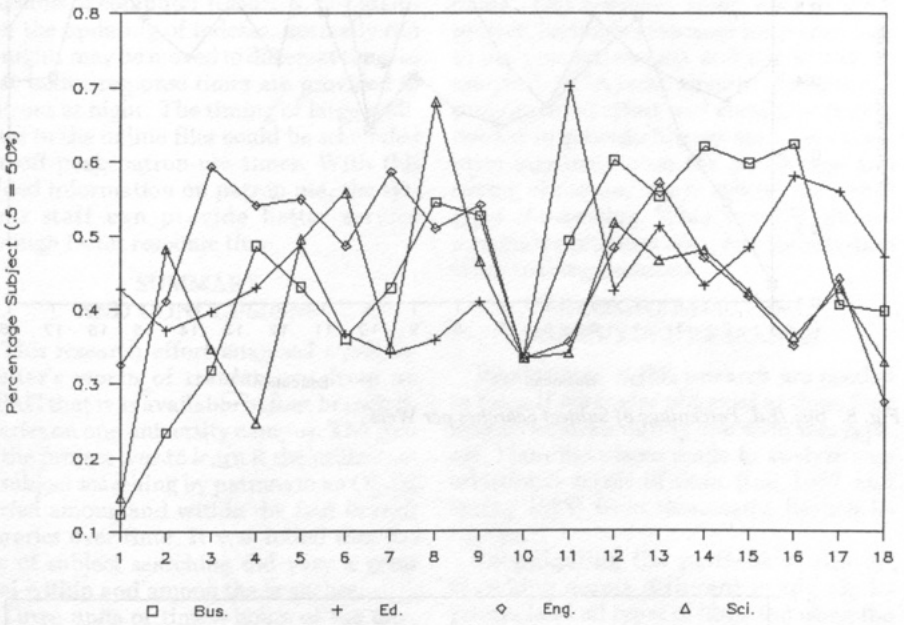

Fig. 7. Percentage of Subject Searches per Week.

When patrons are conducting known-item (author and/or title) searches via an OPAC, they do not usually need the help of a librarian. They may need such assistance when searching by subject. If library management wants to have trained staff on hand when librarians are needed most, then it would seem that librarians should be scheduled to work when there is a high level of subject searching taking place. This would mean that librarians would be scheduled to work on evenings and weekends. In most branch libraries, however, the professional staff is small in number and not able or willing to be scheduled to work nights and weekends when patrons show the highest demand.

The need for professional staff at night and on weekends is not news, but with the data from the use of OPACs it may be possible to isolate peak times so that staff could be scheduled to cover those times. This would not mean that the librarians would have to work every night and on weekends but that some creative scheduling is needed. This could mean that for two weeks during each term (peak subject-searching times) professionals would be scheduled to work at night. There are many ways schedules could be adjusted to take advantage of knowing when patrons are doing the greatest amount of subject searching and professional librarians are needed to work.

Bibliographic instruction is most effective when given at a time of high need on the part of the patron. With the data from this research, a branch librarian could tar-

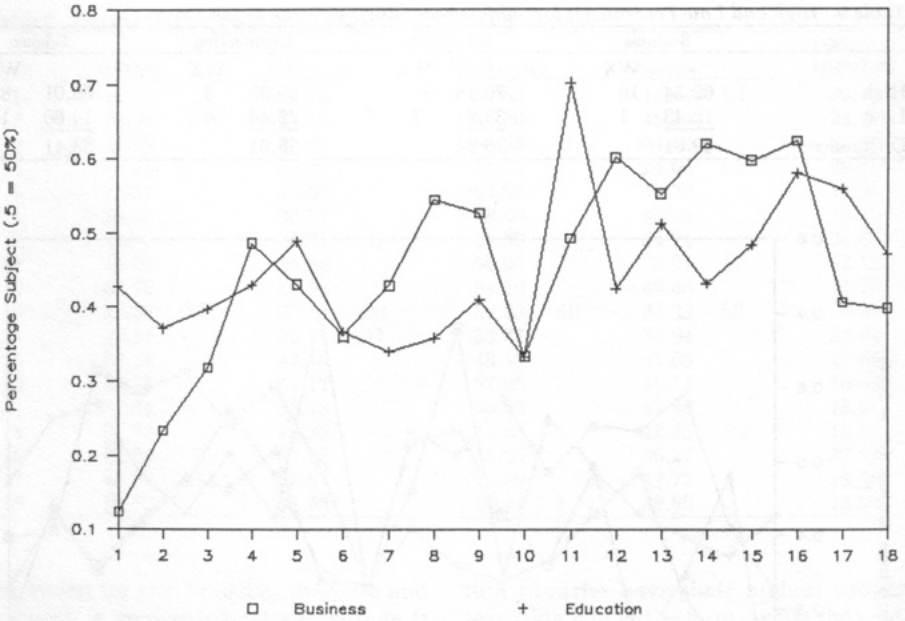

Fig. 8. Bus./Ed. Percentage of Subject Searches per Week.

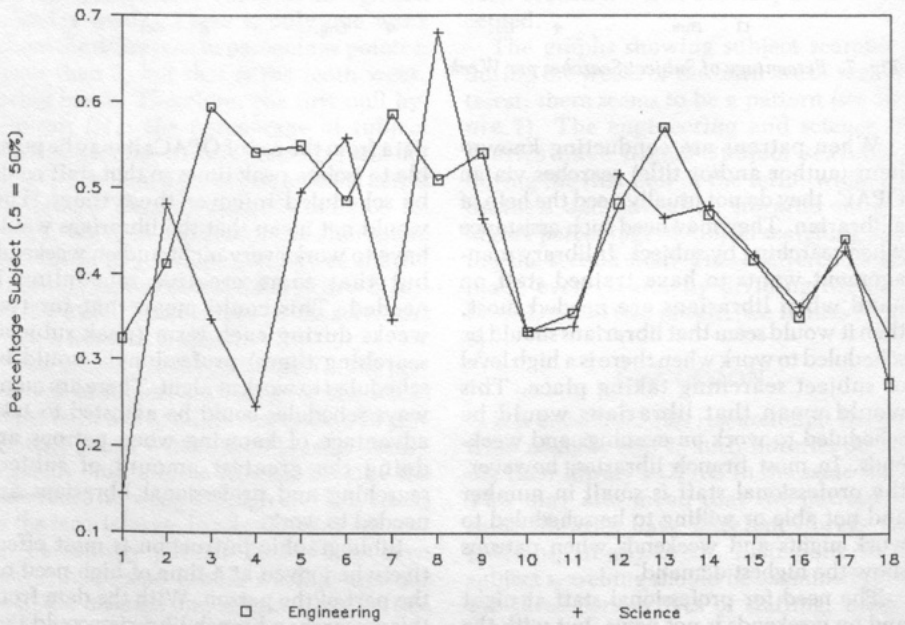

Fig. 9. Eng./Sci. Percentage of Subject Searches per Week.

get times for the delivery of specific bibliographical instruction packages. The centralized or general programs could also take advantage of this information when scheduling, staffing, and timing instruction.

This data (public searching activity) on the use of the OPAC could help in the scheduling of jobs that require large amounts of computer resources. For example, the updating of indexes, normally run at night, may be moved to different times so that better response times are provided to patrons at night. The timing of large additions to the online files could be scheduled for off-peak patron-use times. With this added information on patron use, the systems staff can provide better service through faster response time.

SUMMARY AND CONCLUSIONS

This research effort analyzed a full semester's worth of transactions from an OPAC that was available in four branch libraries on one university campus. The goal of the project was to learn if the utilization of subject searching by patrons in an OPAC varied among and within the four branch libraries over time. It was found that the use of subject searching did vary a great deal within and among the branches.

Three units of time—hours of the day, days of the week, and weeks of the term—were used. It was found that subject searching varies between 22% and 74% over the hours of the day. The range of subject searching over the days of the week moves from a low of 17% to a high of 64%. Over the weeks of the term the range is from 12% to 70%.

The variability within each library over the three different time units was large. The range for the hours of the day was between 15% and 53%. For the days of the week the range was much smaller, from a low of 12% to a high of 34%. For the weeks of the term the low was 36% and the high was 49%.

These large variations in the use of subject searching via OPAC over time and among different branch libraries has implications for the staffing and scheduling of reference services and bibliographical instruction programs. The knowledge of when the public makes use of OPACs can help library managers better schedule and allocate computer resources.

GENERALIZATIONS OF THE FINDINGS

It would be unwise to generalize the findings of this research beyond the four branch libraries at the University of Alabama. This research, along with its sister project, highlights the need for researchers to use population data and not to rely on sample data.[7] A small amount of additional programming effort and computer time is needed to provide library managers complete information on the percentage and timing of patrons' use of subject and other types of searching. When possible, library administrators need complete information when making decisions.

RECOMMENDATIONS FOR FUTURE RESEARCH

Replications of this research are needed to learn if what was observed at these four branch libraries during one term was typical. Plans have been made to analyze two additional terms of data (fall 1987 and spring 1988) from these same branch libraries.

Investigating the patterns of subject searching across different academic libraries (and all types of libraries) using the same and/or different OPACs is also needed. Librarians for years have observed patterns of catalog and collection use. Some of the OPACs can now provide data on both catalog use and circulation. The relationships and patterns of circulation and catalog use need to be explored and reported. Today, with data from OPACs, we can track these patterns and hopefully understand and predict the patterns. This type of management information on catalog use and circulation should help librarians improve many library services.

It would be ideal to have data from OPAC use studies reported on an annual basis in *Information Technology and Libraries*. This researcher is volunteering to tabulate and present this data once a year. Please do send me your findings!

ACKNOWLEDGMENT

This research project would not have been possible without the help of John C.

Johnson, systems programmer with the campus computing center, who provided the basic "use" data from the VTLS system. I would also like to thank the library staff members for permitting the study to be conducted.

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Twenty Years Ago in JOLA

Changes in reference services themselves, however, may make automation of question-answering practical. One trend is toward larger reference collections to be shared by several libraries; some areas have already set up regional reference services. There are also cooperative reference plans whereby several strong libraries agree to specialize in certain fields and cooperate in answering questions referred by the others. These trends will mean two things to reference librarians: greater concentration of resources, allowing more specialized books and mechanization; and screening of questions at the local level, letting reference centers concentrate on more complex questions that utilize their specialized books. Thus it seems likely that special reference centers may look increasingly toward mechanizing their services, and retrieval schemes of the type presented here will be important to consider.

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Contributed by Michael Gorman.

Improved Browsable Displays for Online Subject Access

Mia Massicotte

A browsable display under a specified search term can often frustrate users if the display is carried over several screens. This article investigates methods of compressing headings identified by MARC subfield codes to reduce the size of browsable displays. Arguments are presented that a more efficient system design can be achieved by machine sorting of subdivisions via a conceptual, rather than alphabetical, approach. The author concludes that system architecture for browsable subject index displays must be redesigned to relieve the user of the burden of data organization.

One of the obstacles in the way of effective subject access in OPACs (online public access catalogs) is undue length of a browsable index display under a specified search term. The complexities associated with online subject access have been firmly documented in the literature, notably by Cochrane, Markey, Mandel and Herschman, and others.[1] Well-founded criticisms of *LCSH (Library of Congress Subject Headings)* and LC practice need to be addressed.[2] Even the unlikely event of a major restructuring of *LCSH*, however, cannot solve the myriad problems facing effective subject access. We must undertake a more practical problem-solving approach, and quickly, if we are to remove some of the hurdles facing our OPAC users today. By concentrating solely on the browsable index display, we may move toward eliminating some of the difficulties currently encountered during subject searches while at the same time exploiting, to the user's advantage, the existing large body of subject data resident in our bibliographic files.

While browsing a subject index is a desirable feature in an OPAC, often the display under a specified search term is extremely lengthy due to the number of index entries clustered under that term in alphabetical proximity. Many OPACs display a particular subject index term on one line, followed by a list of each unique subdivision arranged alphabetically on successive lines of the display (see figure 1). Interspersed in this list are other types of headings (e.g., inverted word order) that machine filing embeds as a result of the alphabetical sorting routine. For many users, browsing the subject index has meant combing through large numbers of subject entries that have been machine indexed in alphabetical order.[3]

In a lengthy index display of a specified search term—consider anything over one screen lengthy—the user is generally assaulted by all kinds of alphabetically arranged subdivisions. Prompting the user to limit the search by a variety of available techniques, such as Boolean operators, word proximity, and the like, may not be viewed as particularly helpful suggestions,

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```
Islam
Islam (The Arabic word)
Islam--Addresses, essays, lectures
Islam--Africa
Islam--Africa--Addresses, essays, lectures
Islam--Africa--Bibliography
Islam--Africa--Congresses
Islam--Africa, East
Islam--Africa--History
Islam--Africa, North--History
Islam--Africa, Northwest--History
Islam--Africa, Subsaharan--Bibliography
Islam--Africa, West
Islam--Africa, West--History--Addresses, essays, lectures
Islam--Algeria
Islam--Algeria--Addresses, essays, lectures
.
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.
Islam--Collected works
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Islam--Dictionaries
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Fig. 1. Subject Index Term "Islam and Politics" and Subdivisions.

no matter in what friendly language they are couched. The user in many cases does not know what is required in order to be more specific. Add to this the copiously documented problems of lead-in vocabulary, level of indexing of the documents themselves, spelling, syntax, command semantics and protocol, and so forth, any one of which can place insurmountable obstacles in the user's path, and we can easily conclude that we are far from providing users with an efficient service.

DESCRIPTION OF THE PROBLEM

The problem we are faced with is undue display length of a browse list under a given search term. Scanning an alphabetically arranged list of indexed terms is simply not sufficient to assist the user. New character strings are added daily to the index, and indexes will continue to expand at an ever-increasing rate. This factor alone will eventually make browsing the alphabetical index less and less viable as a method of searching. If we begin to index our documents more exhaustively, for example, by adding more subject headings per record as recommended by the CLR-sponsored subject access meeting, we will arrive at this stage even earlier.[4]

Does this mean that browsing large subject indexes cannot be an effective method of subject searching? Emphatically no. However, allowing the option to browse through the subject index does not absolve system designers of the responsibility to organize the index display for maximum gain. Take the example of a user who realizes immediately upon browsing a subject term that geographical aspects of the subject are irrelevant to the search. Nevertheless, geographic subdivisions are dutifully displayed, dispersed throughout the alphabetical array of subdivisions. Successive screens are cluttered with this information, and the user is forced to browse this list to pick out potentially meaningful subdivisions. The subdivisions themselves (including the generally unhelpful types: "–Addresses, essays, lectures"; "–Miscellanea"; and so forth) are not grouped in a conceptual fashion but simply filed alphabetically. Given the existing structure of *LCSH*, a way must be found to manipulate the index itself, and the new terms continually added to it, in order to arrive at a coherent and succinct display of the subject index terms in our files.

GETTING AROUND THE PROBLEM

In the same way that subject headings attempt to provide a conceptual framework

in which to collocate materials (however faulty that framework is), so too can subject subdivisions be grouped to provide further definition of the original concept. An online catalog should orient the user to what is contained in the database and provide a conceptual framework within which a search may be freely and easily conducted, allowing serendipity to come into full play. If such a conceptual framework were presented to the user, despite how broad a topic was searched, and furthermore, if it were presented on one screen, a user could place as-yet-undefined interests into that framework without having further obstacles placed directly in the search path.

What is required, then, is a sort of meta-index: a conceptual, rather than alphabetical, index of the individual index entries grouped under a particular search term or stem. Let us take the list of main, unsubdivided LC subject headings as a given. As pointed out earlier, these already reside in millions of bibliographic records. They are further subarranged *A* through *Z* by numerous subdivisions, which, in turn, may likewise be subdivided. Users cannot be expected to intuit all the possible subdivisions we have indexed our documents under, but in reality, this is what we are tacitly expecting them to do.[5] Neither will a user be readily able to detect all subdivisions that may be potentially relevant to the search, however specific or general the topic is formulated in the user's mind. To date, we have relied heavily on the persistence of the user to select or reject our self-imposed, and somewhat arbitrary distinctions.

To help users define their interests in a way that will coincide with the system's indexing terminology, we must begin to construct a conceptual framework that will be immediately and intuitively accessible to them. If we look at geographical subdivision, for example, and use it to provide us with a working model, we may begin to examine how the existing MARC record structure could be combined with better system design to provide the user with a mental "picture" of the database.

All subdivisions in MARC subject headings (6XX fields) are preceded by a subfield code. A routine could be employed to vastly reduce the size of index displays by substituting a general message for all records subdivided by a particular subfield code. In the case of the *z* subfield code for geographical subdivision, for example, the substituted text in the index display could be a phrase such as "subdivided by geographical areas."

A recently conducted browse of the Utlas database index under the term "Islam and Politics" can better illustrate this point. While Utlas is a bibliographic utility, not an OPAC, the enormous size of its browsable indexes can provide us with some idea of how large files behave in general.

A browse of the Utlas index under the heading "Islam and Politics" (see figure 2) retrieved ninety-six index entries—far too may to view on three or even four successive screens (the maximum single-screen display in the Utlas browsable index is twenty lines). A closer look at the individual index entries revealed that of the ninety-six index entries, only five entries were for titles. Of the remaining ninety-one entries for subject headings, eighty-one happened to have geographic subdivisions.

For purposes of the index display, if we were to compress the eighty-one records where a *z* geographical subfield code is present by substituting a textual message, we might be presented with a screen that looks something like figure 3.

Though the display is still far from optimal at this point, it represents a step in the right direction in terms of the display and management of data contained in the subject headings. Certainly much of the "noise" present in the original display has been eliminated. It is evident at the outset that a conceptual framework is operative, given the textual message appearing on the last line of the display. Furthermore, we can now see that other groups of concepts have clearly emerged, such as the format "Juvenile films." While at first it might appear that the screen is too simple, this is precisely what we should be aiming toward. The sample screen in figure 3 is a condensation of what is represented in the database under that subject heading, and a clear one at that.

If we extend this same method of compressing index entries and substituting tex-

```
Browse of the Utlas index

 1   Islam and politics
 2   Islam and politics Addresses essays lectures
 3   Islam and politics Adresses essays lectures
 4   Islam and politics Afghanistan
 5   Islam and politics Africa
 6   Islam and politics Africa North
 7   Islam and politics Africa North Addresses essays lectures
 8   Islam and politics Algeria
 .
 .
48   Islam and politics Malaysia
 .
 .
96   Islam and politics Turkey History 20th century Congresses
97   Islam and power
```

Fig. 2. Browse of the Utlas Index.

```
1   Islam and politics
2   Islam and politics--Addresses, essays, lectures
3   Islam and politics--Congresses
4   Islam and politics--Early works to 1800
5   Islam and politics--History
6   Islam and politics--Juvenile films
7   Islam and politics--Miscellanea
8   Islam and politics--Periodicals
9   Islam and politics--SUBDIVIDED BY GEOGRAPHICAL AREA, E.G.
                       AFGHANISTAN
```

Fig. 3. Compression and Substitution of Textual Message.

tual messages for the chronological subdivisions that are preceded by the *y* subfield in the MARC record, we can achieve similar results in the reduction of the size of the display while simultaneously providing the user with a certain context. Geographical and historical subdivisions may now be easily rejected or pursued, although the user may not have known to specify or exclude them in the initial search strategy. By presenting subcategories, we present options to the user, thereby automatically incorporating some of the benefits of explicit Boolean searching.

THE CHALLENGE OF THE *X* SUBFIELD

With some caution, we may now approach the problem of how to handle the hundreds of subdivisions present in the *x* subfield. This subfield presents us with the greatest challenge for improving browsable subject displays since it has served as a catch-all for subdivisions that are neither geographical nor chronological in scope. In it are incorporated form and topical subdivisions, which are free-floating (not linked to a particular heading, such as "Congresses"), as well as specialized topical subdivisions (such as "Automobile motors—Fuel injection"). Since many topics are subdivided because no other suitable terminology exists (for a variety of reasons), the non-free-floating subdivisions stand to benefit the most from a hierarchical restructuring of *LCSH* in combination with computer-manipulated phrase rotation and enhanced cross-references to improve lead-in vocabulary. Quite apart from the topical subdivisions, however, the list of

free-floating subdivisions is a logical starting place for considering alternative methods of improving browsable displays.

A look at the list of free-floating subdivisions reveals a redundancy of related terms that can also be grouped into larger categories. For example, seventeen unique, free-floating subdivisions listed in the *LC Guide to Subdivision Practice* represent graphic or illustrative aspects of a subject.[6] Similarly, there are subdivisions representing legal, technical, mathematical, scientific, economic, sociological, and political aspects of a subject. There are, of course, different ways in which the categories could be established; but, optimally, the first level of display should generate broad categories that can be enumerated on a single screen.

It would not be difficult to begin by examining the list of free-floating subdivisions to establish general categories under which they themselves can be grouped. By conceptually linking related terms, a table of existing subdivisions could be built, as long as we can specify what text should be mapped into the online display. Since the list of free-floating subdivisions is finite, we could specify, for example, that under any given main heading, "when two or more of the following seventeen terms appears in the *x* subfield, substitute the text 'Graphic or illustrative aspects' in the index display." The same can be done for concepts relating to legal aspects, mathematical aspects, and so forth. We needn't worry if a particular free-floating subdivision may be interpreted in more than one way because the tables do not need to be mutually exclusive. The same term might appear both in a table of "economic aspects" as well as in a table for "political aspects" if such is the intent of the *LCSH* scope note governing how that subdivision is to be used. Using this as a point of departure, broad conceptual groups could help reduce the size of a browsable display under a specific index term to a maximum of one screen at the first level of display.

What we have is a type of menu approach where users further select their areas of interest. Unlike a true menu-driven system, however, the design does not actually depend on a hierarchical tree structure but in some respects behaves as though it does. Flexibility is not restricted by lengthy search paths that can disorient the user, and the user may employ other conventional means of limiting the search at any desired point. By focusing on a very small group of concepts initially, the user picks up cues as to how a topic is subarranged in the database. The user does not have to know beforehand which possible categories are available and is also spared from having to make sense of what may appear to be arbitrary distinctions. It also allows the user to invisibly bridge some of the terminological and indexing obstacles that previously stood in the way.

As the user gets conceptually closer to an area of interest, other traditional techniques for limiting searches may *now* be gainfully employed. Suppose the user has determined that geographical areas are of interest and selects that category. The system might respond by automatically displaying the possible geographical areas available for selection. If that in itself would be unmanageable (due, for example, to exceeding the single screen limit on the size of index displays), the system may prompt the user to enter the geographical area.

Thus, we have somewhat skirted the problem of requiring the user at the early stages of inquiry to have prior knowledge of what is available in the universe of the database. We have not required the user to hunt haphazardly through successive screens of subdivisions. For the user who has, by accident or design, selected a particular subdivision, we have minimized the danger of overlooking other relevant subdivisions—subdivisions that were not made meaningful due to terminological ambiguity, obscurity, or irrelevant context. By conceptually linking related subdivisions in the index display, we could help users visualize the categories that reflect the subject *content* of the database. With a conceptual framework, users could more effectively and easily find their way around.

POSSIBLE METHODS AVAILABLE TO US

Using compression techniques in combi-

nation with tables in which the finite set of existing character strings in the *x* subfield can be mapped opens up new possibilities for more effective system design. Each unique, main subject heading should appear only once in the general browsable display, no matter how many subdivisions are linked to it. In the same way that browsing a name authority file should reveal only one occurrence for each unique name, so should the subject index be similarly constructed. The general index should reveal a list of main subject terms, and term selection should further reveal levels of subcategories suitably arranged in a conceptual (not necessarily alphabetical) fashion.

We may consider methods of manipulating existing subject heading data for more effective browsable displays, keeping in mind some characteristics peculiar to present and past subdivision practice.

1. Under any main subject heading, match and compress each unique sorting element within the geographical subfield (for example, all occurrences identified by the same character string, e.g., Africa) so that each unique geographic area occupies only one line in the appropriate level of browsable display. This would eliminate the problem of compound headings or headings with inverted word order splitting a file (see entries above and below the heading "Islam—Africa, East" in figure 1). It would also cluster all matching subject headings, even when further subdivisions are present. The second level of display in figure 4 gives some idea of how this particular method could operate. A hierarchy of subject heading index display would thus permit successively deeper layers of subdivisions, revealed as the user sees fit.

2. Specify a matching routine that will link a main heading that has been subdivided by both direct and indirect subdivision practice. Since the practice of direct geographic subdivision ("Fountains—Rome") has been replaced in recent years with indirect geographic subdivision

a) First level of display (upon selection of main term)

```
BROWSING SUBJECT TERM: ISLAM
N citations found under the term ISLAM
Term is also subdivided by the following categories:

1. Congresses
2. Periodicals
3. Subdivided by geographical area, e.g. Afghanistan
   .
   .
[User selects 3)
```

b) Second level of display:

```
BROWSING TERM: ISLAM--SUBDIVIDED BY GEOGRAPHICAL AREA
N citations found under the term ISLAM-SUBDIVIDED BY GEOGRAPHICAL AREA
Term is subdivided by the following geographical areas:

1. Africa
2. Africa, East
3. Africa, North
4. Africa, West

[User selects 2)
```

c) Third level of display:

```
BROWSING TERM: ISLAM--AFRICA, EAST
N citations found under the term ISLAM--AFRICA, EAST
Term is also subdivided by the following categories:

1. Bibliography
2. Congresses
3. History
```

Fig. 4. Possible Levels of Display.

("Fountains—Italy—Rome"), these headings would currently appear dispersed in an alphabetical display. Therefore, when two *z* subfields are present (indirect subdivision), the character string in the second *z* subfield can be matched against an identical occurrence appearing in the first *z* subfield (direct subdivision). This would cluster all identical geographic areas together regardless of past practice.

3. Since most form subdivisions are made redundant by coding that exists in the MARC fixed fields, the system might simply ask if a list of formats used with the topic is desired, rather than displaying the formats routinely. Alternatively, a table could be specified to cluster subdivisions that represent the type or format of the work.

4. Consider abandoning certain free-floating subdivisions altogether, such as LC has already done with "Addresses, essays, lectures" and "Yearbooks." Subdivisions of this type add nothing to increase a subject's specificity and considerably hamper effective subject retrieval by arbitrarily separating records that could otherwise be clustered together.[7]

5. Tables would be operative if a user selects a subject term or phrase when the number of index entries exceeds a predetermined limit; otherwise, there is no need to compress entries. Non-free-floating subdivisions could be treated as "specialized aspects" for purposes of limiting the display after a search item has been specified. Researchers must closely examine the specific topical subdivisions to see if any significant redundancy of concepts emerges that would be suitable for compression and to identify areas that will prove incompatible with such an approach.

These are only some of the characteristics of subdivisions that need to be investigated closely if we aim to gain control of the data existing in MARC records and to manipulate it with the user in mind. Imaginative solutions to problems may begin to surface once we are able to reduce the noise levels that are present in current browsable displays.

WHERE WE CAN GO FROM HERE

In designing effective browsable subject index displays, we must move toward examining compression techniques to limit the size of displays presented to the user. The use of tables must also be examined as an effective method of handling the existing redundancy of concepts present in LC subdivisions, substituting textual messages for groups of conceptually similar terms.

On a larger scale, an expanded MARC record could greatly aid the manipulation of data in subject heading fields. The MARC record to date has not been exploited with regard to subject access, although improvements have been suggested.[8] The *x* subfield code should be replaced by a detailed, mnemonic coding scheme designed to cluster similar *concepts* together (for example, subfield *m* = subdivisions for mathematical aspects). Ironically, the specificity that subdivision has tried to provide has been obscured in the MARC record by a general subfield code that cannot be manipulated effectively in the machine environment.

The technological achievements possible with online systems have great scope for subject access. The browsable display is one area that will respond favorably to our immediate attention, and libraries do not need to wait for action on a national scale to proceed with improvements. Computers have sorting capabilities that can be exploited more creatively than simply routinely listing every subdivision from *A* to *Z*. Clustering conceptually similar terms can reduce the size of a large display while simultaneously providing a structure that will assist a subject search. The architecture of online public access catalogs must be designed to place the burden of data organization on the technological capabilities of the system (which is exactly the type of thing computers are, after all, designed to do), rather than resting it with the user.

We must attempt to design a conceptual framework that will assist a user quickly and intuitively, something that was never really possible in a card catalog due to its physical and logistical limitations. It is incumbent upon the profession to speedily discover new ways of manipulating our existing encoded MARC records to rectify some of the problems inherent in our current online systems. Computing power al-

lows us to invent innovative solutions to problems that the profession could not adequately solve before, but this cannot be done unless we unload some of our preconceptions of how catalogs are supposed to be constructed and what users expect of a library catalog. We must step back and approach our dual tasks of bibliographic control and information retrieval with insights made possible by state-of-the-art technology.

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Clustering LC Classification Numbers in an Online Catalog for Improved Browsability

Jeffrey C. Huestis

The 1982 conference on subject access in online public access catalogs (OPACs), sponsored by the Council on Library Resources (CLR), targeted three broad areas for improvement: use of library classification, access to keywords found in bibliographic records, and improved utilization of controlled subject headings.[1] A key question in all three areas is how improvements are to be implemented and by whom. This article reviews the benefits of classification in an OPAC and suggests some strategies for overcoming the major problems related to LCC use in an OPAC, particularly those techniques that can be implemented in any local system without major institutional support.

Keyword access is clearly a function of the software used in the local environment, and it is not surprising that this has become a competitive priority among system vendors. The other two areas require support by the local system but have been viewed by most observers as dependent on institutional action at the national level, particularly by the Library of Congress, the bibliographic utilities, and other agencies (e.g., Forest Press) in the library marketplace.

For instance, the work in classification that followed the CLR conference quickly focused on the Dewey Decimal Classification (DDC), partly because of its inherent structural properties, but primarily because its schedules and indexes are available in machine-readable form from Forest Press.[2] By contrast, the Library of Congress Classification (LCC) has been given only cursory attention because of basic problems in its structure and because of the absence of machine-readable LCC schedules and indexes.[3] This is unfortunate because of the wealth of subject analysis represented by the LCC schedules as they have been developed and as they have been used.

THE ROLE OF CLASSIFICATION IN AN OPAC

Because of resource constraints, present use of classification in American libraries serves the limited purpose of physical placement on the shelves in a way that enables browsing in open stacks. Wherever possible, call numbers are taken as is from an external source of cataloging copy such as the Library of Congress. Most of us have better things to do than struggle with the problem of how best to classify a book, let alone how best to construct and maintain a classification system. The attention given classification at the CLR-sponsored conference reflects a changing attitude among a few researchers who, in light of new technology, are rethinking classification with a view toward its use for *content-based*

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searching. (To avoid confusion, the term *subject* is here taken in the narrower sense of a controlled vocabulary term; while *content* is used to designate the more general concept of what a document is about, especially as it relates to the document's place in a collection.)

Content-based searching may have a higher priority than shelving as an object of serious research, but it is still a step down from the original purpose of classification, which from Aristotle onward had the grand goal of a unified structure embracing all human knowledge. No one has seriously believed in the attainability of such a structure for some time, but even an imperfect classification provides a *network of relations* among objects and concepts that exhibits a property called *connectedness*. When one is browsing in a database, such a network provides the pathways by which "probes" (the random attempts of a naive or casual user) can be used as the starting points for "navigation" from initially retrieved records to an expanded set of related records.

Browsing, as a user behavior, is itself receiving new interest. Traditionally, browsing has been viewed as leading to the serendipitous discovery of what one needs or wants without having realized it. But it is becoming evident that what we call browsing is a fundamental part of content-oriented access.[4] The commonly accepted wisdom that, in using a library catalog, experienced researchers favor known-item searching over subject access has begun to change with the advent of the OPAC. However, existing subject searching facilities are still inadequate for the advanced researcher's needs—many would argue that in any system, for any searcher, content-based searching is inherently inexact, an art, not a science. So one of the criteria for a good subject retrieval system must be its support for browsing.

The parallel search strategies and indeterminacy of decision-making characteristic of browsing behavior are, at least in part, an outgrowth of what the searcher already knows about the subject area and about the tools with which he is working. As a result, we can do very little to predict what approaches will be needed by an individual searcher following a particular line of inquiry and, consequently, what access points we should provide. But we can make some estimate of how many *possibilities* a user may be willing to look at before he finds something of interest. Here we get into the challenge of man/machine interface design. For instance, the completeness of the information displayed must be weighed against the number of screens it takes to display it. But whatever the optimal balance point is, browsing support should involve the ability to present a set number of citations that, by some measure, are each other's nearest "neighbors."

The maintenance of a fixed-size "neighborhood" is much more manageable within the fairly rigid mechanics of a classification system than in the cross-references that link a thesaurus. A thesaurus (as such) is organized in alphabetic, rather than conceptual, groupings; pursuing cross-references involves much page turning or screen flipping, using auxiliary tools. Also, in some thesauri, notably the Library of Congress Subject Headings (LCSH), the relations do not provide a connected whole but are divided into many *subnets*. The survival of these subnets is protected by the principle of "specific entry," which ensures that subject headings cannot be used to pull together a group of specific works within a broader topic: the sort of thing a browser might want to do. Worse, this compartmentalization can reinforce the circular thinking of one who is trying to generate search terms from an existing knowledge base that is unequal to the task: the typical situation of the undergraduate.

The attention given DDC's machine-readable schedules has tended to obscure the perception that a classification tree, in itself, is a major addition as an access point in an online catalog. Any two objects in the collection are relatable via some combination of parent, child, and sibling relations within this tree, and simple mechanical manipulation of the notation is analogous to mindlessly scanning up and down the bookshelves from the point where one's desired book was designated to be. (The current LC practice of appending the year of publication to all call numbers provides information in an online call number index, similar to that provided by the condition of a book's spine, which may guide the user in

deciding which book to pull off the shelf first.)

However, because call number searching is a novelty for most library users, few of them can be expected to successfully manipulate the classification's notational structure in order to exploit the connectedness of class relations. Furthermore, our informal transaction log analysis indicates that OPAC users frequently make less use of truncation facilities than they should in any type of search. When applied to a call number index, not truncating turns out to be an inconvenient approach to known-item searching (retrieving either one or zero items) because call numbers are designed to be unique.

Thus, a desirable property of call number indexing in an OPAC is for the system to do an automatic browse when an overly specific call number is entered that returns no results. The most straightforward way of doing this is simply to truncate digits from the right of the string entered until a nonempty retrieval set is obtained.

PROBLEMS WITH THE LC CLASSIFICATION

Even in LCC, a simple automatic truncation strategy will produce reasonable results as it cuts back through the cutter(s) and the decimal portion of the LCC major class. Beyond that point, a basic algorithm must skip the integer part of the LCC class and truncate back to the LCC division. This jump generally produces a retrieval whose size is unmanageable unless the user knows how to do a binary search, flipping back and forth through successively smaller subsets of the retrieved entries. The auto-truncation method is, essentially, the algorithm used by Northwestern University's NOTIS system (which we have at Washington University) except that their truncation takes somewhat larger "bites," beginning with the cutters.

The inapplicability of truncation to the LCC major class is due to the main structural problem that other observers have seen in LCC's use for subject searching. As an enumerative classification, LCC represents broad concepts by ranges of numbers that are not grouped in any notationally significant way. (In contrast, the explicitly hierarchical, consistently left-justified DDC represents specific subjects as fractional values within the numeric representations of broader subjects.) For instance, if one wants to search in LCC on the general subject of "bookbinding," one would have to successively try every class number from Z 266 to Z 276. Moreover, while a range of LCC numbers covers a broad subject, the individual items retrieved within that range treat more specific topics, as represented by the numbers within the range. General works that cover the broader subject may very well be found in a separate range (typically preceding, but not necessarily contiguous to, the more specific classes).

On the other hand, the consistency of DDC's representation of hierarchy is more apparent than real. When one considers DDC's standard subdivisions and area tables, early forms of facet analysis, it becomes evident that some unfavored facets are being scattered across the collection. Both DDC and LCC separate parent nodes from their children as a compromise with reality—the world just isn't hierarchical and, fortunately, resists all efforts to make it so. That the two classifications structure the world differently is a major factor in the dispersion patterns examined in a recent study by the OCLC Office of Research.[5]

RECENT WORK AT WASHINGTON UNIVERSITY

After a call number index was added to our OPAC at Washington University in St. Louis, the problems with the automatic truncation routine outlined above made us aware of the need for an improved browsing facility if call number access was to achieve any kind of acceptance by users. Such a facility is now in the final stages of testing. It is based on information about meaningful LCC number *ranges* that is derived from the bibliographic database itself. Each of these class number ranges represents a cluster of numbers that, together, cover a general concept common to the individual numbers within the range. A representation of each range is stored in machine-readable form within the online catalog and is accessible to the online index-searching program.

The development of the augmented index began with the manual entry of the *LC*

Classification Outline into a machine file.[6] The groupings in that document provide minimal coverage, at the most general level, for all classification schedules. Slightly more than 1,500 ranges were identified by this means, but in most subject areas, these ranges were so broad as to provide minimal improvement over the automatic truncation algorithm described above.

Subsequently, because of the recognized problems of any single classification, and in cognizance of the DDC project going on at OCLC, we performed a feasibility study for providing a Dewey index derived from our LC-copy bibliographic records. Predictably, the LC practice of generic posting meant that most of the Dewey numbers extracted from LC records were too general for retrieval purposes. However, a "facet outlook" on the cross-classification (DDC-LCC) dispersion problem suggested that the specificity of these general entries could be improved by appending LCC numbers to index entries for the Dewey numbers with which they co-occur in bibliographic records. This was done.

A casual perusal of this *composite* DDC/LCC index confirmed that a number of different LCC classes typically appear under one Dewey number, serving to differentiate the general Dewey postings. However, in the absence of textual explanations such as might be drawn from online schedules, the user friendliness of the display leaves so much to be desired that it is questionable how useful it would be to any but the most desperate searcher. In any event, the results suggested a path for development of the LCC browsing facility.

Many of the different LCC classes under one Dewey number are members of the same LCC division. For the purpose of identifying meaningful LCC clusters, if two or more LCC class numbers from the same division co-occur under the same Dewey number in the composite index, it seems reasonable to interpret the general concept identified by the Dewey number as overarching the range of LCC numbers exhibiting such co-occurrence. We stress the term *reasonable*; while the machine process may approximate human judgements, it will not duplicate them. The objective of so grouping LCC numbers is only to produce a reasonable grouping of concepts, not to duplicate the LCC schedule. This concept of reasonable grouping can be applied at several levels of subject generality, so the decision was made to capture groups identified under Dewey numbers at varying levels of truncation.

Several passes were made through the composite index, for the purpose of LCC range identification, using the following simple program:

```
For each Dewey number grouping do :
  For each LCC division within the Dewey
  grouping do :
    Output-record < = LCC Division
      | Lowest LCC Class Number
      | Highest LCC Class Number ;
    Write output-record ;
  end-do ;
end-do ;
```

In each pass, the Dewey number grouping constituted a set of Dewey numbers that were equal up to a given character position. The character position cutoffs used were three, five, six, seven, eight, nine, and ten (the four-character cutoff, marking the position of the decimal point, was not used). Initially, only cutoffs three through seven were processed, but the clusters produced in technical subject areas were still too general.

Figure 1 shows the number of ranges produced from each pass and the degree of overlap between any two of these range sets. (Row and column numbers indicate the number of Dewey digits used in the analysis.) The diagonal (top left to bottom right) gives two counts for each individual pass. Because the composite index was processed in Dewey order, some duplicate LCC ranges were produced within a single pass. The upper numbers along the diagonal give the raw count, while the lower numbers give the count of LCC ranges with duplicates stripped out. The number in each cell below the diagonal represents the number of unique ranges derived by combining the results of the two passes indicated by the row and column of that cell. The numbers above the diagonal indicate the corresponding number of duplicates. For instance, Cell(3,3) + Cell(10,10) = Cell(3,10) + Cell(10,3).

	3	5	6	7	8	9	10
3	3,025 2,939	(1,487)	(994)	(786)	(622)	(601)	(594)
5	6,708	5,454 5,236	(3,033)	(2,372)	(1,936)	(1,878)	(1,843)
6	9,214	9,502	7,683 7,279	(4,934)	(3,832)	(3,730)	(3,645)
7	10,827	11,558	11,019	9,253 8,674	(5,596)	(5,547)	(5,411)
8	10,831	11,824	11,971	11,602	9,078 8,524	(5,861)	(5,648)
9	10,801	11,832	12,023	11,601	11,137	9,162 8,474	(6,881)
10	10,627	11,675	11,916	11,545	11,158	9,875	8,998 8,282

Number of Dewey Digits

Fig. 1. Overlap Between Pairs of LCC Ranges as Defined by Dewey Numbers Truncated to Lengths Indicated.

While rigorous analysis of range overlap is outside the scope of the present paper, some observations about the variables involved would be in order. The higher degree of overlap for longer Dewey numbers (lower right corner of the table) might seem counterintuitive, since these more specific class numbers should apply to books on fairly specific subjects. One source of such duplication is that shorter numbers are included in the longer-number passes, with trailing blanks; but the tapering of duplicate counts, left to right within each row, argues against this as the major cause. Another explanation is that the same LCC ranges are being delineated by Dewey numbers in different sections of the DDC, which would be consistent with the results of the OCLC cross-classification dispersion study. (In a sense, such duplication argues for the validity of the process—that these duplicative clusters represent identifiable concepts.) The decreasing number of clusters produced beyond cutoff seven is presumably due to the fact that LCC class numbers appearing as singletons under a Dewey number cannot be used for range definition (i.e., excessively fine Dewey specification "atomizes" the LCC groupings).

A problem with such pseudo-classification is the high likelihood of ludicrously inappropriate groupings. These anomalies, however, tend to err on the side of generality. The search algorithm added to the online system to process these stored ranges selects a nonempty, narrower range before a broader one, and no stored ranges include more than one LCC division.[7] So it is likely that most anomalies will be masked out of accessibility by narrower ranges and that, in the worst case, the results are no worse than would have been produced by the automatic truncation routine. A more serious problem is that of too-narrow ranges masking out broader ranges. This can be addressed by additional support for "tree-climbing" as discussed below.

The online browsing facility provides three modes of operation:

1. automatic retraction from a failed probe in the index (i.e., an improvement to the original automatic truncation routine described above). In this

mode, a failed probe results in an automatic retry on the most specific cluster, which includes the point where the absent class number would have been;
2. an explicit request for such a browse around a particular number, even if that number is present; and
3. access to more general clusters by allowing the specification of a range of LC class numbers. This facility can bridge across LC divisions, although it would be unwise to promote this knowledge to the public, for system performance reasons.

REMAINING PROBLEMS

A number of problems can be anticipated in the use of such an index by the public, so presently the index is only available to library staff, including reference staff serving the public.

1. In both the LCC Cluster Index and the DDC/LCC Composite Index, the user is presented with a display of call numbers and nothing else. Users of a predominantly LCC library may not be familiar with DDC (and, of course, the reverse would be true). In fact, it is probably fair to say that most end-users are not in command of either classification. If this were not true, then range requesting (number three above), the easiest of the three modes to implement, would be adequate to cover all explicit requests. The major motivation of the LCC clustering is to provide purely mechanical delineation of subject "neighborhoods" for users not familiar with LCC and not equipped with schedules. The major problem in providing a more user-friendly display is the unavailability of such schedules in machine-readable form.

   As noted earlier, this lack of machine-readable support structures is one of the main reasons LCC has not attracted more attention as an online tool. One approach to rectifying this would be the inclusion of LCSH from the records retrieved. Alternatively, brief title information could be displayed, as is currently being considered for extensions to the NOTIS call number index at another site. In the case of subject headings, it would be necessary to choose between presenting only one of (possibly) several headings or presenting all headings. The disadvantage of including all headings is that users have fewer entries to observe on one screen, so they must flip through more screens to browse the entire retrieval.

   There is no escaping the difficulty that the display of call numbers alone is imposing. Considering the difficulties associated with subject headings, it appears that inclusion of titles in the index is the most straightforward solution and would also be the least redundant as regards the information displayed on the screen.
2. The LCC Cluster Index does not address the problem that specific and general works may be classed in separate LCC number ranges. It is, however, possible for the industrious searcher to locate a more specific range, or a more general one, by use of the Composite Index. A typical scenario might be as follows:

   A user does a browse search in a particular LCC range and finds that the works retrieved are more specific than what she or he is looking for. The user looks at several of the records retrieved and picks one or more Dewey numbers from these records. Since the Dewey classification is more explicitly hierarchical than LCC, the user can perform several searches in the Dewey index, using varying levels of truncation on the Dewey numbers to "climb" up the classification tree. One or more of these searches should identify alternative LCC ranges, which are used for more general works on the subject identified by the original LCC search. The user can then do specific probes, requested browses, or explicit range searches within these alternative LCC classes.

   Alternatively (and perhaps more plausibly), a naive user gains an initial toehold in the database, which is too broad, and needs access to more specific works. Figures 2–9 show a series of NOTIS screens giving the results of a search leading from an initial query on ball games to a call number listing for books on specific games. This brief ex-

```
LTWU find s ball
                                        NOTIS 4.4 COPYRIGHT NORTHWESTERN UNIV

LTWU MORE
                                                NOTIS INDEX SEARCH          D008
 SUBJECT HEADING GUIDE -- 130 HEADINGS FOUND, 1 - 17 DISPLAYED
  1 BALL GAMES
  2 BALL GEORGE W
    BALL HUGO <1886-1927
  3   --EXHIBITIONS
  4   --STYLE
  5 BALL HUGO <1886-1927 /TENDERENDA DER PHANTAST
    BALL-BEARINGS
  6   --LUBRICATION
    BALLAD OPERAS
  7   --SCORES
  8   --TO 1800 -LIBRETTOS
  9   --TO 1800 -VOCAL SCORES WITH PIANO
 10   --18TH CENTURY
 11 BALLADS
 12   --HISTORY AND CRITICISM
 13   --LADINO -ISRAEL -JERUSALEM -HISTORY AND CRITICISM
    BALLADS CUBAN
 14   --HISTORY AND CRITICISM
 15 BALLADS DUTCH
 16 BALLADS ENGLISH
 17   --CANADA
```

Fig. 2. "Find S = Ball," and Resultant Subject Guide Display.

```
LTWU
                                                NOTIS INDEX SEARCH          D008
 SUBJECT/TITLE INDEX -- 3 TITLES FOUND, 1 - 3 DISPLAYED

BALL GAMES
  1 acquiring ball skill: a psycholo (1969)WU Olin:GV861 W45 1969b
  2 lead-up games to team sports     (1964)WU Olin:GV861 B55
  3 group games for girls and women  (1957)WU Olin:GV861 G7 1957
```

Fig. 3. Subject Index Display for Line 1 of Subject Guide Display.

ample is not intended as a realistic picture of user behavior but only to show steps that are derivable from the results of previous steps.

3. The problem of erroneously too-specific LCC ranges was mentioned above. One approach to getting around this problem is "tree-climbing" using the Composite Index, as outlined in the preceding paragraph. Alternatively, the user could do a requested browse on the numbers just above and just below a retrieval he or she suspects is too narrow. Either of these would produce a retrieval on a broader range.

Both methods of "tree climbing" impose a significant demand on the searcher: to recognize an incomplete retrieval and then to manipulate the command language and evaluate the results in order to do the necessary navigation. Some additional support could be provided by the existing system for such commands as MEDLINE's "tree" and "explode." Alternatively, the impact of narrow ranges can be limited by allowing the searcher to specify a minimum number

```
LTWU DONE                                                    AAV2054
                                                NOTIS CATALOGING          D008
WU# AAV2054 FMT B R/TYP a BL m DT 03/30/88 R/DT none     STAT mm E/LEV 5 DCF a
ccc 19880323113837.0
SRC d PLACE wau LANG eng MOD    I/LEV    REPRO    D/CODE s DT/1 1957 DT/2
CONT       ILLUS a     GOVT    BIOG    FEST 0 CONF 0 FICT 0 INDX 0 ME/B 0

 035/1:  : ¦a (OCoLC)09122708
 040:    : ¦a SOI ¦c SOI ¦d WTU
 049:    : ¦a WTUU
 090/1:  : ¦a GV861 ¦b .G7 1957
 092/1:  : ¦a 796.3 ¦b A5121g, 1957
 245:00: ¦a Group games for girls and women / ¦c presented by the National
Section for Girls and Women's Sports of the American Association for Health,
Physical Education and Recreation.
 260:0 : ¦a Washington : ¦b The Association, ¦c c1957.
 300:   : ¦a 32 p.: ¦b ill. ; ¦c 23 cm.
 650/1: 0: ¦a Ball games.
 650/2: 0: ¦a Sports for women.
 710/1:20: ¦a American Association for Health, Physical Education and
Recreation. ¦b National Section for Girls and Women's Sports.
```

Fig. 4. Bibliographic Record Display for Line 3 of Subject Index Display.

```
LTWU find cc 796.3
                                        NOTIS 4.4 COPYRIGHT NORTHWESTERN UNIV
```

```
LTWU MORE
                                                NOTIS INDEX SEARCH        D008
 CALL NUMBER INDEX -- 77 ENTRIES FOUND, 1 - 21 DISPLAYED
  1 WU: 796.3 (GV861)
  2 WU: 796.3019 (GV861)
  3 WU: 796.31 (GV1017 T4)
  4 WU: 796.32 (GV1785 H8)
  5 WU: 796.323077 (GV885.3)
  6 WU: 796.323077 (GV885.3)
  7 WU: 796.323077 (GV885.35)
  8 WU: 796.3230973 (GV883)
  9 WU: 796.3232 (GV885.3)
 10 WU: 796.3232 (GV885.3)
 11 WU: 796.3232 (GV885.3)
 12 WU: 796.3232 (GV888)
 13 WU: 796.3232 (GV888)
 14 WU: 796.3232 (GV889)
 15 WU: 796.3232 (GV889)
 16 WU: 796.3232 (GV889)
 17 WU: 796.3232 (PN6018)
 18 WU: 796.3233 (GV885.2)
 19 WU: 796.323630973 (GV885.7)
 20 WU: 796.323640979549 (GV885.52 P67)
 21 WU: 796.3238 (GV886)
```

Fig. 5. "Find CC = 796.3"—Composite Index Search on Dewey Number from Preceding Bibliographic Display (Field 092) and Resultant Composite Index Display.

```
LTWU find cl gv1017
                                        NOTIS 4.4 COPYRIGHT NORTHWESTERN UNIV

LTWU                                                NOTIS INDEX SEARCH          D008
 CALL NUMBER INDEX -- 11 ENTRIES FOUND, 1 - 11 DISPLAYED
  1 WU: GV 1017      H2      Y4                              OLIN <UNLINKED
  2 WU: GV 1017      H7      F5                              OLIN
  3 WU: GV 1017      H7      W413 1979                       OLIN
  4 WU: GV 1017      P17     L48                             OLIN <UNLINKED
  5 WU: GV 1017      S6      F58                             OLIN
  6 WU: GV 1017      T4      T4                              OLIN
  7 WU: GV 1017      T4      T4                              OLIN
  8 WU: GV 1017      V6      A8                              OLIN <UNLINKED
  9 WU: GV 1017      V6      N3                              OLIN
 10 WU: GV 1017      V6      N32                             OLIN
 11 WU: GV 1017      V6      S27                             OLIN <UNLINKED
```

Fig. 6. "Find CL = gv1017"—LCC Index Search on LCC Number from Line 3 of Composite Index Display.

```
LTWU FIND cl -gv1017
                                        NOTIS 4.4 COPYRIGHT NORTHWESTERN UNIV

LTWU                                                NOTIS INDEX SEARCH          D008
 CALL NUMBER INDEX -- 12 ENTRIES FOUND, 1 - 12 DISPLAYED
  1 WU: GV 1015.5    T73     S28 1984                        OLIN
  2 WU: GV 1017      H2      Y4                              OLIN <UNLINKED
  3 WU: GV 1017      H7      F5                              OLIN
  4 WU: GV 1017      H7      W413 1979                       OLIN
  5 WU: GV 1017      P17     L48                             OLIN <UNLINKED
  6 WU: GV 1017      S6      F58                             OLIN
  7 WU: GV 1017      T4      T4                              OLIN
  8 WU: GV 1017      T4      T4                              OLIN
  9 WU: GV 1017      V6      A8                              OLIN <UNLINKED
 10 WU: GV 1017      V6      N3                              OLIN
 11 WU: GV 1017      V6      N32                             OLIN
 12 WU: GV 1017      V6      S27                             OLIN <UNLINKED
```

Fig. 7. "Find CL = −gv1017"—LCC Explicit Browse Request and Resultant LCC Index Display.

```
LTWU FIND cl -gv1014
                                        NOTIS 4.4 COPYRIGHT NORTHWESTERN UNIV
```

```
LTWU MORE
                                                NOTIS INDEX SEARCH          D008
 CALL NUMBER INDEX -- 137 ENTRIES FOUND, 1 - 21 DISPLAYED
  1 WU: GV  863      A1       V65 1983                    OLIN
  2 WU: GV  865      A1       A66 1980                    OLIN
  3 WU: GV  865      A1       K37                         OLIN
  4 WU: GV  865      D68      C53 1979                    OLIN
  5 WU: GV  865      J59      M87 1982                    OLIN
  6 WU: GV  865      M38      A32                         OLIN <UNLINKED
  7 WU: GV  865      R6       A29 1972                    OLIN <UNLINKED
  8 WU: GV  865      R6       A44 1987                    OLIN
  9 WU: GV  865      R6       T93 1983                    OLIN
 10 WU: GV  865      S7       L48 1985                    OLIN
 11 WU: GV  867      A8                                   OLIN <UNLINKED
 12 WU: GV  867      D5                                   OLIN <UNLINKED
 13 WU: GV  867      J4                                   OLIN <UNLINKED
 14 WU: GV  875      C6       A8                          OLIN <UNLINKED
 15 WU: GV  875      K29      B78 1985                    OLIN
 16 WU: GV  875      L6       S84 1987                    OLIN
 17 WU: GV  875      N4       M67                         OLIN <UNLINKED
 18 WU: GV  877      A133     1987                        OLIN
 19 WU: GV  877      B27      1974                        OLIN <UNLINKED
 20 WU: GV  877      B27      1976                        OLIN
 21 WU: GV  877      B27      1979                        OLIN
```

Fig. 8. "Find CL = –gv1014"—LCC Explicit Browse Request to Force Broader Cluster Than That Retrieved in Figures 2–6 and Top of Resultant LCC Index Display.

```
LTWU
                                                NOTIS INDEX SEARCH          D008
 CALL NUMBER INDEX -- 137 ENTRIES FOUND, 117 - 137 DISPLAYED
117 WU: GV  991      O43                                  OLIN
118 WU: GV  991      O43      1983                        OLIN <UNLINKED
119 WU: GV  992      L85                                  OLIN
120 WU: GV  993      G75                                  OLIN <UNLINKED
121 WU: GV  994      K7       A34 1979                    OLIN
122 WU: GV  995      M86                                  OLIN <UNLINKED
123 WU: GV  999      R6       1977                        OLIN
124 WU: GV 1002.9    P75      G34                         OLIN <UNLINKED
125 WU: GV 1004.5    F7                                   OLIN <UNLINKED
126 WU: GV 1015.5    T73      S28 1984                    OLIN
127 WU: GV 1017      H2       Y4                          OLIN <UNLINKED
128 WU: GV 1017      H7       F5                          OLIN
129 WU: GV 1017      H7       W413 1979                   OLIN
130 WU: GV 1017      P17      L48                         OLIN <UNLINKED
131 WU: GV 1017      S6       F58                         OLIN
132 WU: GV 1017      T4       T4                          OLIN
133 WU: GV 1017      T4       T4                          OLIN
134 WU: GV 1017      V6       A8                          OLIN <UNLINKED
135 WU: GV 1017      V6       N3                          OLIN
136 WU: GV 1017      V6       N32                         OLIN
137 WU: GV 1017      V6       S27                         OLIN <UNLINKED
```

Fig. 9. Bottom of LCC Index Display from Search in Figures 2–7.

of titles to be retrieved or a minimum number of class numbers to be included, both of which would force the online program to skip over too-specific ranges. The count of titles for each range would need to be stored with each range entry in the index to avoid substantial system overhead. Deriving these counts would require significant processing, but they need not be recalculated every time the index is generated. Whether or not this tabulation is part of the file inversion process, the availability of the results to the index generation program could be used to prevent the loading of ranges with less than ten or twenty entries in the index, assuming that searchers can easily scan that many entries in a terminal display and evaluate them themselves. (All such support will be limited by the imperfections and inconsistencies in both indexes. For instance, we are still looking at how to handle the problem of narrow ranges that overlap each other.)

A NOTE ON COSTS

Much of this article has been given over to arguments supporting the potential benefits of class number searching and of enhanced system support for such searching. The benefits must be weighed against the costs involved. These involve more than the cost to the library of developing and maintaining any new facility. Another cost factor is implied in the question of user friendliness as it relates to the user's time investment in learning and using the index.

With regard to development and maintenance costs, it should be remembered that a call number index is a high priority, if not an absolute requirement, in supporting the circulation function. Effectively, then, we are only concerned with the incremental cost of improving the call number index for content-based searching purposes.

The cost of maintenance involves both the processing required to periodically reevaluate and regenerate the LCC clusters and composite index entries and the space required to store the additional information. The observed stability of the LCC clusters argues that reevaluation and regeneration need be performed no more than once or twice a year. (When the index was first loaded, 19,972 clusters met the criterion of encapsulating at least 10 entries in the database. At this writing, we have had 13 weekly updates after loading new records from OCLC tapes, bringing the total to 20,059, for an average of about 7 additions per week). As with the regular LCC call number index entries, composite index entries only need to be generated for new additions to the database. Currently 69 percent of our bibliographic records contain LC-assigned Dewey numbers, and this may be taken as the factor by which the composite index adds to the storage requirements of the LCC index file. However, the basic NOTIS indexes make use of data compression—stripping off trailing blanks in each entry and duplicate leading characters from one entry to the next; the data compression is particularly effective in the call number index because of the high degree of front compression, so the call number index is not a large space consumer in the context of the whole system. Regarding the space requirements of the clusters, merging 20,000 clusters into an index of only 350,000 entries is a minor expense and would be even less so in a converted database of 1 to 2 million titles.

A more significant issue than ongoing batch maintenance is the cost of cluster searching by users of the online system. As implemented in NOTIS 4.4, a basic call number search involves one probe of a VSAM B-tree plus a forward scan through a series of data-compression blocks to generate the initial display. In the augmented index, a requested browse involves 2 B-tree probes with a forward scan in each. An automatic browse involves the original failed probe and scan plus the requested browse processing. A range request involves the same processing as a basic call number search.

In measuring the cost of machine resource use, one must confront considerable variation, from one installation to another, of processor size and configuration, of database size, and of user population as expressed in transaction counts. More significant is the explosive rate of computer technology development. Accordingly, we adopt here the computer scientist's approach of analyzing costs as an arithmetic

function of the amount of data to be processed. This type of efficiency measure has remained remarkably stable as the technology has evolved. In the processes described above, the time complexity of the I/O operations is basically logarithmic as related to B-tree probes and linear as related to the number of items processed in the forward scans.

In short, the searching operations are highly efficient. Furthermore, by preventing long forward scans on LC divisions (in automatic retraction), the clusters actually *save* considerable processing overhead.

The costs associated with development were also largely incremental. The programming required to identify LCC clusters from a flat file of composite index entries (basically the algorithm shown above) is comparable to an assignment in a beginning programming course, as was the programming to produce those composite entries (given the basic LCC entry generation support). The programming to support formatting of the clusters for storage in the call number index, and for their use in the online system, was somewhat more challenging. But the incremental knowledge required to develop and support the LCC clusters over that required to master the base indexes (for purposes related to our circulation conversion) was minor.

Costs related to user friendliness are harder to quantify and would require fairly sophisticated survey work. However, there are some indicators of how these relate to the potential benefits. Consider the bewildering array of personal bibliographic systems, specialized information-retrieval tools, "expert systems" packages, and now "hypermedia"—then consider the state-of-the-art of the OPAC itself. What accounts for the disparity? At a recent user group meeting, a NOTIS representative estimated that 50 percent of the cost of incorporating new system features was in documentation, training, and testing. One of the more experienced users surmised that another 25 percent was in the analysis to determine whether the feature should be incorporated in the base system at all.

Without commenting on the accuracy of either of these estimates, it seems safe to speculate that OPAC development is lagging as a result of libraries' commitment to their least-experienced and least-frequent users. One solution to this problem might be a two-tiered OPAC. The core system should be oriented toward the naive or casual user, with ample prompts and help screens and near-perfect reliability, as regards data completeness and consistency. The more advanced user, or the more adventurous one pursuing a difficult-to-search topic, should have access to more exotic paths, in exchange for which he must be prepared to accept slower response time, less-polished documentation, and more "false-drops" due to incomplete, inconsistent, or uncontrolled database content.

The advanced OPAC components could be viewed as the high-risk "venture capital" part of the catalog. Some features will find little acceptance. Those that are well used should be enhanced with improved formatting and "help" facilities to make them part of the base OPAC and accessible to a broader user group. Parallel systems, assuming substantial overlap in the resources for their implementation, once again involve incremental costs, but the increment is not likely to be small. So why should libraries support advanced systems for what is probably a minority of their users?

Returning again to the basic user *unfriendliness* of call number index searching, one might predict that alternative forms of database navigation, such as this classification-based approach, will only come into their own when a user can look at one good record and say, "Give me more of the same." In response the system would then perform parallel searches from various aspects of the record (author, subject headings, class numbers) and apply some heuristic measures to order the results for the user's review. The development of such heuristics will benefit from more knowledge of user-relevance judgements using various search strategies. Systems can measure "aboutness"—only users can decide "relevance" (the distinction is C. J. van Rijsbergen's).[8] At this point in time, the real benefit of new searching tools is not to the user but to the system designer. If libraries and their online systems are not to fall further into perceived (if not actual) obsolescence, it is critical that we take advantage

of the information available from day-to-day library usage for modeling user behavior and adopt a more experimental approach to OPAC design. Such an approach is consistent with the research agenda set out by the CLR conference.

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The Second Time Around: Preparing the RFP for a Second-Generation System in a Consortium Environment

Linda G. Predmore

The Spokane Cooperative Library Information System (SCOLIS) is a highly successful Northwest consortium of multitype libraries. Unlike some consortia, the network is fully cooperative in the services offered to patrons, regardless of library affiliation. The consortium, supported by an automated circulation system that reached its capacity in 1985, elected to embark on the arduous road toward procuring a new and greatly expanded integrated system using the Request for Proposal (RFP) process. The two-year planning process resulted in an RFP sent to vendors of library automation systems in winter 1987.

Automation in libraries is not new anymore. What is new is that automated systems are aging. Systems need to be replaced or upgraded into second-generation systems. Many libraries are deciding either to upgrade an existing computerized system or to replace it with a new system. This article demonstrates how the Spokane Cooperative Library Information System (SCOLIS), a local multitype library cooperative, decided in 1985 to replace its automated circulation system through the RFP process. The aims of the article are (1) to record the development of a unique cooperative entity, which is very successful, and (2) to describe the process used to assemble a second RFP. This experience may be useful to other libraries encountering a similar situation.

BACKGROUND

Spokane County lies in eastern Washington State, adjacent to the Idaho Panhandle. In its early history Spokane was a major railroad and agricultural center and the largest center of population between Seattle and Chicago. Spokane was not without cultural elements in those rough and tumble days. Public library service was established as early as 1891, and an institution of higher education was founded in 1882. Now the larger library community includes a county library district serving 1,700 square miles of unincorporated area, two community colleges, one college, two universities, and a variety of special and school libraries.

A feeling of isolation exists in this region. Spokane, the city, is 300 miles from the heavily populated western side of the state and boasts a population of 172,100, while the rest of the county adds another 182,200 (as of 1985). The next largest town in the county has a population of 7,610, and only

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two other towns in the county have populations of more than 2,000. People in eastern Washington have had to be independent and self-reliant yet willing to cooperate to get the most out of the resources available. Communities are proud of their histories and unique personalities.

Library services provide a special glimpse of the spirit of cooperation that moves many projects in the Spokane region, exemplified by the people who shaped SCOLIS. The library directors who administer the five SCOLIS libraries have been professional colleagues for many years. They are Michael J. Wirt (Spokane County Library District), Betty M. Bender (Spokane Public Library), Charles Baumann (Eastern Washington University Library), John Thompson (Spokane Falls Community College), and Verona Southern (Spokane Community College). Through a variety of professional activities they have developed a trust and respect for the talents and perspectives each brings to any activity. This trust allowed the growth and development of the joint policies, which, in turn, fostered cooperative procedures and activities. The strength of this spirit of cooperation is the source of the success of SCOLIS.

In the Spokane region there is a tendency to speak of SCOLIS as if it were a living entity. There is a sort of "HAL"-ish quality to the way librarians and library staff interact with the computer system that supports many library activities in this region. Indeed, SCOLIS is more than just a computer system.

SCOLIS has two distinct facets. The first consists of a series of cooperative arrangements and agreements among the five participating libraries. These arrangements and agreements are designed to facilitate the provision of library service to the constituencies of the individual libraries and to the patrons of the collected libraries. It was this kind of cooperation that encouraged the second facet, the joint automation of circulation activities, to become a reality.

The automation of circulation functions and the creation of centralized computer services were a natural outgrowth of cooperative activities already undertaken but would not have been so successful without them.

HISTORY OF SCOLIS

In 1978 the Spokane County Library District decided to automate its circulation functions. Joseph R. Matthews, then a consultant to the library community, was hired to assist the library district. He performed the necessary research and developed a Request for Proposal (RFP). As part of his research, Matthews collected information on two of the other future SCOLIS participants, Spokane Public Library and Eastern Washington University Library. This information was appended to the RFP as a "what if" scenario. For example, what would be the impact on data storage if Spokane Public Library's holdings were added?

Dataphase was the chosen vendor; however, contract negotiations were broken off as unresolvable after nine months. Universal Library Systems was invited to respond. By the time the decision to go with Universal was made, all of the other SCOLIS participants, which included Spokane Public Library, Eastern Washington University Library, and Washington Community College District 17, had decided to join, and the cooperative was born. The first library, Spokane County Library District's Valley Library, came online in 1980, and the last of the libraries came up in 1981, a date notable for two reasons: SCOLIS was the first multitype library network of its kind in the country, and Universal cut its teeth with this network.

GOVERNANCE OF SCOLIS

The original equipment was purchased by the Spokane County Library District for approximately $430,000. The other libraries paid for the portion of the hardware that was needed to support their participation in the network. They also contracted for other services from the library district. Although the library district owns and operates the system (with final decision-making authority resting with the district's board of trustees), governance of SCOLIS has been a matter of consensus among the participants. The director of the library district, Michael J. Wirt, as SCOLIS administrator, meets quarterly with the directors of the other libraries. This group, the Cooperative Users Council, advises

Wirt on matters of policy, financing, and services.

The SCOLIS manager coordinates the execution of these policy decisions. The manager meets monthly with representatives from the libraries. The SCOLIS coordinators' purpose is to translate policy into consistent working procedures, which often involves compromises between academic and public library local practices. The SCOLIS coordinators are generally heads of public services or technical services and, thus, are capable of making binding decisions for their individual libraries. Coordinators also work to resolve problems, frequently making policy recommendations to the Cooperative Users Council.

The SCOLIS manager also meets quarterly with another group representing each agency. These people, heads of cataloging departments, are known affectionately as the CHUMS, an acronym for *C*ataloging *H*eads *U*nited in the *M*aintenance of *S*tandards. The CHUMS are responsible for database integrity, data entry, format, and consistency.

OPERATION COST

Annual operating costs for SCOLIS are less than $250,000 for the entire network, making it an automated bargain for the five libraries.

The Spokane County Library District acts as fiscal agent for SCOLIS and bills agencies semiannually for their share of expenses. Each agency pays an equal share of such overhead expenses as salaries, benefits, utilities, rent, travel, etc. In addition each pays a proportional share based on its use of the system, the amount of circulation activity, and the size of its holdings. Calculated to a single percentage, these factors comprise a formula that distributes costs equitably. For example, the public libraries have very high circulation activity and sizable holdings, the university has large holdings but comparatively low circulation, and the community colleges have low activity and comparatively few holdings. In addition, each agency is billed for those direct costs, such as supplies and postage, it individually incurs. Each agency is responsible for its own data communications links to the CPU.

SERVICES TO PARTICIPANTS

SCOLIS provides a variety of services to each participant. The most obvious is the maintenance of the automated circulation system. The computer center staff consists of the manager, the system operations supervisor, and two half-time operators. Under problem conditions, a person from the library district's technical services department provides additional support. The staff are responsible for the security of the system, the proper operation of the equipment, interaction with hardware and software maintenance vendors, and troubleshooting support for end users, the library staff. Coverage is ninety hours over a seven-day week.

In addition, staff may consult on equipment purchases, make recommendations for more efficient use of the system, and research options for improving service. Staff run all reports, both scheduled and on demand, for each agency. Each day SCOLIS operators compile and print an average of 250 overdue notices for all agencies.

SERVICE TO PATRONS

Because of SCOLIS, Spokane area library users receive better, faster, and more convenient service. The patron is treated as a SCOLIS patron and may transact most types of library activities wherever it is most convenient for the patron. A single patron registration form and a single library card are used by the five participants. The card allows patrons to access collections in any facility. Patrons may request materials from any location and borrow from or return to any location. There is a uniform fee structure, and, with minor exceptions, patrons may pay fees at any location. Many uniform policies and procedures were already in place prior to automation, but SCOLIS spurred even more cooperation for the benefit of the patron.

TECHNICAL INFORMATION

The circulation system software, *ULISYS*, is provided and maintained by Universal Library Systems of West Vancouver, British Columbia. The software runs on a Digital Equipment Corporation

PDP11/70 with one megabyte of main memory. Disk storage was originally on three DEC RP06s, which were replaced in 1984 with two Control Data Corporation fixed disk drives with 842 megabytes of formatted memory. There are fifty-five terminals, mostly DEC VT100s and 220s, in sixteen locations. Non-DEC terminals have been added when replacements were needed. There are a variety of DEC and non-DEC printers attached as "slaves," and Intermec portables provide backup during system downtime.

The shared holdings consist of 560,000 bibliographic records, more than 1.1 million items records, and 220,000 patron records. Bibliographic records are added to the system directly and through tape load from both the Western Library Network (WLN) and the Online Computer Library Center (OCLC) bibliographic utilities. Bibliographic records are edited from the MARC record to an abbreviated, non-MARC form, a decision based on the high cost of data storage at the time and a perceived lack of need for the full MARC format. Circulation activity topped the 3 million mark in 1986, and increased circulation activity, after the initial percentage jumps, settled at a steady 4.8 percent to 5 percent per year. Bibliographic holdings are growing at a rate of 1.2 percent per year and item holdings, at 2.2 percent per year.

The system capacity was reached in 1985, when the load of terminals reached the maximum number that could be attached and the disk storage and file size had been increased to the maximum. Current computer literature suggests that the life span of a system should be five years. Although capacity may have been reached in 1985, its fifth year, the system was expected to operate for at least two more years to allow the agencies to reorganize, finance, and procure a new system.

The growth in holdings and activity needed to be controlled if SCOLIS was going to survive the two-year period. SCOLIS coordinators developed a series of contingency options that all five libraries agreed to exercise if needed. The options, only to be activated if SCOLIS began to experience serious deterioration from heavy use, included stockpiling bibliographic utility tapes, eliminating duplicate records, and slowing the input of new data into the system. Harsher measures included scheduling terminals for use and scheduling access to particular functions, such as inquiry. Maintaining SCOLIS through the two years of planning and procurement of the new system was a top priority supported by all five participants.

EXPANSION PLANS

In 1985 a Future Planning Committee convened to begin planning for a new system. This group, consisting of one or more representatives from each agency, conducted a needs assessment. The results were arranged by priority into needs that could be met by changing the existing system and needs that could only be met by a new, expanded system. Two studies were performed. One analyzed the existing system and the growth in system use, including projections for computer terminals, CPU main memory, and disk storage for a system that would support SCOLIS as a circulation system or with many enhancements and additional participants. The second study examined telecommunications, analyzed the existing network, and recommended changes to make the existing telephone-line-based network more efficient and cost-effective. Alternative technologies for data communications were explored to see which would be feasible for the greatly expanded network that would support the new system.

The expertise necessary to perform these studies did not exist in any of the SCOLIS libraries at the time, and none of the agencies had sufficient staff to allow the assignment of the research to any one individual. LSCA Title III grant monies were obtained to hire Joseph R. Matthews' and Associates and Stuart P. Browne and Associates to perform respective studies in winter 1985–86. Findings were conclusive; while minor improvements could be made to the existing system, SCOLIS had "maxed out" and needed to be replaced as soon as possible.

The activities of 1986 were significant. Unlike the first installation, the library district could not pay for the entire new system. In addition, the other participants de-

sired a stronger voice in the governance of the network, particularly if they were going to be purchasing a share of the proposed system. To this end, Wirt began to investigate the possibilities and ramifications of a consortium agreement. Such an agreement would create a board of directors, consisting of the directors of the five libraries. The consortium would purchase the new system and contract with the library district for the operation of the system. Washington law allows for the formation of Interlocal Cooperation Agreements among public agencies. A draft document was written, edited, and studied by the legal counsels for each agency. This agreement had to be in place before the new system was procured in 1988.

Dealing with the financing of the new system was a complicated matter. Both Matthews' and Browne's studies indicated the new system would cost between $500,000 and more than $1 million dollars, depending on a variety of factors. Each agency, as before, would be expected to pay for the portion of the system that supports its participation plus a share of the central site expenses. The community colleges and the university are on biennial budgeting cycles, while the public library and the library district are on annual budget cycles. In addition, there are varying degrees of flexibility for agencies to set aside monies to pay for such future capital expenditures as the new computer system. Each agency had to begin the process that would ensure its share of the SCOLIS purchase price.

External circumstances affected how soon SCOLIS could be replaced. The most important was the economy, which in Washington State had stagnated, affecting tax revenues at all levels. Two of the SCOLIS agencies receive substantial portions of their revenues from taxes. The loss of federal revenue sharing affected the public library. The state legislature, which allocates the budgets of the community colleges and the university, severely cut allocations to higher-education institutions.

Necessarily, the position of the SCOLIS manager, which previously had been a half-time position, was increased to full-time in 1987. The SCOLIS manager began preparing the Request for Proposal (RFP), which would initiate the procurement of what was now being called SCOLIS II.

THE REQUEST FOR PROPOSAL

Why did SCOLIS decide to embark on the RFP path of procurement, since by any measure this is an expensive process? The hardware had been reliable, with an average availability of 98 percent for all the years of use. The software had also been reliable and performed to expectation, and response times remained acceptable in circulation functions. Although response times in inquiry functions became increasingly long, this was not unacceptable because response times had always been longer than users wanted. There were some client/vendor difficulties from time to time with software maintenance; but, presumably, this situation was not any more significant than it would have been with any other vendor.

By the end of the research and study of needs, SCOLIS II was envisioned as a different creature from SCOLIS I. Users were looking for much more flexibility, capability, and growth capacity than could be provided from a simple upgrade. A building-block image can be used to illustrate: the basic block is the circulation system, and additional functions, other modules, and new participants are units to be placed on top as funding and interest support additions. The same metaphor can be used for the hardware.

There were two main advantages for SCOLIS to pursue the RFP. First, the definition of specific needs was converted into detailed written form, and the agencies had to reexamine their cooperative procedures and policies. This allowed creative vision to define the provision of library services rather than an accommodation dictated by the current system. Also, the planners were able to pursue new areas of cooperation not previously conceived of or thought possible and to take advantage of technological innovations. Second, the RFP document would become part of the contract with the successful vendor and would figure prominently in contract negotiations.

Writing the RFP began by collecting examples of RFP's written for larger systems

within the last five years. Libraries generously shared their documents with the SCOLIS manager. After reading the RFPs, the manager segregated and compared sections that dealt with functional capabilities. The SCOLIS manager drafted sections designed to meet perceived needs in a particular function. For example, sections concerning checkout were submitted to the SCOLIS coordinators. The group commented, edited, changed, or deleted until the section clearly stated SCOLIS' expectations of the checkout function. The manager rewrote the section and returned it to the coordinators. Typically, a section went through two to four revisions before acceptance. The calculated cost of the final version was approximately $101 per page for the 275-page document.

The SCOLIS coordinators met for four hours every two weeks for six months to finish the sections on functional capabilities. The CHUMS were involved in the same fashion but dealt only with data entry, authority control, and conversion. The SCOLIS manager detailed the technical specifications and the instructions to vendors. In June 1987 the final draft was finished.

The Cooperative Users Council had decided to seek the editorial advice and help of an expert to read the RFP in its final form. For this purpose, SCOLIS secured the services of Robert A. Walton and Associates. Revisions were completed by the SCOLIS manager during summer 1987. The final document was printed and released to vendors in September 1987, and vendor proposals were due back to SCOLIS by December 1, 1987.

WHAT WAS LEARNED IN THE PROCESS

It cannot be reiterated too many times that planning must begin early. One should begin planning for the next system as soon as the first system is installed, but, in reality, most libraries do not have the luxury of staying in the planning mode all the time. With a major expenditure of money for automation, most libraries have difficulty dealing with the financing of another system immediately. Another reality is that people get "burned out" experiencing a system installation and do not have the interest or energy to begin all over again. Users simply want to use the system for awhile. However, it is important not to wait until the existing system is at capacity before the planning efforts begin. Not that the planning and implementation of a new system take so long (although it always takes longer than one thinks), but the first system, in this case SCOLIS I, may not be able to function until the next system, SCOLIS II, is installed.

A SCOLIS staff member has likened the system to a Nash automobile (the hardware and software) pulling a trailer (the holdings) on a road that is steadily inclining (the increasing demand). The trailer gets heavier, the road steeper, and the Nash older and harder to repair when it breaks down. Planning the purchase of the next automobile is best done before the car begins the incline.

Writing an RFP takes fantasy and wishful thinking and translates them into realistic language. While the first system may have handled circulation functions well, users want the new system to do all the old "stuff" and be able to make coffee too, preferably espresso. Planners need to be aware that asking for exotic capabilities in the system, particularly if it is indicated in the RFP that this is a mandatory ability, is going to paint a vendor into a corner. Vendors will not submit proposals, thus possibly removing otherwise viable candidates from consideration because their systems cannot make coffee. Or more likely, vendors will promise the requirement and raise the price of their systems, letting the requestor pay the development costs. Vendors with little expertise in a particular area will probably recommend the safest method to meet the need, even if that is the most expensive method. This point was made to SCOLIS planners by Walton when the SCOLIS RFP asked vendors to configure telecommunications using packet radio. Telecommunications are usually not the strong suit of a library automation vendor, particularly in technology other than telephone data lines. Since the library will be dealing directly with telecommunications vendors after installation, it is better to leave telecommunications out of the RFP, except as an information item.

While functional abilities for each system have unique and special attributes, much in an RFP can be dealt with from a boilerplate. Walton and his associate Frank Bridge provided contract language, performance testing, and other sections that were modified to meet SCOLIS' needs. At this point in library automation activities, there is no advantage for libraries to rediscover the wheel. This was the reason that other libraries were contacted for copies of their RFPs before writing the SCOLIS document. While there are indeed differences in requirements and situations, there are also similarities. There are many excellent examples of RFPs available, and the libraries contacted were more than willing to provide copies of the RFP and expert staff time to answer questions and give opinions.

Writing by committee had distinct advantages. Expertise among the SCOLIS coordinators came from both public and technical services. Each perspective was used on every requirement so that both the cataloger and the reference librarian were accommodated. As a multitype library consortium, both public and academic library needs were addressed. The strength of SCOLIS lies in the melding of these needs to the patron's advantage. An obvious disadvantage of writing by committee is that it takes longer to disseminate materials and to achieve the necessary compromises. SCOLIS planners, however, are convinced that the document is a better one because of this method. The document reaffirms the spirit of cooperation among the libraries.

Finally, and humbling as it may be, even with the best intentions and the writing and rewriting, the final document will be flawed. There are many opportunities to correct errors and omissions through the process, up to signing the contract. Critical thinking and appraisal do not end with mailing the RFP to vendors. Documenting all aspects of the project may be time-consuming, but it saves time in the long run.

SCOLIS II

SCOLIS II, as described in the RFP, is an integrated library system whose strength continues to lie in the circulation functions. The initial installation will expand the terminal load from 55 to approximately 140 for staff use over the seven-year life span of the system. Holdings records will be converted from the existing abbreviated MARC records to a full USMARC record with greatly expanded indexes for searching. The CHUMS recommended that the full MARC record be used in SCOLIS II, based on the declining costs of data storage, the need for greater access, and the increasing possibilities of data exchange using MARC standards. Using the building-block approach, the online public access catalog is expected to be implemented incrementally, potentially pushing the terminal load in excess of 300 terminals. Dial-in access for the public will also be available. SCOLIS libraries are considering the use of CD-ROM for public access catalogs. Other building blocks include acquisitions, booking, and periodicals control.

One of the most interesting possibilities for the growth of SCOLIS, however, lies in the new set of "what if" scenarios in the RFP. Two colleges, a K-12 public school district, another county library district to the north of Spokane County, and a consortium of libraries in Idaho asked to be included in the RFP for the purpose of assessing their individual and combined impacts on the new SCOLIS II system. The addition of these libraries could push the network to more than 400 terminals. It is apparent that SCOLIS has been extremely successful in its mission.

The rest of this story will be written at a later date. The RFP was in the hands of the vendors. SCOLIS personnel eagerly awaited vendors' proposals, which were due in December 1987. SCOLIS II generates real excitement in the libraries. Most of the staff have been through the painful experience of a first automation project and understand too well what lies ahead. They also are outspoken in their support and enthusiasm for the benefits from those efforts, knowing full well that SCOLIS II won't be perfect either. But then, there is always SCOLIS III . . . ■■

Communications

Reserve Departments and Automation: A Survey of ARL Libraries

Suzanne D. Gyeszly

This article describes the current status of the reserve departments of the ARL libraries in the United States based on responses to questionnaires sent to the directors of such libraries. The survey was conducted in late fall 1987, and seventy-eight institutions participated. The percentage of ARL libraries with reserve departments and number and type of staff are reported. The article also lists automated systems used to assist reserve departments and describes the extent to which automation has been applied in such departments at ARL libraries serving small, medium, and large student populations.

Reserve systems have existed in libraries since the late 1800s. They provide specific access to a limited number of materials. The time period for circulation of reserve materials to patrons is usually limited to from two hours to three days. Almost every academic library has a reserve collection of books, photocopied articles, chapters, and other important items such as software, records, and tapes.

Reserve is a labor-intensive activity involving several people who process and circulate the materials. Reserve departments are open late at night, especially near exam times. Automation is not widely available for reserve functions yet, and few studies describe the automated reserve system. James Self's study explains the reserve processing system at Clemons Library at the University of Virginia.[1] Other research, conducted by David Buxton, analyzed the same institution's reserve system.[2]

This article describes the current status of the reserve departments of the ARL libraries based on responses to questionnaires sent to the directors of such libraries (see appendix A). ARL libraries with reserve departments, and the number and type of staff, are listed, as are the automated systems used and the extent to which automation has been applied at ARL libraries serving small, medium, and large student populations.

METHODOLOGY

The questionnaire, developed by C. Colleen Cook (former head of circulation at Evans Library, Texas A&M University, College Station), was pretested at six libraries, then sent to the ninety-four ARL libraries in the United States. Designed to be as simple as possible, the survey asked for statistical data but also provided the opportunity for additional comments.

The questionnaire had three main components: (1) general university and library-related information and statistics, (2) reserve departments, and (3) automation.

The questionnaire and a cover letter were sent to the directors of ARL libraries during fall 1987. They were asked to forward the survey to the librarians or supervisors responsible for overseeing the reserve departments.

Lotus 1-2-3 software was used for processing the data. The materials were sorted in alphabetical order by the responding institutions, and each question was separately analyzed. Figures and tables were prepared accordingly. William Thomas (assistant professor in the Department of Statistics at Texas A&M University) was

Suzanne D. Gyeszly was formerly Acting Head, Circulation Division, and is presently Resource Development Librarian, Social Sciences and Preservation, Sterling C. Evans Library, Texas A&M University, College Station.

consulted regarding the use of the Statistical Analysis System (SAS) program.

GENERAL UNIVERSITY AND LIBRARY-RELATED INFORMATION AND STATISTICS

The response to the survey was gratifying. Of the ninety-four ARL libraries to which the questionnaires were sent, eighty libraries returned them. Two libraries indicated that due to library or university regulations they were unable to respond to the questionnaire. The response rate was 82.9 percent (seventy-eight of ninety-four).

The first four questions were devised to find out general statistical information about the university and library. Interestingly, seventy-four of the respondents (94.6 percent) indicated that their library has a branch, or several branch libraries, with numbers varying from one to twenty-six per campus. The number of branches reflect on the number of reserve departments and their staffing, which will be further investigated in this article. The four remaining respondents (5.4 percent) did not have branch libraries.

Tables 1 and 2 indicate the enrollments and the number of teaching faculty of the participating universities. Six (7.6 percent) of the institutions have enrollments of more than 40,000 students, and thirty-five (44.9 percent) of the participating universities have from 20,001 to 40,000 students. The majority of the institutions, thirty-seven (47.5 percent), have less than 20,000 students. However, campuses with the largest enrollments did not always have the highest number of faculty. The ratio of faculty to students (see figure 1) indicates that the smaller campuses have a proportionately higher number of faculty. Privately funded universities have an average ratio of one to ten, much lower than the public institutions, where several had ratios of one to forty. The highest faculty to student ratio was one to fifty-eight, and the lowest was one to four.

RESERVE DEPARTMENTS

The most positive response came in answer to the question regarding the availability of the reserve departments. All the participating institutions—seventy-eight (100 percent)—have reserve departments. Reserve departments do indeed have an important role in research libraries. Branches as well as main libraries have reserve departments. Sometimes the same reserve readings are available for the students at two locations on a given campus.

The next three questions were devised to determine whether the reserve collections are kept in an open- or closed-stack arrangement, how the readings were arranged, and who are the primary users of the collections. Fifty-two (67.9 percent) of the participating libraries have a closed-

Table 1. Student Enrollment of ARL Libraries

No. of Students (Thousands)	Participating Libraries	Percent of Respondents
0–20,000	37	47.5
20,001–40,000	35	44.9
40,000+	6	7.6
Total	78	100.0

Table 2. Number of Faculty of ARL Libraries

No. of Faculty	Participating Libraries	Percent of Respondents
0–500	8	10.3
501–1,000	16	20.6
1,001–1,500	21	26.8
1,501–2,000	16	20.6
2,001+	17	21.7
Total	78	100.0

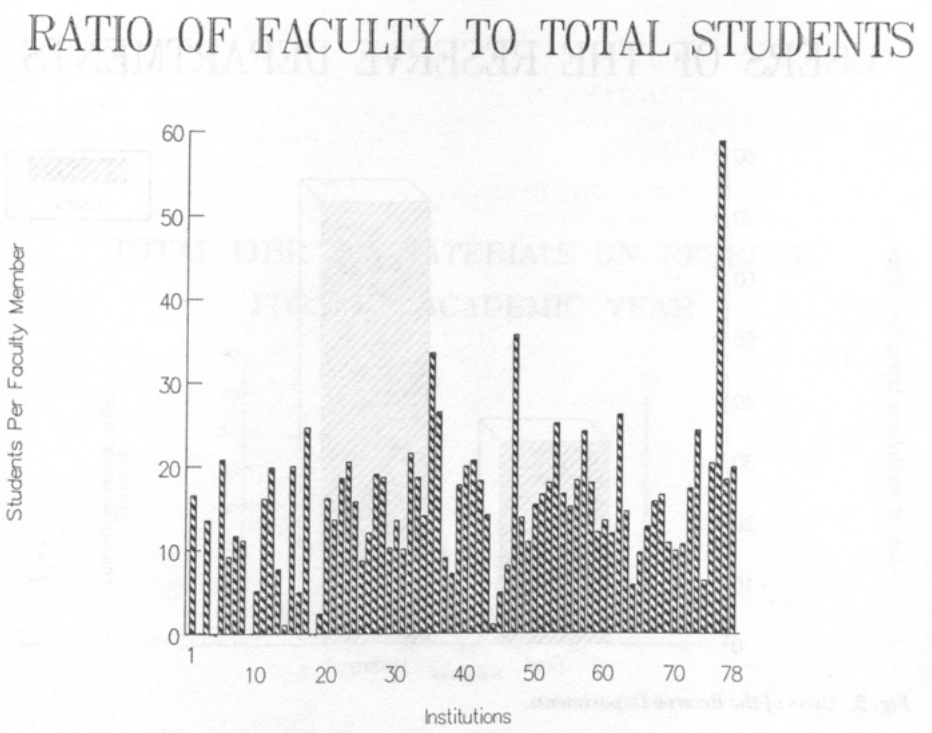

Fig. 1. Ratio of Faculty to Total Students.

stack system. In most of these libraries the reserve lists are available to students, with corresponding call numbers or access numbers, and the reserve department staff retrieve the materials for the patrons. Only three libraries (3.9 percent) indicated open status for the reserve departments. However, twenty-two (28.2 percent) of the respondent libraries had a combination of both open and closed stacks. Usually the majority of items are on closed reserve and kept behind the desk and retrieved for the users by library staff. In some libraries, the open reserves are adjacent to the circulation desk on open shelving, retrieved by the patron, and brought to the desk to be checked out.

Most of the library-owned materials were arranged by call or course number. The majority of the personal materials, however, were filed under the professor's name.

Primary users of the reserve departments are undergraduate students in all disciplines (see figure 2). However, graduate students in humanities, social sciences, and business are also heavy users of the reserve departments.

RESERVE MATERIALS

Several hundred courses were taught during the academic year of 1986/1987 (fall, winter, spring, and summer semesters/quarters). The total number of courses with materials placed on reserve varies among the ARL libraries (see table 3). Six institutions (7.7 percent) reported requests for materials to be placed on reserve for more than 1,500 courses, while seventeen libraries (21.8 percent) had less than 500 courses per institution with materials on reserve. As can be seen in table 3, the majority of libraries—forty-two (53.8 percent)— are processing materials for between 501 and 1,000 courses per year for the reserve departments. Most of the courses are taught during the fall and winter semesters/quarters. Each course list in-

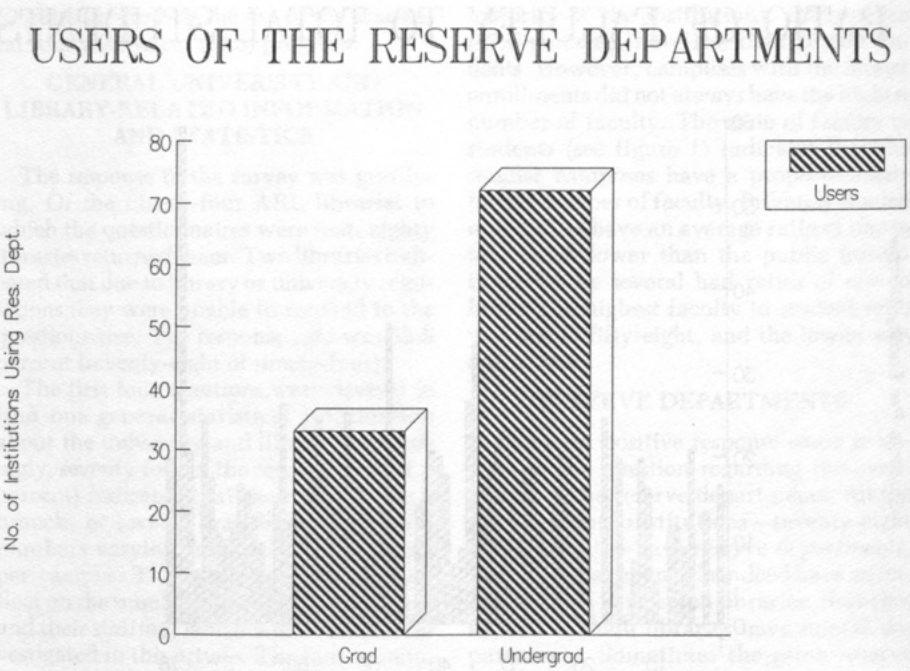

Fig. 2. Users of the Reserve Departments.

Table 3. Institution Size versus Number of Courses

No. of Courses	Institution	Percent of Respondents	Student Enrollment	Institutions	Percent of Respondents
0–500	17	21.80	0–20,000	37	47.5
501–1,000	42	53.80	20,001–40,000	36	46.1
1,001–1,500	13	16.70	40,001+	5	6.4
1,501+	6	7.70			
Total	78	100.00		78	100.0

volves several titles and pieces to be processed before the first day of class. The reserve materials are library owned or the personal property of the teaching faculty. Figure 3 indicates the variety of responses and shows that an institution is likely to have an almost equal number of library-owned and personal material on reserve.

STAFFING THE RESERVE DEPARTMENT

To process the reserve materials at the beginning of each semester/quarter, the reserve departments must have a sufficient number of staff available. The participant institutions were asked to specify how many staff members process the reserve materials, including such activities as preparing the materials for the users and providing public access. The participants were asked to specify the number of full-time equivalent (FTE) professionals, paraprofessionals, and clerical and student assistants involved in the reserve reading activities.

The answers to the question about the staffing patterns of the reserve departments brought diverse information. Few profes-

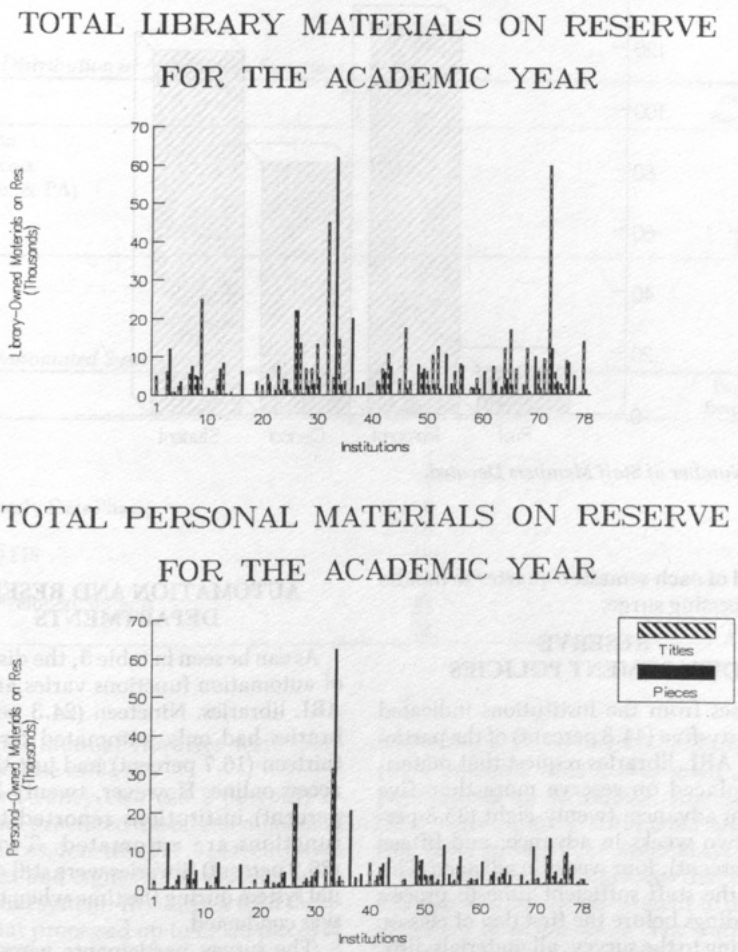

Fig. 3. Total Library and Personal Materials on Reserve.

sionals work in the reserve departments (see figure 4). Among them, 15.65 FTE professionals work in supervisory positions in all participating ARL libraries. Their jobs relate to circulation as well as reserve functions. The majority of the reserve department staff of the respondent ARL institutions are paraprofessionals (127.95 FTE) and clerical (85.35 FTE) and students employees (118.5 FTE). (The total number of FTE student time is calculated for just one week only!) Libraries with multiple branches have at least one 0.5 FTE paraprofessional employee or one FTE clerk. Several respondents indicated that additional help is needed at the beginning

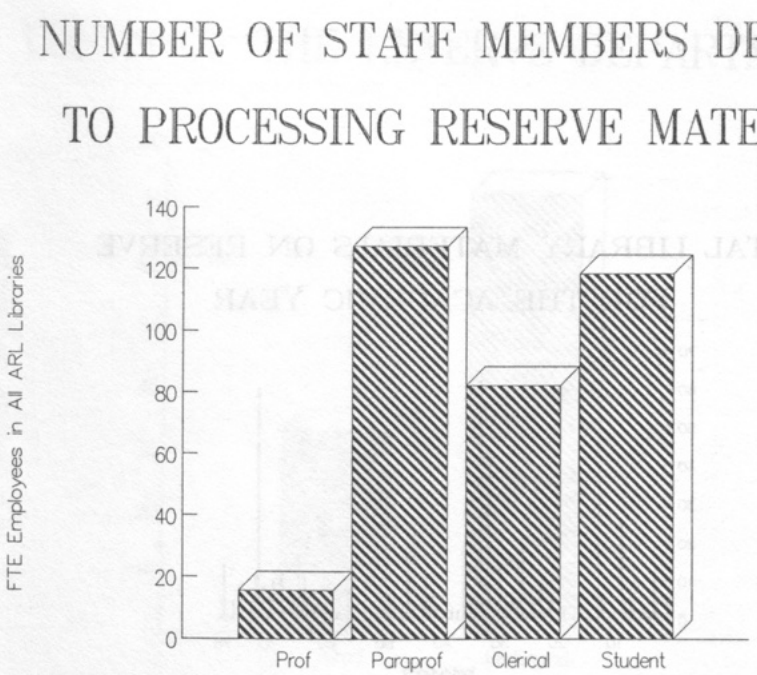

Fig. 4. Number of Staff Members Devoted.

and end of each semester/quarter to handle the processing surge.

RESERVE DEPARTMENT POLICIES

Responses from the institutions indicated that thirty-five (44.8 percent) of the participating ARL libraries request that materials be placed on reserve more than five weeks in advance; twenty-eight (35.8 percent), two weeks in advance; and fifteen (19.2 percent), four weeks in advance. This allows the staff sufficient time to process the readings before the first day of classes. According to the survey, all materials, lists, or requests submitted to the reserve departments before the requested deadline were processed before the first day of classes. However, all seventy-eight respondents indicated that a majority of the professors submit the reserve list or their personal materials after the first day of classes. All lists and materials received after the deadline are processed in the order in which they are received at the reserve departments.

AUTOMATION AND RESERVE DEPARTMENTS

As can be seen in table 5, the distribution of automation functions varies among the ARL libraries. Nineteen (24.3 percent) libraries had only automated circulation; thirteen (16.7 percent) had just the public access online. However, twenty-five (32.1 percent) institutions reported that both functions are automated. Twenty-one (26.9 percent) libraries were still on a manual system during the time when the survey was conducted.

The survey participants were asked to name their automated system (see table 6).

FINDINGS AND CONCLUSIONS

To assess the effect of automation, the relation between the total pieces processed and the number of reserve departments' staff who worked with automation and without automation were observed (see table 7). Student enrollment and the auto-

Table 4. Notices for Placing Materials on Reserve

Time	Participating Libraries	No. of Respondents
Two weeks	28	35.8
Four weeks	15	19.3
More	35	44.9
Total	78	100.0

Table 5. Distribution of Automation Functions

Functions	Participating Libraries	Percent of Respondents
Circulation	19	24.3
Public Access	13	16.7
Both (Circ. & PA)	25	32.1
None	21	26.9
Total	78	100.0

Table 6. Automated Systems

Name	Participating Libraries	Percent of Respondents
CARL	2	2.6
CLSI	7	8.9
GEAC	7	8.9
LS/2 (formerly DataPhase)	6	7.7
NOTIS	6	7.7
Future NOTIS	10	12.9
None	21	26.9
Locally Developed Systems	19	24.4
Total	78	100.0

mated and manual libraries were compared also (see table 8).

Of the twenty-two (28.2 percent) libraries that processed the largest number of reserve pieces, fourteen (17.9 percent) were automated and eight (10.25 percent) were on a manual system. In contrast with the libraries that processed up to 2,000 pieces of reserve reading during the year, nine (11.5 percent) were automated and seven (8.9 percent) were on a manual system (see table 7). There was no significant difference between the number of pieces handled by the staff of the reserve departments with or without automation. The staff size did not decrease with automation.

The six (7.7 percent) ARL libraries with the largest student enrollment (more than 40,000 students) had automated systems (see table 8). However, of the thirty-seven (47.4 percent) institutions with student populations up to 20,000, just eighteen (23.1 percent) were automated and nineteen (24.4 percent) had manual systems.

It is important to remember that this was a survey and not an experiment to discover the effect of automation. The author did not compare the same reserve system before and after automation. Most of the libraries that handled the largest number of pieces were automated and also had several branches, requiring a larger staff. The effect of automation on the productivity of staff members was not addressed in the survey. A further survey will be needed to study the questions of the effect of automation on staff size and staff productivity of the reserve departments.

Table 7. Pieces, FTE Employees, and Automated and Manual Systems

No. of Pieces	Participating Institutions	Automated FTE Staff 1–3	Automated FTE Staff 3–5	Manual FTE Staff 1–3	Manual FTE Staff 3–5	Planning Automation
0 – 2,000	16	8	1	7	0	1
2,001 – 4,000	4	3	0	1	0	0
4,001 – 6,000	9	4	1	2	2	1
6,001 – 8,000	16	10	0	5	1	2
8,001 –10,000	3	2	0	0	1	0
10,001–12,000	8	4	0	4	0	2
12,001+	22	9	5	4	4	4
Total	78	40	7	23	8	10

Table 8. Student Enrollment versus Automated and Manual Systems

No. of Students (Thousands)	Participating Libraries	Automated	Percent of Respondents	Manual	Percent of Respondents	Planning Automation
0–20,000	37	18	23.1	19	24.4	6
20,001–40,000	35	23	29.5	12	15.4	4
40,001+	6	6	7.7	0	0.0	0
Total	78	47	60.3	31	39.7	10

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2. David T. Buxton, "The Clemons Library Reserve Circulation System: A Model for Distributed Processing in Library Networks," *Information Technology and Libraries* 3:178–82 (June 1984).
3. Larry Hardesty, "Use of the Library Reserve Collection at DePauw University," (ERIC Document Reproduction Service, ED 192 734, July 1980).
4. James Self, "Reserve Readings and Student Grades: An Analysis of a Case Study," *Library Information Science Research* 9:29–40 (Jan./Mar. 1987).
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APPENDIX A. RESERVE DEPARTMENT SURVEY OF ARL LIBRARIES

1. Demographic Information:
   University: _____ Respondent: _____
   (name and phone)
   Main Library: _____
   (name)
   Number of Branches: _____
   Undergraduate Library: _____
   (name)
2. Enrollment: Graduate: _____
   Undergraduate: _____
3. Number of Faculty: _____
4. Do you have reserve department(s) in your libraries? _____
   In which library(ies)? _____

Please answer the following questions for your largest reserve operation.

Reserve Department in _____ Library

5. Who are the primary users of the reserve department (e.g., science and engineering undergraduates)?

_____

6. Is the reserve collection in an open- or closed-stack arrangement? Please describe.

7. How are library materials arranged on the shelves (e.g., call number order, courses, etc.)?

8. How are personal (non-library-owned) materials arranged on the shelves (e.g., accession number, course, call number, etc.)?

9. What is the average number of courses on reserve for the
   fall semester?
   spring semester?
   summer semester(s)?
   quarter?

10. What is the average number of library-owned materials on reserve for the

	titles	pieces
fall semester?		
spring semester?		
summer semester(s)?		
quarter?		

11. What is the average number of personal (non-library-owned) materials on reserve for the

	titles	pieces
fall semester?		
spring semester?		
summer semester(s)?		
quarter?		

12. How many staff members are devoted to processing reserve material (i.e., preparing materials for the shelf, providing public access to the materials through a card or automated catalog, etc.)?
    _____ FTE professional(s)
    _____ FTE paraprofessional(s) (e.g., library assistant)
    _____ FTE clerical staff
    _____ number of student assistant hours per week

13. How many staff members are devoted to other department duties, including circulation (check in/out), opening, closing, etc.?
    _____ FTE professional(s)
    _____ FTE paraprofessional(s) (e.g., library assistant)
    _____ FTE clerical staff
    _____ number of student assistant hours per week

14. Is your department automated?
    _____ public access
    _____ circulation

15. Please name your automated system.

16. What deadlines do you give faculty for placing materials on reserve each semester (e.g., two weeks before the first day of classes, etc.)?

17. How do you handle requests to place materials on reserve after the deadline?

18. Do you make photocopies of reserve readings? If so, what guidelines do you follow? Do you charge professors for the copies?

19. Do you have reserve materials fully processed by the first day of classes? _____ If not, on an average, how many weeks have lapsed before you have reserve material fully processed?

Comments:

Please return to Suzanne D. Gyeszly, Acting Head, Circulation Division, Sterling C. Evans Library, Texas A&M University, College Station, TX 77843. Prepared by C. Colleen Cook and Suzanne D. Gyeszly.

Twenty Years Ago in JOLA

The consensus of considered opinions of participants as to what an information transfer system at MIT might be like in 1975 served as a point of departure in planning experiments. It was agreed that a confluence of three streams of progress in the information transfer field will yield the framework of such a system: 1) library data processing techniques, 2) development of a national network of information centers, and 3) extension of on-line, interactive computer communities.

Review by Peter Stangl of *INTREX: Report of a Planning Conference on Information Transfer Experiments*, *JOLA* 1, no.4:274 (Dec. 1968).
Contributed by Michael Gorman.

Macintosh-based Keyword Access to IEEE Serial Publications

Elena Romaniuk

The creation of a "keywords versus author list" and "keywords versus title list" to access IEEE serial titles using a Macintosh Plus and Microsoft Works *software is described. It is shown that this approach provides a fast, inexpensive, and simple alternative for providing tools that aid the search for bibliographically complex materials.*

In 1983 the Department of Electrical Engineering within the newly created Faculty of Engineering was established at the University of Victoria (UVic). As a result, the University of Victoria Library started to acquire, in addition to other types of relevant engineering publications, all serials, including conference proceedings published by the Institute of Electrical and Electronics Engineers (IEEE). IEEE is the world's largest publisher in electrical/electronics/computer science and engineering, producing about 20 percent of the world's literature in these fields.[1] Serials published by IEEE include more than 50 periodicals and 100 conference proceedings per year. The IEEE serials collection in the University of Victoria Library currently consists of approximately 150 bibliographic records for periodicals and approximately 370 bibliographic records for conference proceedings. Given the bibliographically complex nature of IEEE serial publications and the fact that no subject access to the UVic serials collection currently exists, IEEE titles can be difficult to find. This article describes the creation of a "keywords versus author list" and a "keywords versus title list" to access IEEE serial publications using a microcomputer and inexpensive, commercially available software. Even though it is possible to program the existing UVic serials file to produce a variety of keyword listings, no significant amount of programming money has been available for a number of years, either to upgrade the existing file or to have additional tools produced from it. The microcomputer-based keyword approach provides a fast, inexpensive, and simple tool for finding bibliographically complex materials.

Elena Romaniuk is Serials Librarian, University of Victoria Library, Victoria, British Columbia, Canada.

EQUIPMENT

The equipment used consisted of a Macintosh Plus, a DataFrame XP Twenty hard disk drive with 20 MB of memory, and the Apple LaserWriter Plus printer. *Microsoft Works*, the software used to create and manipulate the database and to produce the keyword lists, was chosen because it is not only relatively inexpensive but has also been highly rated for ease of use and flexibility. *Microsoft Works* is a program containing four tools: a word processor with drawing and mail merge features, a database with reporting features, a spreadsheet with charting capabilities, as well as communications software. For this particular project the word processor and the database tools were used.

METHODOLOGY

The relevant bibliographic records in the University of Victoria serials file were identified as those that have the Institute of Electrical and Electronics Engineers coded as part of the main entry, publisher, or sponsoring body fields. A printout of approximately 500 of these records was generated from the serials file. Each IEEE record was manually scrutinized, and keywords were identified and highlighted within the body of the bibliographic record for input into the microcomputer database. To provide more access points, additional keywords were extracted from within the phrases already used. Keywords were also added if they were implied in initials. IEEE uses a similar approach in providing subject access to the publications listed in its catalogs and in the *Index to IEEE Publications*. A thesaurus was not used to control the vocabulary.

The framework of the database was cre-

ated using *Microsoft Works*. This was a very easy and straightforward task. Although *Microsoft Works* does have specific size limitations for record and field lengths, such as a maximum of 60 fields per record, 248 characters per field, and 64 characters per field name, these were not a problem; and the entire file (approximately 600 records or 100 K) can be easily stored on a floppy disk. The database was designed with seven fields per record: new, keywords, author, title, call number, date, and comments. The *new* field is used to indicate new records added to the database since the last printing, and the *date* field is used to keep track of when each record is updated. The program contains a convenient built-in feature for entering the date. The *comments* field is used to add other relevant information. The fields are arranged in the order given but can be changed quickly and easily, and new fields can also be added or deleted at any time. The records can be displayed one at a time or as a list. Record contents can be updated in either display format, and new records can be added anywhere in the sequence. The database can be searched in a variety of ways and also allows Boolean searching. The records can be sorted on any field, and although sorting by call number does not produce perfect results due to the established practice of assigning the Cutter numbers, the approximation can be useful.

To print the keyword lists from the database, the fields were first sorted alphabetically by keywords. Report specifications were then defined by

- size of the margins, the contents, and specifications for the headers or footers, including page numbers
- page size and page orientation chosen for printing, as well as a possible overall reduction of print
- size and order of the fields to appear in the report, easily adjustable directly on the screen
- selection rules used to print all or only a portion of the file

Two reports were defined to print the keyword lists. The "keywords versus author list" (see figure 1) was produced to facilitate easy identification of author/main entry records, mainly to be used by technical services staff. This report is an alphabetical listing, in columns, of keywords with the corresponding main entry and call number printed alongside. The second report, the "keywords versus title list" (see figure 2), was produced to facilitate easy identification of the exact title. In this list the title of the publication is displayed along with the keywords and the call number. Each keyword-title-call-number string is displayed as one line, so very long phrases are truncated when letter-size paper is used for printing. The truncation does not significantly affect the clarity of the information provided, as enough information is provided to allow one to determine whether a given publication is the one required. To prevent truncation, the laser printer can be used with legal-size paper, or one can use an Imagewriter II printer and specify a custom size of paper. Another way to prevent truncation and display all of the information would be to merge the records into a word processing document and print each record in a "label" format. One can print the reports with page numbers, date, and other information specified in the footer.

The word processing function of *Microsoft Works* is used to print a title page for each list, including a brief explanation of the way each list should be used.

The keyword lists are updated on a continuing basis and printed approximately every other month. Each new printing completely supersedes the previous one. The lists are distributed to various divisions within the library, such as interlibrary loan and reference, and are also available for public use in the periodicals reading room, which houses the current issues of most periodicals. The lists are sent to the Department of Electrical and Computer Engineering and to the Department of Computer Science where they are kept in the departmental reading rooms available for consultation by faculty, staff, and students.

DISCUSSION

Several papers have been written dealing with the advantages and disadvantages of cataloging IEEE publications as serials and monographs.[2] At the University of Victoria Library, the majority of IEEE conference

KEYWORDS	AUTHOR	CALL NO
MELECON	MEDITERRANEAN ELECTROTECHNICAL CONFERENCE	TK5/M4
MEMBERSHIP DIRECTORY	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS	TK139/I5
MICRO	MICROPROGRAMMING WORKSHOP	QA76.6/W692
MICRO-DELCON	MICRO-DELCON	QA76.5/M5
MICROELECTRONICS	UNIVERSITY/GOVERNMENT/INDUSTRY MICROELECTRONICS SYMPOSIUM	TK7874/U5
MICROELECTRONICS	UNIVERSITY/GOVERNMENT/INDUSTRY MICROELECTRONICS SYMPOSIUM	TK7874/U5
MICROPROCESSOR FORUM	IEEE MICROPROCESSOR FORUM	TK7895/M5I15
MICROPROCESSORS	WORKSHOP ON AUTOMOTIVE APPLICATIONS OF MICROPROCESSORS	TL272.5/W6
MICROPROGRAMMING	MICROPROGRAMMING WORKSHOP	QA76.6/W692
MICROPROGRAMMING	MICROPROGRAMMING WORKSHOP	QA76.6/W692
MICROPROGRAMMING	WORKSHOP ON MICROPROGRAMMING	QA76.6/W692
MICROWAVE	IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM	TK7876/I14
MICROWAVE AND MILLIMETER-WAVE MONOLITHIC CIRCUITS	IEEE MICROWAVE AND MILLIMETER-WAVE MONOLITHIC CIRCUITS	TK7876/I16
MILITARY COMMUNICATIONS	IEEE MILITARY COMMUNICATIONS CONFERENCE	UA940/I14
MILLIMETER WAVES	INTERNATIONAL CONFERENCE ON INFRARED AND MILLIMETER WAVES	TA1750/I58
MINING INDUSTRY	MINING INDUSTRY TECHNICAL CONFERENCE	TN343/M5
MINING INDUSTRY ELECTROTECHNOLOGY	WESTERN MINING INDUSTRY ELECTROTECHNOLOGY CONFERENCE	TN343/W4
MONOLITHIC CIRCUITS	IEEE MICROWAVE AND MILLIMETER-WAVE MONOLITHIC CIRCUITS	TK7876/I16
MULTIPLE-VALUED LOGIC	INTERNATIONAL SYMPOSIUM ON MULTIPLE-VALUED LOGIC	QA9.45/I57
NAECON	IEEE NATIONAL AEROSPACE AND ELECTRONICS CONFERENCE	TL505/I17
NASECODE	NASECODE CONFERENCE	TK7871.85/N27
NAVIGATION	IEEE POSITION LOCATION AND NAVIGATION SYMPOSIUM	TL695/I18
NETWORK PLANNING	INTERNATIONAL NETWORK PLANNING SYMPOSIUM	TK5105.5/I47
NETWORKING	COMPUTER NETWORKING SYMPOSIUM	TK5105.5/C6323
NEW DIRECTIONS IN COMPUTING	INTERNATIONAL SYMPOSIUM ON NEW DIRECTIONS IN COMPUTING	QA75.5/I65
NON-NUMERIC PROCESSING	WORKSHOP ON COMPUTER ARCHITECTURE FOR NON-NUMERIC PROCESSING	QA76.9/A73W68
NORTHEAST BIOENGINEERING	NORTHEAST BIOENGINEERING CONFERENCE	R856/A2N6
NUMERICAL ANALYSIS OF SEMICONDUCTOR DEVICES AND INTEGRA	NASECODE CONFERENCE	TK7871.85/N27
OCEANOGRAPHIC DATA SYSTEMS	WORKING SYMPOSIUM ON OCEANOGRAPHIC DATA SYSTEMS	GC10.4/E4W6
OCEANS	OCEANS CONFERENCE	TC1505/O33
OFFICE AUTOMATION	IEEE COMPUTER SOCIETY OFFICE AUTOMATION SYMPOSIUM	HF5548.125/I15
OFFICE AUTOMATION	IEEE INTERNATIONAL CONFERENCE ON OFFICE AUTOMATION	HF5548.125/I15
OPERATING SYSTEMS	INTERNATIONAL CONFERENCE ON ARCHITECTURAL SUPPORT FOR PROGRAMMING LANGUAGES AND OPERATING S	QA76.9/A73I5
OPTICAL COMPUTING	INTERNATIONAL OPTICAL COMPUTING CONFERENCE	TA1632/I57
OPTICAL DATA STORAGE	TOPICAL MEETING ON OPTICAL DATA STORAGE	TK7895/M4T67
OPTICAL FIBER COMMUNICATION	TOPICAL MEETING ON OPTICAL FIBER COMMUNICATION	TK5103.59/C658
OPTICS	TOPICAL MEETING ON INTEGRATED OPTICS	TA1660/T65
PACIFIC RIM	IEEE PACIFIC RIM CONFERENCE ON COMMUNICATIONS, COMPUTERS AND SIGNAL PROCESSING	TK5102.5/I23
PACS	INTERNATIONAL CONFERENCE AND WORKSHOP ON PICTURE ARCHIVING AND COMMUNICATION SYSTEMS (PACS)	R858/A2I62
PAPER INDUSTRY	PULP AND PAPER INDUSTRY TECHNICAL CONFERENCE	TS1080/P8
PARALLEL PROCESSING	INTERNATIONAL CONFERENCE ON PARALLEL PROCESSING	QA76.6/I578
PATTERN RECOGNITION	IEEE COMPUTER SOCIETY CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION	TK7882/P3I12
PATTERN RECOGNITION	INTERNATIONAL CONFERENCE ON PATTERN RECOGNITION	TK7882/P3I5
PATTERN RECOGNITION AND IMAGE PROCESSING	IEEE COMPUTER SOCIETY CONFERENCE ON PATTERN RECOGNITION AND IMAGE PROCESSING	TK7882/P3I12
PECORA	WILLIAM T. PECORA MEMORIAL SYMPOSIUM ON REMOTE SENSING	G70.4/W5

Fig. 1. Keywords versus Author List.

KEYWORDS	TITLE	CALL NO
OPTICS	DIGEST OF TECHNICAL PAPERS - TOPICAL MEETING ON INTEGRATED OPTICS	TA1660/T65
OPTOELECTRONICS	KEY ABSTRACTS. OPTOELECTRONICS	REF/TA1750/K4
PACIFIC RIM	CONFERENCE PROCEEDINGS - IEEE PACIFIC RIM CONFERENCE ON COMMUNICATIONS, COMPUTERS AND SIGNAL PROC	TK5102.5/I23
PACS	INTERNATIONAL CONFERENCE AND WORKSHOP ON PICTURE ARCHIVING AND COMMUNICATION SYSTEMS (PACS) FC	R858/A2I62
PAPER INDUSTRY	IEEE CONFERENCE RECORD OF ... ANNUAL PULP AND PAPER INDUSTRY TECHNICAL CONFERENCE	TS1080/P8
PARALLEL PROCESSING	PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON PARALLEL PROCESSING	QA76.6/I578
PATTERN ANALYSIS AND MACHINE INTELLIGENCE	IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE	Q327/I124
PATTERN RECOGNITION	PROCEEDINGS - IEEE COMPUTER SOCIETY CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION	TK7882/P3I12
PATTERN RECOGNITION	PROCEEDINGS - INTERNATIONAL CONFERENCE ON PATTERN RECOGNITION	TK7882/P3I5
PATTERN RECOGNITION AND IMAGE PROCESSING	PROCEEDINGS - CONFERENCE ON PATTERN RECOGNITION AND IMAGE PROCESSING	TK7882/P3I12
PECORA	PECORA PROCEEDINGS	G70.4/W5
PESC RECORD	PESC RECORD	TK3001/I12
PETRI NETS	INTERNATIONAL WORKSHOP ON TIMED PETRI NETS: [PAPERS]	QA166/I59
PETROLEUM AND CHEMICAL INDUSTRY	RECORD OF CONFERENCE PAPERS - PETROLEUM AND CHEMICAL INDUSTRY CONFERENCE	TN863/P4
PHOENIX	CONFERENCE PROCEEDINGS - ANNUAL INTERNATIONAL PHOENIX CONFERENCE ON COMPUTERS AND COMMUNICATIO	TK5105.5/I5
PHOENIX	CONFERENCE PROCEEDINGS - ANNUAL PHOENIX CONFERENCE ON COMPUTERS AND COMMUNICATIONS	TK5105.5/I5
PHOTOVOLTAIC SPECIALISTS	CONFERENCE RECORD OF THE ... IEEE PHOTOVOLTAIC SPECIALISTS CONFERENCE	TK2960/I17
PHYSICAL MEASUREMENTS AND INSTRUMENTATION	KEY ABSTRACTS. PHYSICAL MEASUREMENTS AND INSTRUMENTATION	REF/QC39/K4
PICTURE ARCHIVING AND COMMUNICATION SYSTEMS (PACS)	INTERNATIONAL CONFERENCE AND WORKSHOP ON PICTURE ARCHIVING AND COMMUNICATION SYSTEMS (PACS) FC	R858/A2I62
PICTURE DATA DESCRIPTION AND MANAGEMENT	PROCEEDINGS OF THE WORKSHOP ON PICTURE DATA DESCRIPTION AND MANAGEMENT	TA1632/W69
PLANS	RECORD - IEEE POSITION LOCATION AND NAVIGATION SYMPOSIUM	TL695/I18
PLASMA SCIENCE	IEEE CONFERENCE RECORD - ABSTRACTS	TA2005/I15
PLASMA SCIENCE	IEEE TRANSACTIONS ON PLASMA SCIENCE	TA2001/I124
PLASTICS INDUSTRIES	IEEE CONFERENCE RECORD OF ... ANNUAL CONFERENCE OF ELECTRICAL ENGINEERING PROBLEMS IN THE RUBBER AN	TS1871/C6
POSITION LOCATION AND NAVIGATION	RECORD - IEEE POSITION LOCATION AND NAVIGATION SYMPOSIUM	TL695/I18
POWER	PAPERS PRESENTED AT THE ... ANNUAL CONFERENCE - RURAL ELECTRIC POWER CONFERENCE	TK4018/R8
POWER APPARATUS AND SYSTEMS	IEEE TRANSACTIONS ON POWER APPARATUS AND SYSTEMS	TK3001/I124
POWER DELIVERY	IEEE TRANSACTIONS ON POWER DELIVERY	TK3001/I126
POWER ELECTRONICS	IEEE TRANSACTIONS ON POWER ELECTRONICS	TK7881.15/I17
POWER ELECTRONICS SPECIALISTS	PESC RECORD	TK3001/I12
POWER ENGINEERING	IEEE POWER ENGINEERING REVIEW	TK3001/I122
POWER MODULATOR	IEEE CONFERENCE RECORD OF ... POWER MODULATOR SYMPOSIUM	TK7872/M6P6
POWER SYSTEMS	CONFERENCE RECORD - CONTROL OF POWER SYSTEMS CONFERENCE	TK1005/C67
POWER SYSTEMS	CONFERENCE RECORD - CONTROL OF POWER SYSTEMS CONFERENCE & EXPOSITION	TK1005/C67
POWER SYSTEMS	IEEE TRANSACTIONS ON POWER SYSTEMS	TK3001/I128
POWER SYSTEMS AND APPLICATIONS	KEY ABSTRACTS. POWER SYSTEMS AND APPLICATIONS	REF/TK3001/K45
POWER TRANSMISSION AND DISTRIBUTION	KEY ABSTRACTS. POWER TRANSMISSION AND DISTRIBUTION	REF/TK3001/K45
PRECISION ELECTROMAGNETIC MEASUREMENTS	CPEM DIGEST	QC755.6/C6
PRIVACY	PROCEEDINGS OF THE ... SYMPOSIUM ON SECURITY AND PRIVACY	QA76.9/A25S89
PROBLEMS IN THE OPTIMIZATION OF DATA COMMUNICATIONS SY	PROCEEDINGS OF THE ACM SYMPOSIUM ON PROBLEMS IN THE OPTIMIZATION OF DATA COMMUNICATIONS SYSTEM	TK5105.5/D36
PROCEEDINGS OF THE IEEE	PROCEEDINGS OF THE IEEE	TK5700/I6
PROFESSIONAL COMMUNICATION	CONFERENCE RECORD - IEEE PROFESSIONAL COMMUNICATION SOCIETY	T10.5/I12
PROFESSIONAL COMMUNICATION	IEEE TRANSACTIONS ON PROFESSIONAL COMMUNICATION	T10.5/I1124
PROGRAMMABLE CONTROLLERS	INTERNATIONAL COMMUNICATIONS AND ENERGY CONFERENCE: [DIGEST OF TECHNICAL PAPERS]	TK5101/A1I5
PROGRAMMING LANGUAGES AND OPERATING SYSTEMS	PROCEEDINGS - INTERNATIONAL CONFERENCE ON ARCHITECTURAL SUPPORT FOR PROGRAMMING LANGUAGES AND	QA76.9/A73I5

Fig. 2. Keywords versus Title List.

proceedings have been cataloged as serials.

It is our aim at the University of Victoria Library to acquire and provide access to all IEEE serial publications and, in particular, to all conference proceedings cataloged as serials. This task is made difficult by the bibliographically complex nature of IEEE serials and made more so by the University of Victoria Library's unique serials system. The UVic system consists of a combination of manual serial records, an online bibliographic file in an obsolete MARC format, and a separate online authority file for corporate bodies. The online bibliographic file is used to produce two sequences of microfiche: title and classification. Bibliographic records in the *title* sequence are not displayed under the main entry but under the exact title and include summarized holdings statements. This sequence provides cross-references for titles cataloged under the author as main entry. The *classification* sequence contains the same bibliographic information as the title sequence, but the records are arranged in LC call number order.

The online corporate body authority file is used to produce the "Index of Sponsoring Bodies" microfiche, listing all corporate bodies associated with the serial entries in the title sequence. Cross-references are used to direct the user to the cataloging form of the corporate name. Since the authority file used to produce this index is not linked to the bibliographic file, these cross-references do not appear in the title sequence. Therefore, the user may be forced to go through two cross-references in two different sets of microfiche to get to the desired bibliographic record. Since these three listings represent all of the access points to the serials collection, the user has to know either the exact title, the exact call number or general LC classification number, or the cataloging form of the corporate name in order to find the desired bibliographic entry and, hence, the material. No other subject access to the collection currently exists. The microcomputer-based database of IEEE serial titles and their corresponding keywords were created so that a simple tool could be produced and provided to library users to aid easy access to the IEEE serial collection. So far, the keyword lists have elicited a number of positive comments from many users including staff, faculty, and students.

A database of the same design was also created for all Association for Computing Machinery (ACM) serial titles, and corresponding keyword lists were printed and distributed in the library and to interested departments. The response to these was again enthusiastic.

The existing IEEE database was used as the basis for a second *Microsoft Works* database designed to keep track of all IEEE conference publications cataloged as serials. This database was designed with additional fields to those listed above. These are *began*, to indicate the beginning date of publication; *holdings*, representing combined holdings for letterpress and microform expressed as years only; *micro*, to indicate those years available on microfiche; *published since 1984*, because our overall open order plan for IEEE conference publications began in 1984 (this information is available in the yearly summary of conference proceedings published by IEEE and listed in the annual *Index to IEEE Publications); comments*, for any additional information; and *status*, to indicate whether a conference is ongoing or has ceased publication. The fields *on order* or *out of stock* were later also added. Since this file is used for keeping track of conference proceedings and their holdings only, all other periodical titles and duplicate entries were eliminated. This did not prove to be as time-consuming a task as it seemed initially, since one can very quickly rearrange the order of the columns appearing on the screen, alphabetize on any field almost instantaneously, and split the screen if necessary to view and scroll through several columns of information at once. The records, alphabetized by title, quickly showed which entries had more than one set of keywords assigned per title. A somewhat more time-consuming project was the gathering and input of the holdings information from manual records, as well as the input of the published conference proceedings listed in the *Index to IEEE Publications*.

Once all of the relevant information was input into the conference holdings database, a report was defined so that a list of all

conferences and their holdings could be printed with an Imagewriter II printer using a custom size of paper, 8 1/2 by 22 inches, with a horizontal orientation. All of the fields were included in the report with very little truncation taking place. The approximately 300 records were alphabetized by keywords, since this is the fastest way to identify the main entry, title, and call number for any given record and to view the corresponding holdings. The database is updated as new proceedings are received by the library. The *date* field can be used to identify the records in which changes have taken place, so one has the option of printing only new or changed records. The whole file is reprinted from time to time, depending on the number of changes made since the last complete printing. Subsets of the file can also be printed, since one can search the various fields and also specify searching parameters using Boolean operators. Thus, for example, conferences for which no proceedings have been received in a given year can be identified, as can conference proceedings that are on order or out of stock.

The IEEE conference holdings database is now being used as the basis for designing a Hypercard stack that will allow end-user searching of this file, using any of the words or call numbers contained in the records, to find out which IEEE conferences cataloged as serials are in the library and what the library's holdings are. Similar databases and Hypercard stacks are planned for ACM materials and other files.

Copies of the templates of the existing files are available by sending a blank diskette (3 1/2 inch, double-sided, double-density) to the author at 2173 Central Ave., Victoria, B.C., Canada, V8S 2R6.

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1. *1988 IEEE Publications Catalog* (New York: Institute of Electrical and Electronics Engineers, 1988).
2. Jim E. Cole, "Conference Publications: Serials or Monographs?" *Library Resources & Technical Services* 22:172 (Spring 1978); Michael E. Unsworth, "Treating IEEE Conference Publications as Serials," *Library Resources & Technical Services* 27:221–24 (Apr./June 1983); Karl E. Johnson, "IEEE Conference Publications in Libraries," *Library Resources & Technical Services* 28:308–14 (Oct./Dec. 1984). ■■

Twenty Years Ago in JOLA

The reliability of bibliographic data supplied to university libraries from faculty and students has long been questioned. Any search system which accepts such data must be designed: 1) to increase the level of confidence through machine generated search structures and variable threshholds and 2) to reduce the dependence upon spelling accuracy, punctuation, spacing and word order.

Frederick H. Ruecking, "Bibliographic Retrieval from Bibliographic Input: The Hypothesis and Construction of a Test," *JOLA*, 1: no.4:228 (Dec. 1968).
Contributed by Michael Gorman.

A Book Catalog Produced from USMARC Records Using *Bibliofile, Pro-Cite, Biblio-Link,* and *Word Perfect*

Merle Lee Colglazier, Jr.

A computer-printed book catalog was produced for the Ecumenical Resource Center (ERC) in Richmond, Virginia, from a 1,500 USMARC-record database, using microcomputer technology and the Library Corporation's BiblioFile *catalog-production software, Personal Bibliographic Services' (PBS)* Pro-Cite *bibliography-production software,* Biblio-Link to USMARC Communications Format Records *software, and WordPerfect's* WordPerfect *word processing program.*[1] *This paper is a "how-I-did-it" report about a workable and affordable method of rising above the drudgery of the endearing, old-fashioned card catalog. General information about the details of the catalog project is provided, and the capabilities and limitations of the software used for this particular application are explained. The procedures used are presented—including the mistakes, problems, and solutions—to assist others who attempt a similar method.*

The Ecumenical Resource Center (ERC) is a small, Christian, educational media resources library located on the campus of the Presbyterian School of Christian Education. Organized in 1985, the ERC has a small collection, but it is growing steadily in size and membership. At present there are 120 local churches with membership in the ERC. Currently it operates with part-time staff and limited hours. The collection includes books, audiovisuals, curriculum materials, and serials.

Understandably, the need for a book catalog for a collection of 1,500 titles requires explanation. The decision in favor of a book format catalog was made primarily for the convenience of the users and to help the ERC expand its mission. The book catalog format permits remote research of the collection, thus extending service when the ERC is closed and saving time for users who must travel a great distance to the ERC. Moreover, the book catalog serves a vital marketing function to nonmembers by promoting awareness of the resources available at the ERC. Supplements for the catalog will be produced regularly, and a new edition will be prepared every other year. The ERC decided cautiously to retain a card catalog initially for a backup even though the book catalog eliminates the need for it. Perhaps when more of the users have computers and the requisite software, it will be possible, as someone has suggested, to distribute files of the catalog on diskette to the users as an alternative to the book catalog.

The project involved recataloging the ERC collection. The classification system was changed from a local subject scheme to Dewey, LC subject headings were added, and the catalog records were converted to MARC format. These standards were chosen because acceptable catalog records are readily available for a large percentage of the religious resources likely to be added to the collection and to permit easier bibliographic control over the collection as it continues to grow. *BiblioFile* was used as the cataloging utility with which catalog cards and labels were produced. The hardware used included an international standard Hitachi CD-ROM drive, NEC Pinwriter P6 dot-matrix printer, and Corona 400 IBM PC compatible (8088 microprocessor) with a 40 MB hard disk operating with MS DOS version 3.1.[2]

Three approaches were used to build the MARC database file: copy cataloging of the LC MARC database using *Bibliofile*, transcribing and editing previous catalog records, and original cataloging from title page photocopies as the record source. LC MARC cataloging was available for 40 percent of the resources in the collection, almost exclusively for books and serials. Catalog cards and labels were produced in this stage of the project. After this was completed, the ERC closed for two weeks to process the resources and reorganize the collection.

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The next stage involved transferrring the completed catalog records from *BiblioFile* to *Pro-Cite* for database management and book catalog production. *BiblioFile* provides a utility program that converts the catalog records stored in the internal program format into the USMARC communications format for exporting to other computer programs. (The latest version also has an import utility program for processing USMARC records from other sources). The MARC conversion program was used to prepare the completed catalog records for transfer into *Pro-Cite*. The converted records were stored on the hard disk in a file named COM.CP in the *BiblioFile* directory.

Then came the truly exciting part of the project—the USMARC records were transferred into a *Pro-Cite* import file using the *Biblio-Link* program (see figure 1)! The *Biblio-Link* program allows the user to select tags and subfields from the USMARC records that are to be included in the transfer process and to assign forty-five destination fields for the *Pro-Cite* record format (see figure 2). Which USMARC records work with this *Biblio-Link*? As explained in the user's manual,

> This Biblio-Link works with either spanned or unspanned USMARC records. The former are primarily distributed by the Library of Congress on tape. Local service agencies can move these records to disk. The latter are distributed by services such as Biblio-File and EBSCO Subscription Agency. They are also created when you use the MITINET system for cataloging and retrospective conversion. The Biblio-Link may also work with other cataloging systems that provide USMARC Communications Format records.[3]

The program is configured to recognize and transfer the commonly used USMARC records, tags, and subfields that were in existence as of January 1987.

An explanation should be made here regarding the *Pro-Cite* record format. *Biblio-Link* accepts the transfer of subfield data for all USMARC record formats, but the transferred records are stored in the *Pro-Cite* record format, which is not a pure "MARC-compatible" format.[4] The *Pro-Cite* record format does not use subfield delimiting, and the program does not convert the transferred records back to the pure USMARC record format (see figure 3). However, the output for the book catalog entries is completely satisfactory even though the record formats are not identical. In another MARC-based computer-produced-book catalog project at the University of California for a substantially larger collection, Gibson reported that the software used, *BIBCON*, produced "MARC-like records rather than full MARC records . . . [however] this lack of detailed discrimination causes no problem . . . for the output of book catalog entries."[5] As in this important earlier project, the lack of pure MARC compatibility for *Pro-Cite* does not diminish the completeness of the information output in book-catalog format.

Two problems with quality control occur, however, even though *Biblio-Link* performs a complete transfer of the USMARC record. In the first place, *Biblio-Link* does not presently recognize field indicators in the USMARC record during the transfer process. For example, the program will not discriminate between LC or NLM subject headings. Thus, if one is working with LC subject headings in the 650 field, before the transfer process it is necessary to delete the NLM subject headings—also located in the 650 field and identified by 02 in the indicator space of the LC MARC record—because *Biblio-Link* does not discriminate the indicators. This editing inconvenience is necessary only if strict subject authority control is required in the subject index output. The programmers at PBS are aware of this limitation but currently do not provide indicator discrimination in any of the MARC *Biblio-Links*.

The second problem with quality control involves transferring the Dewey classification number. Since the program transfers the complete record, it does not abbreviate the Dewey number in the 082 field. Thus, the entire number, including prime marks, is transferred. This creates an obvious problem for libraries that abbreviate the Dewey number. Until PBS produces the code for either *Biblio-Link* or *Pro-Cite* to solve this problem, instructions to ignore the superfluous numbers can be given in the book catalog.

After the import file was built, the *Pro-Cite* program was used to perform the sort-

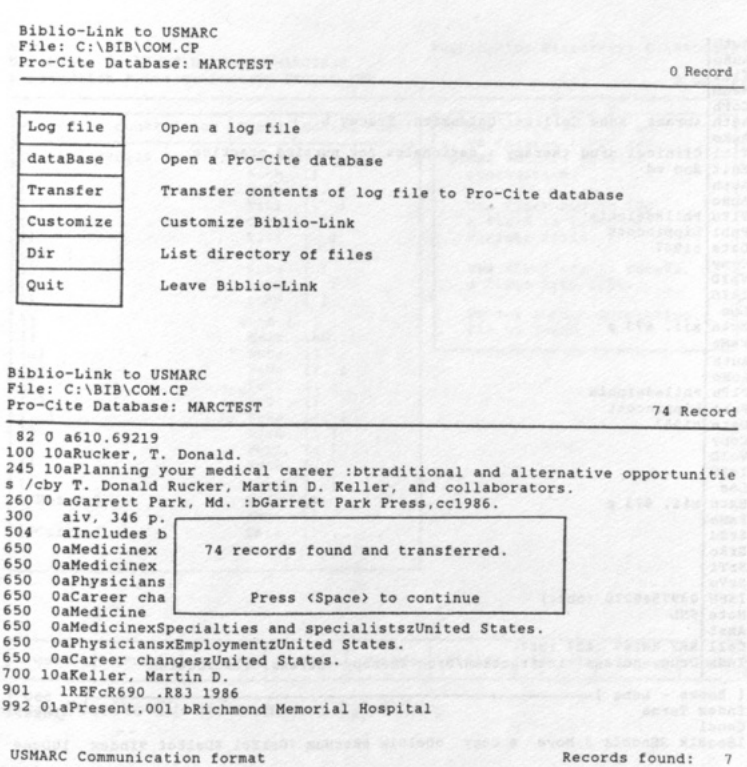

Fig. 1. Screen from Biblio-Link *of USMARC Record Transfer.*

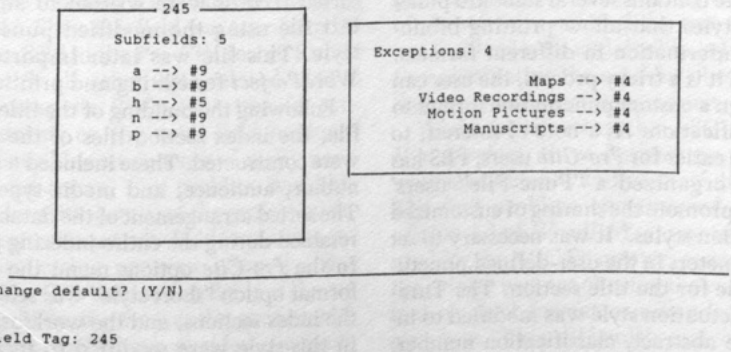

Fig. 2. Biblio-Link *Screen of Changing* Pro-Cite *Destination Field for MARC Tag and Subfields.*

```
Auth
AuRo
Titl
Medm
CoPh
Auth  Abrams, Anne Collins//Goldsmith, Tracey L.
AuRo
Titl  Clinical drug therapy : rationales for nursing practice
Edit  2nd ed
Auth
AuRo
PlPu  Philadelphia
Publ  Lippincott
Date  c1987
Copy
VoID
IsID
Loc
Extn  xii, 673 p
PaMe
Auth
AuRo
PlPu  Philadelphia
Publ  Lippincott
Date  c1987
Copy
VoID
IsID
Loc
Extn  xii, 673 p
PaMe
SrEd
SrRo
SrTi
SrVo
ISBN  0397546270 (pbk.)
Note  SNL
Abst
Call  REF RM262 .A27 1987
Indx  Drug--nurses' instruction/Drug Therapy--nurses' instruction

[ Books - Long ]————————————————————————————————————[   560 ]
Index Terms                                                Insert
Cancl
1BegBlk 2EndBlk 3 Move  4 Copy  5DelBlk 6RecNum 7DelEol 8DelEof 9Index  10Done
```

Fig. 3. Screen from Pro-Cite *of Record Format.*

ing and indexing functions for the book catalog. The import file was retrieved from the *Biblio-Link* directory upon entering the *Pro-Cite* program. First, it was necessary to search for and eliminate duplicate records using this *Pro-Cite* program option. Then sorting and indexing were done to produce the necessary sections for the catalog.

Pro-Cite contains several standard punctuation styles that allow printing bibliographic information in different formats. Although it is a tricky process, the user can also design a custom punctuation format to any specification. As a note of interest, to make life easier for *Pro-Cite* users, PBS has recently organized a "Punc-File" users' group to promote the sharing of customized punctuation styles.[6] It was necessary to set the parameters in the user-defined punctuation style for the title section. The Turabian punctuation style was modified to include the abstract, classification number, notes, and physical description with spacing and formatting (see figure 4). After setting the punctuation file parameters for the title section, the sort function was used on the title field for the entire database to create an alphabetical title listing. The sort program retains the alphabetical arrangement of the selected field for all other indexing and printing operations. Then the sorted records were written to an ASCII text file using the modified punctuation style. This file was later imported into *WordPerfect* for editing and printing.

Following the building of the title section file, the index section files of the catalog were constructed. These included a subject, author, audience, and media-type index. The sorted arrangement of the database was retained during the entire indexing process. In the *Pro-Cite* options menu the citation format option "short style" was selected for the index sections, and the workform fields in this style were modified to include selected fields from the *Pro-Cite* record. For

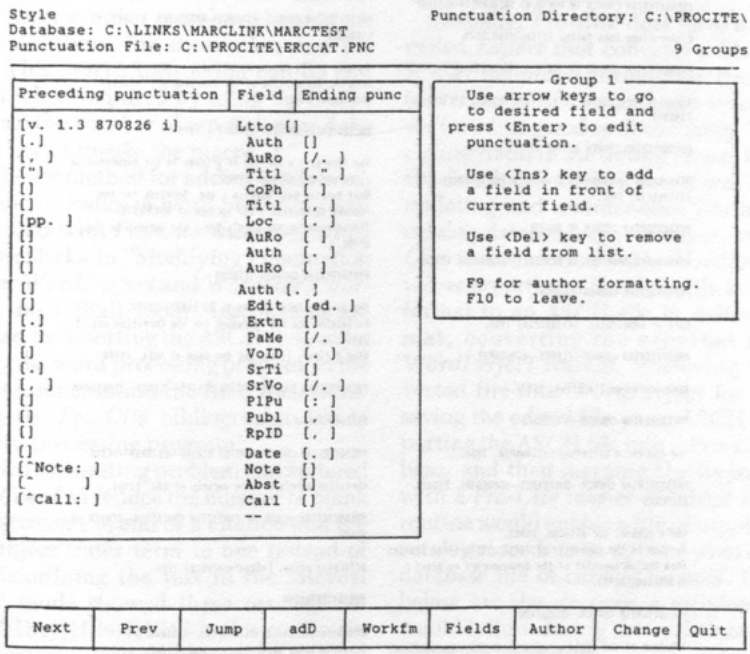

Fig. 4. Screen from Pro-Cite *of Punctuation Style Editing.*

example, the subject index was made by using the index function and selecting the title, media-type descriptor, and publication date in the record output format (see figure 5). The indexed database was then written to an ASCII file. The remainder of the index sections were constructed in similar manner by selecting the short style for the citation format and indexing the sorted database on the desired fields. The only difficulty encountered with indexing occurred with the audience field. Since this field was transferred to the notes field in the *Pro-Cite* record format along with all other note-related MARC fields during the *Biblio-Link* transfer process, indexing on the notes field produced the undesirable consequence of many unrelated index terms. This problem was handled in the editing stage of the project by deleting the irrelevant note field terms with the word processing program. Specifying a unique *Pro-Cite* destination field for the audience field during the transfer process with *Biblio-Link* could have avoided the problem.

While it would have been possible to print listings of the sorted and indexed records using the *Pro-Cite* print program, instead the records were written to ASCII output files and the files were imported to the word processing program *WordPerfect* for editing, spell checking, page formatting, and printing. The powerful features in *WordPerfect* enabled the editing routines to be conducted with little effort. The page formatting and printing capabilities of the software enabled the text to be output in 20 cpi type and double-column text, thus eliminating the need for photographic reduction and page composition.

When transferring the ASCII files to *WordPerfect*, three formatting problems were encountered and successfully solved. The first problem encountered was that version 4.1 of *WordPerfect* was not configured for the NEC P6 printer; consequently, the printer was not obeying the column format or print format commands from the program. This difficulty was overcome with help from the *WordPerfect* customer

PRESBYTERIAN CHURCH IN THE U.S. (GENERAL)--HISTORY

Explorations into faith. [filmstrip] 1977.

PRESBYTERIAN CHURCH IN THE U.S. (REUNION WITH UPCUSA)

A family portrait we, the Presbyterians. [filmstrip] [1983?].

PRESBYTERIAN CHURCH IN THE UNITED STATES

Witnessing together in a world of differences. [filmstrip] 1982.

PRESBYTERIAN CHURCH OF BRAZIL

Witnessing together in Brazil. [filmstrip] 1981.

PRESBYTERIAN CHURCH--CLERGY

Care of candidates. [filmstrip] 1980.

PRESBYTERIAN CHURCH--CLERGY--BIOGRAPHY

Somebody knows I'm alive. c1977.

PRESBYTERIAN CHURCH--DOCTRINES

The church, a believing fellowship, 1981.

PRESBYTERIAN CHURCH--DOCTRINES--ADDRESSES, ESSAYS, LECTURES

God's claims, our mission. c1983.
Worship in the community of faith : liturgical studies from the perspective of the contemporary reformed tradition. c1982.

PRESBYTERIAN CHURCH--EDUCATION

Together at the table : children in the congregation, c1981.

PRESBYTERIAN CHURCH--GOVERNMENT

Presbyterian polity for church officers, c1986.

PRESBYTERIAN CHURCH--HISTORY

Kentucky Presbyterians. c1983.

PRESBYTERIAN CHURCH--LITURGY--ADDRESSES, ESSAYS, LECTURES

Worship in the community of faith : liturgical studies from the perspective of the contemporary reformed tradition. c1982.

PRESBYTERIAN CHURCH--LITURGY--TEXTS

The funeral : a service of witness to the Resurrection : the worship of God. c1986.
Holy baptism Holy baptism ; and, Services for the renewal of baptism : the worship of God. c1985.
The service for the Lord's Day : the worship of God, c1984.

PRESBYTERIAN CHURCH--SERMONS

The Apostle Peter speaks to us today, c1977.
Reclaiming the Old Testament for the Christian pulpit, c1980.
Wind & fire : living out the book of Acts. c1984.

PRESBYTERIAN CHURCH--UNITED STATES--CLERGY--BIOGRAPHY

Minister/Mayor, c1987.

PRESBYTERIAN CHURCH--UNITED STATES--LITURGY--TEXTS

Christian marriage : the worship of God. c1986.

PRESBYTERIAN SCHOOL OF CHRISTIAN EDUCATION--CENTER ON AGING

Affirming aging. [videorecording] 1986.

PRESBYTERIANISM

Presbyterian polity filmstrips. [filmstrip] 1978.
Presbyterians, their history and beliefs. c1978.
Remember and go forth: God's covenant with the community of faith, c1986.
Road map a travel guide for Presbyterians exploring how their church works. [sound recording] [197-?].

PRESBYTERIANISM--HISTORY

Fig. 5. Record Output Format for Subject Index.

service staff and by using the following procedure. In the "Print Format" mode the pitch was set to 15, the font was set to 2, and the right justification was turned off. In the "Line Format" mode the margin was set to 8 and 119. In the "Math/Columns" mode the text column was defined as follows:

Evenly spaced columns? Yes
Number of spaces between columns 3
Groups kept together on a page? No
Number of text columns 2

The "Column On/Off" switch was selected. Then the text was retrieved using the "Text In" mode, the cursor was repositioned to the end of the document, and the "Column On/Off" switch was turned off. The moral of the story is to check hardware and software compatibility before buying.

The second problem was that the underline character for the title field transferred as an underline character "___" immediately preceding and following the title when I transferred the ASCII file into *WordPerfect* version 4.1. I needed to replace this underline character with a complete underline. I solved the problem by setting up a macro instruction that deleted this character, moved the title over one space to the left (to occupy the space left by the deleted underline character), and then underlined the titles. The macro instruction used to accomplish this is listed below.

[F2] (search), [___] (underline character), [F2], [Back Space], [Alt] [F4] (Block on), [F8] (underline), [F2], [___] (underline character), [F2], [F8] (underline), [Back Space], [N] (No), [Back Space].

Using the escape key, I set the macro to repeat 1,570 times. After the program worked for over an hour I went to bed for the night, and when I woke up in the

morning—amazing! Now I know how ecstatic the shoemaker must have been in the fairy tale about the shoemaker and the elves! This macro instruction can be employed when required by using the escape key to set the number of repetitions and the macro key to invoke the macro.

A quicker method for adding underlines, boldface, or italics to word processing programs used with *Pro-Cite* was reported by Carolyn Slivka in "Modifying Punctuation Files for *WordPerfect* and *WordStar*," *Format* 2, no.4 (Fall 1988). Instructions are provided for inserting the ASCII style codes used by the word processing program in the *Pro-Cite* punctuation file first, then transferring the *Pro-Cite* bibliographic file to the word processing program.

A third formatting problem encountered was the need to reduce the number of blank lines between the end of a citation and the next subject index term to one instead of two. Examining the text in the "Reveal Codes" mode showed three carriage returns ([HRt] [HRt] [HRt]) in this position in every instance. The method used to solve this problem was to perform a forward search for the three carriage returns using the "Forward Search" mode and replace them with two carriage returns using the "Replace" mode. Figures 6 through 9 show printout samples from each section of the catalog.

Other problems encountered in the project include difficulty with the printer bleeding together the stems in the lowercase letter *m* when printed in 20 cpi by the NEC P6 printer. The NEC P6 has the ability to set up user-defined characters, but this was not tested to see if the problem could have been corrected. In addition, the *Pro-Cite* sort program does not strictly follow the ALA rules for filing catalog cards. Instead, the filing sequence places punctuation marks first, arabic numerals next, and letters last. Another limitation encountered in the project involved the need to edit and check spelling for each file separately after the indexing procedures had been completed with *Pro-Cite*. Updating and maintenance activities would be easier if it were possible to check spelling and edit the entire database in one operation and then transfer the file back to *Pro-Cite* for the indexing procedures.

Actually, *Pro-Cite* does have a program called *Export* that converts a file into the ASCII delimited format for transferring into other programs such as a word processor for editing and spell checking. This procedure is still in the testing phase, but when the details are worked out, it will facilitate updating and maintenance routines for a catalog database. For example, using *Pro-Cite* in connection with *WordPerfect* involves exporting a database file in *Pro-Cite* format to an ASCII file in delimited format, converting the exported file into *WordPerfect* format, retrieving the converted file into *WordPerfect* for editing, saving the edited file as an ASCII file, importing the ASCII file into a *Pro-Cite* database, and then merging the imported file with a *Pro-Cite* master database file. This routine would enable a file of supplemental catalog records to be appended to a master database file of catalog records. Outlined below are the six steps a supplement file would follow during this maintenance and updating procedure.

1. Export *Pro-Cite* file in ASCII delimited format.
   Program—*Pro-Cite* "Export"
   Exported File Name—PCEXPORT
2. Convert PCEXPORT into *WordPerfect* format for editing and spell checking.
   Program—*WordPerfect* "Convert"
   Converted File Name—WPINPUT
3. Retrieve WPINPUT into *WordPerfect* for editing.
   Program—*WordPerfect* "Text/In"
   Retrieved File Name—WPINPUT
4. Save the edited file in ASCII delimited format.
   Program—*WordPerfect* "Text/Out"
   Edited File Name—WPOUTPUT
5. Import the edited ASCII file in delimited format into a *Pro-Cite* file for merging with a master database file.
   Program—*Pro-Cite* "Import"
   Imported File Name—PCIMPORT
6. Merge the imported *Pro-Cite* file with a master database file.
   Program—*Pro-Cite* "Merge"
   Imported File Name—PCIMPORT

After numerous unsuccessful attempts to execute this procedure with the assistance of the customer support staff at *WordPer-*

Pattern. 120 p. New York: Seabury Press, [1974].
Note: "A crossroad book."
Call: 254

Minister/Mayor, Hudnut, William H. and Keene, Judy. 1st ed. 184 p. Philadelphia: Westminster Press, c1987.
Note: Includes index.
Call: 977.2/52 B

Ministry resources : planning helps in ten program areas for congregations with small membership, Massa, Michael W. 147 p. Minneapolis: Augsburg Pub. House, c1986.
Note: Written by Michael W. Massa ... [et al.].
Call: 253

Ministry together : a manual for shared ministry training, Matz, Mary D. 39 p. Bethlehem, Pa: Department of Publications, Moravian Church, c1982.
Call: 253

Mirrors of God, Goetz, Joseph W. 93 p. [S.l.]: Joseph W. Goetz, c1984.
Call: 231.7

The missing piece, Silverstein, Shel. 1st ed. [105] p. New York: Harper & Row, c1976.
Note: "An Ursula Nordstrom book."
A circle has difficulty finding its missing piece but has a good time looking for it.
Call: [Fic]

Mission and evangelism, an ecumenical affirmation : a study guide for congregations, National Council of the Churches of Christ in the U.S.A. 83 p. New York, N.Y: NCC, 1983.
Call: 266.009

Mission education [study packet] witness season 1985 : Korea, visions of peace, Presbyterian Church (U.S.A.) Office of Interpretation. packet: various pieces. Atlanta, Ga: The Office, 1984.
Call: 266.023

ROA Films. The mission of the Twelve. [filmstrip] Milwaukee, WI: ROA, 1962. 1 filmstrips (27 fr.) .
Note: AUDIENCE: Primary to Junior High.
Luke 9:1-6).
Call: FS 232.901 Vol.2

Mission to Brazil, Bear, James E. 240 p. [Atlanta, Ga.]: Presbyterian Church U.S., Board of World Missions, c1961.
Call: 266.023

Mission trends no. 1; crucial issues in mission today, comp joint comp Anderson, Gerald H. and Stransky, Thomas F. ix, 276 p. New York: Paulist Press, [1974].
Call: 266.023

Mission yearbook for prayer and study (c1984-):

Model deaf/blind prevocational training project, Stoddard, Denis W. 80 p. Washington, D.C: National Children's Center, Inc, 1976.
Call: 371.9

Models of the church, Dulles, Avery Robert. Expanded ed. p. cm. Garden City, N.Y: Image Books, c1987.
Call: 262.7

Money and the Christian a media kit for exploring money and its use. [kit] Graded Press. [S.l.]: The Press, 1974. 1 filmstrip, 1 sound disc, 1 leader's guide, gameboard and instructions, wall chart, card set, Bible reference sheet; in container.
Note: AUDIENCE: Adults.
Deals with the nature and use of money, and with the issues of financial stewardship for Christians. Provides resources for nine different group learning experiences for use either in a series of lessons or as support for a single learning experience.
Call: MMK 248.6

Moral and spiritual development for the young child, Rouse, Doris Haver and Waldrop, C. Sybil. 95 p. Weekday early education idea book. Nashville, Tenn: Broadman Press, c1981.
Call: 372.8

Morality of power : a notebook on Christian education for social change, McCollough, Charles R. 142 p. Philadelphia: United Church Press, c1977.
Call: 261.8/M7

Fig. 6. Descriptive Section from Book Catalog.

fect, an authority on the staff explained to me that the capability of exporting a file from *WordPerfect* in the ASCII delimited format—with field contents enclosed in double quotes, fields separated by commas, and records separated by carriage returns—is unfortunately not an available option for saving a text file in even the most recent version of *WordPerfect*, though there is always the possibility that this feature will be added as an enhancement to a future version. Meanwhile, the staff at PBS assures me that the word processing program *WordStar* does indeed export a text file in the ASCII delimited format. There may be other word processing programs that execute this procedure also. This capability should be included in whatever program is used to help maintain and update a supplemental catalog file before merging it with the master database file of catalog records in *Pro-Cite*. The same steps outlined in the procedure above would apply with a different word processing program.

This project demonstrated that it is possible to produce a library catalog in book format from USMARC records obtained from *BiblioFile* using a microcomputer and mixing off-the-shelf software priced at around $1,000. The flow chart in figure 10 illustrates the steps involved in the project.

Authority control and cross-referencing were not included in this project, although it would be possible to perform these operations in *Pro-Cite* with a little inventiveness. While the size of the database was small for

KENYON, KATHLEEN MARY DAME

The Bible and recent archaeology, c1978.

KEYES, SHARREL

Lift high the torch : the gospel in the Old Testament studies in Isaiah, c1978.

KEYS, JOEL T.

Our older friends : a guide for visitors, c1983.

KILGORE, LOIS

Eight special studies for senior highs, c1976.

KILLGALLON, JAMES J.

Life in Christ, 1976.

KIMBALL, DON

Power and presence : a theology of relationships, 1987.

KIMBALL, EMILY KITTLE.

How to get the most out of being a volunteer : skills for leadership, c1980.

KING, MARTIN LUTHER JR.

Strength to love, 1981, c1963.

KIRK, J. ANDREW

Liberation theology : an evangelical view from the Third World, 1979.

KIRK, MARTHA ANN

God of our mothers seven Biblical women tell their stories. [sound recording] 1985.

KIRSCHENBAUM, HOWARD

Values clarification; a handbook of practical strategies for teachers and students, [1972].

story], c1982.

KITAGAWA, JOSEPH MITSUO

Religions of the East, [1960].

KITTEL, BONNIE PEDROTTI

Deuteronomy with Bonnie Pedrotti Kittel. [sound recording] 1977.
Kings. [sound recording] 1977.

KLIETSCH, RONALD G.

Directory of educational simulations, learning games and didactic units, c1969.

KLIEVER, LONNIE D.

The shattered spectrum : a survey of contemporary theology, c1981.

KNIGHT, DAVID

His way: an everyday plan for following Jesus, c1977.
To follow His way: a parish renewal program, c1980.

KNIGHT, DAVID M.

Living His way. [sound recording] [198-?].

KNOWLES, LOUIS L.

A guide to world hunger organizations : who they are and what you should know about them, c1984.

KNUDSEN, RAYMOND B.

Developing dynamic stewardship, c1978.

KOBIALKA, DANIEL

Timeless motion. [sound recording] 1982.

KOEHLER, GEORGE

Preparing a teaching plan skill training for the new teacher. [sound recording] 1974.

Fig. 7. Author Index Section from Book Catalog.

this project, the same procedure can be used for a much larger database. Just how large? The maximum size of the *Pro-Cite* database is currently limited to 32,500 records for version 1.3. Rumor has it that PBS plans to release an unlimited version in the future, but until then the current version will probably fulfill the requirements of most small and medium-size collections.

At the time this project was completed, the author successfully tested the transfer of USMARC records from Marcive, Inc., using *Biblio-Link*. In addition to LC records, Marcive supplies records from the Government Printing Office, the National Library of Medicine, and the National Library of Canada. Records may be obtained from Marcive by batch conversion using lists of unique keys submitted either on paper via the U.S. mail and returned on floppy disks or in machine-readable form, up- and downloaded online with a microcomputer.[7] In addition, the latter method may be done from many locations by using a toll-free telephone number. An important advantage of Marcive—with respect to subject authority control and *Biblio-Link*—is its capability to strip fields from USMARC records. Thus, the instruction to strip either NLM or LC subject headings from the records when both occur, as in many LC records, may be established as a permanent condition in the library profile. Marcive provides a cost-effective alterna-

The what's my name game. 1980.

Wilderness. 1974.

Yes, no or maybe so. [198-?].

KITS

Abraham/Ruth stories of the Old Testament. 1982.

Aids for teaching the Bible. [198-?].

Bible background. 1981.

Blood is thicker than water celebrating black history. 1982.

Building family unity a multimedia learning kit. c1977.

Children, we are all free. [1985?].

The creation New Media Bible. 1980.

The crucifixion New Media Bible. 1980.

David, shepherd/king stories of the Old Testament. 1982.

Each one specially. c1982.

Gambling a moral issue. [198-?].

God is with us children discover God's presence. 1985.

Help for recruiters a do-it-yourself kit for recruiting committees in churches. c1981.

Hope springs from God. [n.d].

How you got to be you. c1982.

I wonder why. c1982.

Jesus as liberator. [1985?].

Journey into faith a confirmation resource for junior highs. [198-?].

Lord of life, Lord of me. c1982.

Money and the Christian a media kit for exploring money and its use. 1974.

New Age Dawning,

The new you. c1982.

On the way 150 years of Presbyterian witness in the world. c1987.

Reconciliation the New Media Bible (Genesis 44:3 - 47:26). 1980.

Religion in human culture the Buddhist tradition. 1978.

Religion in human culture the Christian tradition. 1978.

Religion in human culture the Hindu tradition. 1978.

Religion in human culture the Islamic tradition. 1978.

Religion in human culture the Jewish tradition. 1978.

Tools for Bible study. [198-?].

Using community resources. c1972.

MOTION PICTURES

Jesus of Nazareth. 1979.

MUSIC

Joy in singing the hymns of Jane Parker Huber. c1983.

Rainbow songs. c1975.

The Richard Avery and Donald Marsh Songbook. c1972.

Fig. 8. Media-Type Index Section from Book Catalog.

World's uprooted refugees. [filmstrip] 1983.

EARLY CHILDHOOD

Abraham/Ruth stories of the Old Testament. [kit] 1982.

Barnabas and baby Jesus a color filmstrip about the first Christmas candle. [filmstrip] c1979.

Bible story A-V kit for young children 1. [filmstrip] c1980.

Bible story A-V kit for young children 2. [filmstrip] c1981.

Bible story A-V kit for young children 3. [filmstrip] c1983.

Bible story time New Testament. [filmstrip] 1984.

The bread and water man. [filmstrip] 1984.

The City that forgot about Christmas. [videorecording]

God is with us children discover God's presence. [kit] 1985.

The greatest adventure stories. [videorecording] c1986.

I will take you to the Christ child. [videorecording] [1975?].

Jesus and his friends. [videorecording] 1973.

Jimmy and the white lie. [videorecording] c[198-?].

Little stars of Bethlehem. [filmstrip] 1976.

Out of the mouth of babes. [videorecording] 1985.

The small town boy who made good. [filmstrip] 1984.

Summer song. [music] c1970.

Thank you people. [filmstrip] 1984.

Too smart for strangers. [videorecording] 1985.

INTERGENERATIONAL

The celebration revolution of Alexander Scrooge. [filmstrip] [1986?].

Chariots of fire. [videorecording] 1981.

Comfort zone. [sound recording] 1980.

David, shepherd/king stories of the Old Testament. [kit] 1982.

For now 3. [sound recording] 1972.

Free to be ... you and me. [videorecording]

God of our mothers seven Biblical women tell their stories. [sound recording] 1985.

Have yourself a merry little Christmas. [filmstrip] [198-?].

Hymns for now 1 & 2. [sound recording] [198-?].

I hope they don't bomb my lily pad. [filmstrip] [1986?].

Jesus of Nazareth. [videorecording] 1984.

Jesus of Nazareth. [motion picture] 1979.

Journey to Easter. [videorecording] 1987.

Journey to Easter. [videorecording] 1986.

Lent: a time of renewal. [videorecording] 1987.

The lion, the witch, and the wardrobe. [videorecording] 1985, c1950.

The New Media Bible the Gospel According to Luke. 1979.

New roads to faith black perspectives in church education. [filmstrip] 1982.

People of stone. [filmstrip] 1980.

Fig. 9. Audience Index Section from Book Catalog.

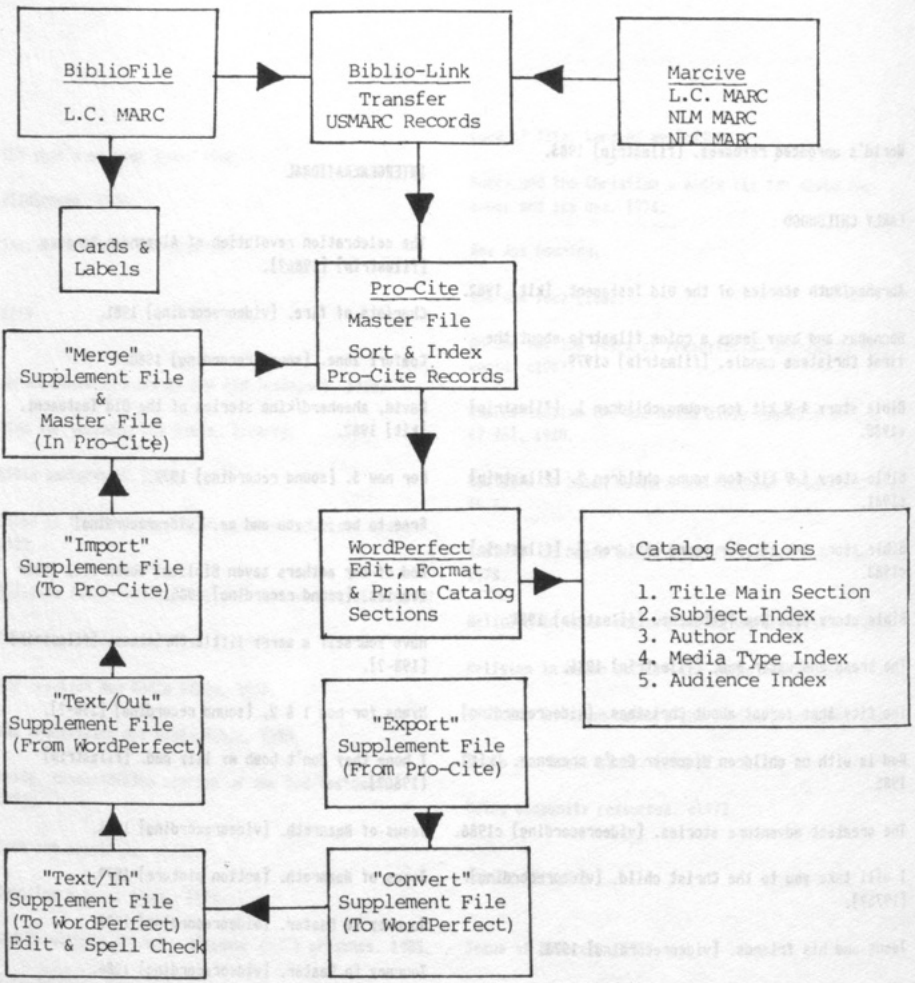

Fig. 10. Flow Chart of Book Catalog Production.

tive source for USMARC records where the volume of cataloging does not justify the expense of subscribing to *BiblioFile*.

Has the library catalog gone full circle? Should the book catalog format be reconsidered in libraries? It would be enlightening to compare expenses for producing and maintaining a book catalog versus a card catalog using current microcomputer technology and library software. In view of advances in library software and declining prices in computer hardware, procedures similar to those presented in this report may establish the book catalog as a more cost-effective format than the card catalog. The advantages of a book catalog may even outweigh those for an online catalog in some situations. The expenses and advantages of the catalog format need to be identified to determine the best alternative. Times have changed, and so has information technology. With the efficiencies provided by library technology today, librarians would be imprudent to retain the card catalog format solely by virtue of tradition.

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5. Liz Gibson, "BIBCON—a General Purpose Software System for MARC-based Book Catalog Production," *Journal of Library Automation* 6, no.4:237–56 (Dec. 1973).
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Reports and Working Papers

Report on the LITA Screen Design Preconference

Bill Drewett

The LITA Screen Design Preconference to the ALA Annual Conference, July 7–8, 1988, in New Orleans, is summarized. A one-day seminar by Wilbert O. Galitz on the elements of good screen design was followed by a second day devoted to more library-specific presentations, including the design of user-friendly screens, the desirability of standards for screen design, a look at screen design from the system buyers' point of view, how to manage a screen design project, and screen design issues for inputting bibliographic data. The program continued with a group discussion, which allowed critique of sample screens, and concluded with a wrap-up session.

LITA sponsored a two-day institute on screen design as a preconference to the ALA Annual Conference in New Orleans, July 7–8, 1988. About seventy attendees participated first in a day-long seminar on screen design issues conducted by Wilbert O. Galitz, whose *Handbook of Screen Design* (QED Information Sciences, 1985) was distributed in advance to participants and served as a basic text for the program. The second day of the preconference consisted of more library-specific presentations from a variety of speakers. Topics included the design of user-friendly screens, the desirability of standards for screen design, screen design from the point of view of system buyers, issues for managing a screen design project, and considerations in the design of screens for the input of bibliographic data. The institute concluded with a group discussion critiquing sample screens and a wrap-up session summarizing small group discussions in the context of the program as a whole.

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GALITZ' SCREEN DESIGN SEMINAR

User Considerations

Galitz emphasized screen design as an important concern in developing automated systems because good design tends to increase data entry speed and decrease errors and the time required to digest information from a system inquiry. He urged designers to understand the user and the nature of system use (discretionary/nondiscretionary, novice/expert), to involve the user in design decisions, to test prototype screens with end users, and to refine prototypes based on user evaluations. The typical user, he explained, has a limited, short-term memory; is overworked and constantly interrupted; and rarely reads documentation. The user's skills and abilities are often overestimated by system designers. Though a well-designed system will allow paths for both novice and expert users, Galitz recommended that, where compromises must be made, design be biased toward increasing the efficiency of the expert user, with the rationale that users typically move toward the expert as their familiarity with the system increases.

System Considerations

A variety of systemwide concerns also bear on screen design. For example, current recommendations for automated systems include the following:

- consistency throughout the system
- minimal complexity, or progressive disclosure of complex functions
- flexible paths for different kinds of users
- acknowledgment of actions by constructive, nonthreatening messages
- allowing recovery from mistaken action

- low variability in response time, with response normally at 0.4 to 0.9 seconds
- context-sensitive guidance or help that is easily accessible, concise, and hierarchical in structure

Guidelines for Screen Design

As a test for good design, Galitz asked, "Can the user look at a screen and identify all its component parts without reading any labels, just as one can identify parts of the front page of a newspaper without reading it?" To achieve this aim, Galitz recommended visually pleasing displays, with attention to balance, sequence, predictability, economy in use of space, and frequent use of logical groupings. Visual displays tend to be most beneficial when the display reinforces the functional or logical grouping of the data on the screen.

Complexity tends to clutter screens, leave users with a negative impression, and increase data entry or inquiry time. Galitz suggested a rough measure to gauge complexity: add the number of field elements on a screen, the number of columns containing starting points for field elements, and the number of rows that contain field elements. Aim to lower this figure by minimizing the number of columns that contain starting points for field elements and by using the fewest number of elements while still providing necessary information.

Screen density, or the percentage of character positions used or "lit" (characters containing visual information), similarly increases search time and errors. Research suggests that local density—the percentage of character positions used in the five-degree cone of greatest human visual perception—may be more important than the overall density in contributing to user perceptions of screen clutter. As a general rule, Galitz recommended displaying only essential information, limiting displays to one screen insofar as possible, and keeping density at 30 percent or less.

Text Displays

In text displays, studies suggest avoiding jargon; using short, direct, nonauthoritarian, nonpatronizing sentences; limiting text to forty to sixty characters per line; and using upper- and lowercase without right justification. (Both uppercase text and right justification tend to slow reading time.) Labels or captions, however, should be uppercased and should be separated from the text by some delimiter and at least one space. (Galitz preferred a colon as delimiter.) Captions for single occurrence fields are effectively placed to the left of the data; for multiple occurrences, placement above the data tends to minimize screen complexity. Right alignment of captions and delimiters, and left alignment of the data, similarly decreases complexity by decreasing the number of field elements starting in different columns. A library example of such placement might be as follows:

AUTHOR: Galitz, Wilbert O.
TITLE: Handbook of Screen Design
PUBLISHED: Wellesley Hills, Mass.: QED Information Sciences, 1985.

For multiple-occurrence fields, however, captions maximize usage of space if placed above the data:

——Descriptors——
Screen Design
Computer Displays
Human-Computer Interfaces

Galitz further recommended that text be highlighted, but preconference attendees felt that because text forms so much of a bibliographic display, highlighting would become irritating. Galitz agreed that in this case his general guideline did not seem to apply well. Both underlining and reverse video can also be used to set off text, but Galitz urged caution in their use. Underlining is a moderate attention getter; reverse video is normally more effective. Galitz added that the use of blinking text or audible signals, which can focus the attention of those other than the current user to the screen, require even greater caution. Otherwise, screens can become annoying or threatening and make the whole system unappealing.

Use of Color

People generally like color screens and tend conceptually to group like-colored screen elements. Designers may effectively exploit this tendency. Still, Galitz recommended first designing for monochrome and being conservative and consistent in

use of color. He suggested bright colors to emphasize elements, contrasting colors to separate them, and similar colors for logical groupings. Warm colors (red/orange) are appropriate where action is needed, center-spectrum colors (yellow/green) for textual material, and dark colors (blue/black) for background. He pointed out that, interestingly, spacing (using blank lines) is more effective than color in improving the legibility of dense text, again reinforcing his earlier guidelines for minimizing complexity and density.

Windows and Icons

Galitz viewed windows as providing a way to make a screen look a bit more like a desk top, with work in different windows simulating the different material spread out over one's desk. Not much research exists on the use of windows, though some suggest the *total* time required for completion of tasks in a windowed environment is greater than in a single-screen system. If time spent manipulating windows is discounted, however, the actual time on the task may diminish. Certainly windows offer much visual support to extend the user's short-term memory. Galitz offered interim guidelines until more research is done: (1) minimize the number of window-manipulating actions, (2) make it easy to set up windows, (3) speed the process of going between windows, (4) provide visual cues to the active window, and (5) provide cues for closing an active window.

Research is limited as well on the use of icons or direct manipulation as an alternative to keyboards. Icons, at best, provide a sense of user-initiated participation in the interface, exploit human visual and spatial cues, aid identification of the context of an action, and tend to give instant visual feedback after action is taken. However, icons may be less efficient for expert users, may not be preferred over a command language, and may be difficult to implement in some applications. Until research suggests otherwise, Galitz recommended that icons be used for very familiar objects and actions, that attention be given to designing easily recognizable symbols that clearly reflect the objects represented, and that symbols be limited to a dozen or so at a time. Designers need to test symbols for a match with user expectations of what is represented, to provide alternatives to icons for expert users, and to use alphanumeric labels if symbols might be confusing.

Data Entry, Inquiry, Multipurpose Screens, and Menus

Galitz separated data entry screens into those with a dedicated source document and those without. With a dedicated source document, the screen should match the source document as closely as possible so that the need to look at the screen, rather than the source, is minimized. Abbreviations and contractions are fine, since the screen will rarely be consulted, and guidance or help in completing the screen should rarely be needed. (The source document should be sufficient to answer questions if the screen matches it closely enough, and users should be trained and experienced.) Without a source document, the screen should be organized for greatest visual clarity—the user will often refer to the screen—and abbreviations or contractions should be avoided. Guidance or help screens are likely to be useful in answering questions about the entry process. Figures 1 and 2 illustrate a data entry screen with a source document: figure 1 is the screen Galitz was given, and figure 2 is his redesign. Figures 3 and 4 similarly show redesign of a screen for data entry without a dedicated source document.

Inquiry screens emphasize the data itself, hence Galitz' bias toward highlighting data. Like entry screens without a document, these screens are best organized for visual clarity and for logical groupings and flow. Galitz' redesign of the figure 5 inquiry screen is shown in figure 6.

Whereas different people use screens for different purposes, it is generally best to design separate screens for each purpose. However, if the same group of people will be using a screen for different purposes, a multipurpose screen, whose design is skewed toward the most frequent type of use, may be required.

Menu screens can clarify system options and ease access to desired functions. Galitz cautioned, however, that menus should present only *relevant* alternatives, should

```
INSURED NAME NORMAN GRAHAM                          PRODUCER JACKSON
POLICY NO    HM332 88753254                      PLACING OFC GREAT FALLS
********** WORK IN PROGRESS DISPOSITION **********

RATE LATER _     PRINT _

SUSPEND _     DENY _     REJECT _     ERASE _
    REASON CODE __       TEXT _____________________________

QUOTE _     PRINT _
    QUOTE OPTIONS __ __ __ __ __

ISSUE POLICY _
    POLICY NO. _____________     USE CAPTION NO. __

ISSUE BINDER _
    BINDER NO. __________     PERIOD   __/__/__ TO __/__/__
    BILL BINDER _             PREMIUM  ________
NEXT FOLLOW UP DATE    __/__/__
```

Fig. 1. Original Screen for Data Entry with Source Document.

```
                    WORK IN PROGRESS DISPOSITION

  INSURED NAME: NORMAN GRAHAM                    PRODUCER: JACKSON
     POLICY #: HM332 88753254                  PLACING OFC: GREAT FALLS

DISPOSITION
 ---------------------
 |       QUOTE: _    | )   PRINT: _   OPTIONS: __ : __ : __ : __ : __
 |  RATE LATER: _    | )   PRINT: _
 |                   |
 | ISSUE POLICY: _   | ) POLICY#: _____________   USE CAPTION #: __
 |                   |
 |     SUSPEND: _    | )  RSN CD: __ TEXT: _____________________________
 |        DENY: _    | )  RSN CD: __ TEXT: _____________________________
 |      REJECT: _    | )  RSN CD: __ TEXT: _____________________________
 |       ERASE: _    |
 ---------------------

SUSPEND / QUOTE ONLY
     BINDER ))   ISSUE: _          #: __________
          DATE ) FROM: __ __ __   TO: __ __ __   NEXT FOLLOW UP: __ __ __
                 BILL: _    PREMIUM: ________
```

Fig. 2. Redesigned Screen for Data Entry with Source Document.

```
INSURED NAME LORETTA JANKOWSKI                    PRODUCER BANNERMANN
POLICY NO    AU782 95673457                      PLACING OFC TUCUMCARI
********** AMENDMENT OF DECLARATION DISPOSITION **********
END FORM NO. J633412 EFFECTIVE DATE 01/26/85   PREMIUM 612.96
TITLE EXCEPTIONAL PERFORMANCE
                  RECOMMENDED BILLING STATUS ANNUALLY

_ RATE NOW  _ RATE LATER

_ SUSPEND    _ DENY  _ ERASE                                  ACTION DATE
    REASON CODE __     TEXT ____________________________      __/__/__

_ ISSUE WITHOUT MATH EXTENSIONS

_ ISSUE                                                  _ REVISE FUTURE PYMTS
    OVERRIDE STATUS OF  _ AT AUDIT  _ INVOICE NOW  _ REVISE PAST/FUT PYMTS
```

Fig. 3. Original Screen for Data Entry without Source Document.

```
                    AMENDMENT OF DECLARATION DISPOSITION
    INSURED NAME: LORETTA JANKOWSKI                  PRODUCER: BANNERMANN
      POLICY #: AU782 95673457                     PLACING OFC: TUCUMCARI
     ENDT FORM#: J633412                              PREMIUM: 612.96
         TITLE: EXCEPTIONAL PERFORMANCE             BILL STATUS: ANNUALLY
                                                   EFFECTIVE DATE: 01/26/85

RATE / ISSUE DISPOSITION
   ----------------------
  |            ISSUE: _  |
  | ISSUE W/O RATING: _  |
  |        RATE NOW: _   |
  |      RATE LATER: _   |
  |                      |
  |          SUSPEND: _  |  )  RSN CD: __ TEXT: ____________________________
  |                      |      FOLLOW-UP DATE: __ __ __
  |             DENY: _  |  )  RSN CD: __ TEXT: ____________________________
  |           ERASE: _   |
   ----------------------
BILLING DISPOSITION
              INVOICE ))          NOW: _          AT AUDIT: _
      REVISE PAYMENTS ))       FUTURE: _      PAST/FUTURE: _
```

Fig. 4. Redesigned Screen for Data Entry without Source Document.

```
TOTALS ))  BILLED    N/C AMT    BASE DED   BASE PD    INJ EXP    MAT DED   RX DED
           1000.00    2000.00                3000.00
 MEDR DED DNTL DED MM ELIG    MM DED    COINS       MM PAID    DRAFT     STAT
                   8000.00    100.00     980.00     3920.00   01/01/80  010

COB ))    ALLOW CHG      ALLOW N/C      PR EXP CRDT      TOT ALLOW CHG
          8000.00                                        8000.00
          OTHER PAYMT    UNPAID BAL     BEN PAYABLE      BEN CRDT     TOT PAYMT
           5000.00        3000.00        6920.00          3920.00      3000.00
SERVICES
 BEN  PROC  S/M ZIP  FROM      TO DATE   OCC WKS DYS   T/NO T/SUF    BILLED
 200  00540 S   606  11/01/79 12/01/79  30                          1000.00
    N/C AMT  CD     MDCR PD     AMT DUE   OFFSET     BALANCE       PROV
     2000.00 A
    INJ EXP    MAT DED   RX DED   BASE DED BASE PD                  DCN
                                             3000.00                H7934612345
    MM ELIG    MM DED    COINS    MM PAID  XDCN          EOB   OVR  POOL  RVSL
     8000.00    100.00    80%       3000.00               1          N
```

Fig. 5. Original Inquiry Screen.

be grouped hierarchically and not overlap, and should allow immediate access to frequent or critical actions. Generally, menus are more useful if depth (the number of screens required to get to a desired function) is minimized, but Galitz recommended limiting choices to four to eight per screen unless there is an obvious and logical breakdown of choices. A "natural" order of choices, if one exists, is desirable. Lacking a natural sequence, one should order by frequency if about eight or less choices exist and alphabetically if more than eight. Research indicates that ordinal codes rather than mnemonic are generally preferable and that either ordinal or mnemonic codes are desirable if more than five choices are possible. (With five or less, use of a mouse or some highlighting technique seemed no less efficient than some kind of coding.)

```
------ TOTALS ------- -- COORD OF BEN --- ------------ SERVICES -------------
  BILLED:   1000.00 !ALOW CHG:   8000.00 !  BEN CD:    200    ! BALANCE:
 N/C AMT:   2000.00 !ALOW N/C:           !    PROC:    540    !  PROV:
BASE DED:           !PR EX CR:           !SIN/MULT:      S    ! INJ EXP:
 BASE PD:   3000.00 !TOT ALOW:   8000.00 !     ZIP:    606    ! MAT DED:
 INJ EXP:           !                    ! FROM DT: 11/01/79  !  RX DED:
                    !                    !   TO DT: 12/01/79  !BASE DED:
 MAT DED:           !OTHR PAY:   5000.00 ! OCC CD:     30    ! BASE PD:   3000.00
  RX DED:           !UNPD BAL:   3000.00 ! A/S WKS:          !  DCN: H7934612345
MDCR DED:           ! BEN PAY:   6920.00 ! A/S DYS:          ! MM ELIG:   8000.00
DENT DED:           !BEN CRED:   3920.00 !  TOOTH#:          !  MM DED:    100.00
                    ! TOT PAY:   3000.00 !TOOTH SF:          !   COINS:     80%
 MM ELIG:   8000.00 !                    !  BILLED:   1000.00 ! MM PAID:   3000.00
  MM DED:    100.00 !                    ! N/C AMT:   2000.00 ! XDCN:
   COINS:    980.00 !                    !  N/C CD:         A !     EOB:         1
 MM PAID:   3920.00 !                    ! MDCR PD:           !    OVER:
 DRFT DT: 01/01/80  !                    ! AMT DUE:           !    POOL:         N
ISS STAT:      010  !                    !  OFFSET:           ! REVERSL:
```

Fig. 6. Redesigned Inquiry Screen.

Perhaps most important, Galitz urged that expert users be allowed direct access to functions without recourse to intermediate menus.

PRINCIPLES OF USER-FRIENDLY SCREENS

The second day of the institute was devoted to more library-specific presentations. Stephen Silberstein (executive vice-president, Innovative Interfaces, Inc.) summarized his beliefs and experience in designing easily used screens. Silberstein emphasized that developing good screens may well take more time than programming for desired functionality. He felt that about eight menu choices was an optimal figure and preferred to place exits at the end of the menu and obvious or likely choices toward the top or beginning. He considered the screen a "valuable and limited piece of real estate" and was critical of clutter from extraneous data like date, time, and barcode numbers. Like Galitz, he found screens with mostly uppercase data to be visually unappealing and awkward to use. Unlike Galitz, however, he preferred mnemonics as codes for menu choices and liked repeating menu choices on the command line; he felt the clarity of choice offset the loss of screen area due to redundancy.

Preconference attendees were uncomfortable with Silberstein's recommendations in cases where single-letter mnemonics had different meanings as the user traversed from one screen to another. Silberstein granted that single-letter mnemonics are likely to be inconsistent through an entire system. He felt strongly that guidance should be an integral part of a system and, in fact, that systems requiring separate help screens should be redesigned! Silberstein disliked displaying neighboring or "near-hit" search results for a search with no exact matches unless there is some explicit indication on the screen why the display is *not* exactly what the user requested. Attendees, however, liked the browsability allowed by displaying results close to the unmatched search string.

STANDARDS FOR SCREEN DESIGN: PROS AND CONS

George Rickerson (director, Office of Library Systems, University of Missouri) discussed the desirability of screen design standards. Though standards might well make it easier to move from system to system, Rickerson had some concern about codifying standards at this point. Variant user interfaces did not come as a result of automation—printed reference sources are

quite different in format and approach, and print sources may be less self-evident in use than many automated systems. A local workstation that allows searching all desired reference tools through some transparent query analysis and routing system would have the same effect as standards for screen design. Further, even good sources for designing screens (like Galitz' handbook) require constant revision as technology advances. Such sources tend to be business-, not library-, oriented. (Compare Williams' opposing view below.) Nonetheless, standards would be of some advantage:

- Automation provides an opportunity to standardize interfaces that did not exist in the past.
- Users need learn standardized interfaces only once.
- Systems might be more quickly developed or enhanced if less time need be devoted to designing screens.

Significant disadvantages may counterbalance these, however:

- The current state-of-the-art of technology seems to mitigate against formation of standards.
- Not enough research exists on the use of automated systems to be certain that standards result from objective judgments.
- The nature of the user interface is often an important part of the marketing of library systems, so standards would be unlikely to be implemented on top of successful existing systems.
- Standards might codify existing practice and prevent or hinder the development of appropriate screens for newer technologies.

Some members of the audience felt that library vendors *would* respond to a significant demand for standards, whatever their current proprietary interest. Others saw standards as more problematic than did Rickerson: screens are the result not just of design but also of hardware and software considerations in the solution of a given library functional problem, so adopting a standard may be unrealistic. Layers of standards, however, starting perhaps with standard terminology in labeling, might be possible. The draft command language standard, for example, allows a range of command names rather than specifying a particular command; similar flexibility might apply to screen guidelines.

Further discussion pointed out that users, when queried about screens, respond based on their current system experience; so surveys of screen preferences might not lead to general guidelines for good design. Some attendees felt that the library user population is so heterogeneous that a spectrum of standards for different types of users, rather than a single design standard, might be necessary.

SCREEN DESIGN FOR THE SAVVY CONSUMER

Joan Frye Williams (director of Client Services, Inlex) surveyed screen design from the point of view of system purchasers. Library systems are, after all, purchased one way or another—systems developed in-house must be "purchased" by governing boards since the boards must be sold on the idea of developing a system. Sales choices tend to be made on the basis of price, vendor reliability, and (very) detailed functionality. In such an environment, good screen design is often not relevant to "selling" a system, so it is not a high priority with system vendors. Williams identified elements of the automated system sales environment that mitigate against good screen design and suggested possible solutions:

- *Schizophrenia*: Systems are not bought by their most frequent users and tend to compromise toward some mythical "middle ground"; it is important to involve end users in all phases of a system evaluation.
- *Management Overload*: Since managers who actually buy library systems have many other concerns, they often seek a quick solution by surveying standard library journals and by hiring consultants, few of whom are versed in or concerned about screen design. Perhaps an aggressive publishing effort in journals like *American Libraries* and *Library Journal* (rather than *Information Technology and Libraries*!) is needed to summarize the benefits of attention to good screen design.

- *Verbal Bias*: Librarians tend to be more comfortable with words than numbers and more comfortable with numbers than with visuals. Only individual work toward developing a more visual orientation may help here.
- *Parochialism*: Librarians tend to discount research from other fields. A better approach might be to welcome and pay attention to such research and to be more open-minded about its applicability in a library environment.
- *Orientation to Detail*: Library education certainly encourages specificity and attention to detail, which may encourage librarians to favor detailed, cluttered screens. Perhaps a boilerplate specification sheet on screen design would help.
- *RFPs:* The RFP drives library system sales, and it is almost never innovative but derived from previous RFPs. Since librarians are most familiar and comfortable with describing the functionality of a system, functionality consumes the vast majority of RFPs and screen design rarely gets more than cursory treatment. Again, a boilerplate specification that could be easily copied might result in a more prominent place for screen design in the sales process.
- *Ignorance and Fear*: Those who make purchase decisions often do not really understand technical issues and fear failure, since many horror stories point to jobs lost over automation decisions. Vendor research, even when valid, is often viewed as a marketing ploy. Such an environment hardly encourages innovative decision making, so perhaps the field should foster and spread good news to balance the bad.

Preconference registrants agreed that screen design is an insignificant part of the RFPs that drive the development and sales of library systems. Further, RFPs tend toward the quantitative, aiming for *more* features, not *better-designed* features. Perhaps the better RFP is the less-detailed one, satisfying the funding authority but allowing maximum flexibility for the library buyer to shop for the most appropriate system.

MANAGEMENT ISSUES IN SCREEN DESIGN

John Kupersmith (assistant for Computer Based Information Services, General Libraries, University of Texas at Austin) viewed screen design as integral to systems design. He argued that screen design questions are best considered in the context of the whole system and are, in fact, amenable to group process. A good screen design group has competencies in design, the structure of the application database, hardware/software constraints, and negotiation with vendors. The group should be in a position to make or influence systemwide decisions, should be quite familiar with the characteristics and needs of system users, and should be able both to lobby for the system (especially among library staff) and to obtain feedback from staff and from library users.

Kupersmith recommended a straightforward methodology. Start first with the simplest screen, test it, and redesign as necessary. Move on to the most similar screen; design and test it; then move to the next most similar, and so on. At various points in the design process, it will be likely that testing suggests changes to the original, most simple design, so allow as much flexibility as is feasible. To aid flexibility, take advantage of software for screen mapping, word processing templates, and electronic mail.

Despite Kupersmith's strong bias for group design, some attendees felt that a committee will invariably design a camel rather than a horse. Work done by an individual designer, followed by group review, may avoid compromise decisions and speed the design process.

DESIGN ISSUES IN SCREENS FOR CREATING BIBLIOGRAPHIC DATA

Lennie Stovell (library systems analyst, Research Libraries Group) discussed the design of screens for the input of bibliographic data in the context of Galitz' guidelines for data entry screens. She noted that input is likely to be done by trained, nondiscretionary users but that a source document may well not exist. The card catalog or MARC is not really intended as a source document, and for original cataloging, no document at all will exist. Thus designers of screens for bibliographic input cannot as-

sume the existence of a standard source document. Nonetheless, MARC has virtually become a source document, with MARC tags acting as captions or labels for fields, and experienced users can recognize MARC tags quickly. In practice, if a source document exists, it will be a worksheet designed by the library to fit the system screen, the reverse of the situation for which Galitz suggested guidelines!

Stovell felt that bibliographic applications do have peculiarities that complicate design. Bibliographic data is indeed very unpredictable—variable in both the number and length of data elements—and it is difficult to set a legitimate maximum field length in most cases. The nature of the data makes it difficult to know the width and number of columns sufficient for data entry. This may have encouraged designers to develop more complex screen arrangements than in other applications.

Stovell concluded that Galitz' guidelines could be of some help in a library application as long as the peculiarities of the data were kept in mind. MARC tags do provide logical groupings in a way that Galitz recommended, since similar tags tend to have similar meanings. Designers might profitably work to exploit these groupings and to pay more attention to columnar spacing, which Galitz suggests can help decrease complexity and increase the visual appeal of screens.

INSTITUTE WRAP-UP

Small group discussions, designed to allow attendees to critique sample screens in the context of the previous presentations, followed Stovell's presentation. Christine Borgman (Graduate School of Library Science, UCLA) summarized the discussion for the group as a whole and brought the program to a close.

Borgman first offered comments on Galitz' presentation the previous day. Galitz, she felt, centered on command language screens and spent little time on direct manipulation (use of icons), an increasingly popular form of interface. He also limited discussion to the traditional twenty-four-by-eighty alphanumeric display screen, despite increasing use of more graphic displays. His approach to complex problems was at times rather matter-of-fact. A study pointing to one design solution is often countered by a second study in another environment; and since many studies center on a single application, generalizing about results may be hazardous. Galitz' conclusions, too, can conflict with one another rather quickly when applied to a real design problem; it would be helpful to have a sense of the priority of his suggestions. Like Stovell, Borgman viewed library data as lengthy and unpredictable, and she cautioned that Galitz' findings tended to result from research based on relatively short, fixed-length data in insurance and airline applications. It is legitimate to question to what degree such guidelines are useful in the library environment, especially since Galitz announced a bias toward the expert user, and libraries tend to have a constant stream of novice users who are unlikely ever to become experts. Nonetheless, Borgman agreed that Galitz put considerable effort and thought into his work and that his suggestions are at least as valuable as any other published guidelines.

Borgman indicated that small group discussions had shown considerable consistency in pointing to areas of concern. Typical questions included the following:

- What knowledge of user behavior can we apply to designing displays?
- How can we best evaluate the effectiveness of displays?
- How can we design effective displays but still allow flexibility to incorporate such new technologies as high-resolution graphics, enhanced ability to use color, and interfaces that bypass keyboard interaction?
- How will new kinds of software like hypertext and expert systems influence screen design and information retrieval?

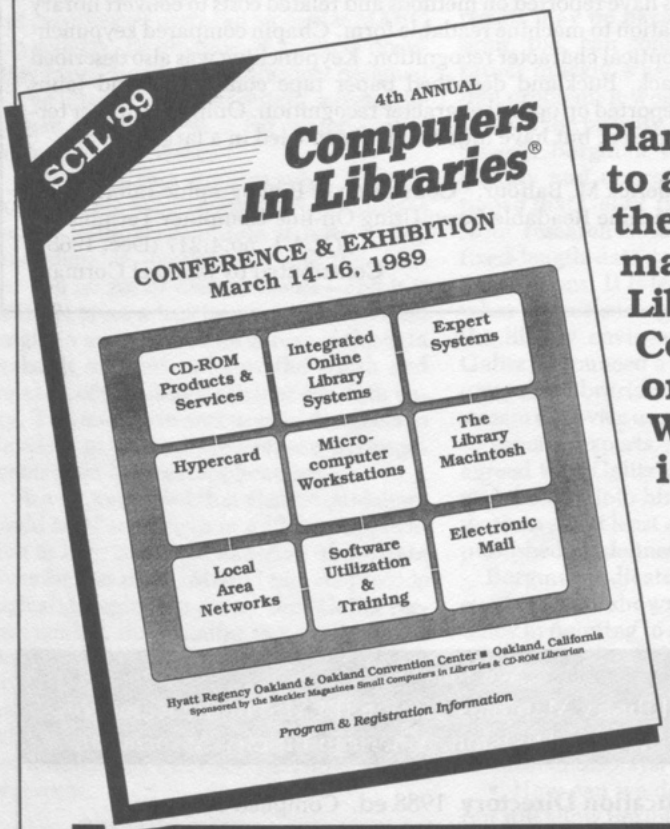
Borgman added that library school students, when asked to evaluate library system displays, asked similar questions. She concluded by posing some questions for future ALA groups to consider:

- If standards are developed, will they simply mirror the concerns of the most vocal groups?
- In a highly specific application, such as cataloging, why not use jargon?
- Should users themselves decide how displays are organized?
- How does one know what is really *needed* on a given display? ■■

Twenty Years Ago in JOLA

Several recent articles have reported on methods and related costs to convert library bibliographic information to machine readable form. Chapin compared keypunching, paper tape, and optical character recognition. Keypunching was also described by Hammer and Black. Buckland described paper tape conversion, and Johns Hopkins University reported on optical character recognition. Online computer terminals have been proposed, but have hitherto not been tried in a large library.

Frederick M. Balfour, "Conversion of Bibliographic Information to Machine Readable Form Using On-line Computer Terminals," *JOLA* 1, no.4:217 (Dec. 1968).
Contributed by Michael Gorman.



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News and Announcements

Barbara E. Markuson Wins LITA/Gaylord Award

Barbara E. Markuson, executive director of the Indiana Cooperative Library Services Authority (INCOLSA), is the recipient of the 1988 Library and Information Technology Association (LITA)/Gaylord Award for Achievement in Library and Information Technology.

The $1,000 cash award and citation recognizing achievement in library and information technology are donated by Gaylord Brothers of Syracuse, N.Y. Administered by the LITA/Gaylord Award Committee, the award is given in recognition of distinguished leadership, notable development of application of technology, or superior accomplishment in research, education, or original contribution to literature in the field.

The 1988 award was presented in recognition of Markuson's leadership in shaping the development of library automation and development over the past two decades.

"Barbara Markuson combines a strong commitment to library cooperation with a clear and unambiguous understanding of the role automation must play in developing a nationwide system of library resource sharing," said Louella Wetherbee, chair of the LITA/Gaylord Award Committee.

"From her early participation in the Library of Congress' MARC format development to her current leadership role as a network director, Barbara Markuson has never lost sight of the fact that networking proceeds from the bottom-up and not the top-down. She has led scores of libraries through the arduous process of linking automation with networking to enhance local access.

"By her dedication, scholarship, and professionalism, Markuson plays a key role in the nation's network," said Wetherbee.

The award was presented by LITA President William Gray Potter and Stephan Hofflich, vice-president and general manager of Gaylord Information Systems, at the LITA President's Program during the American Library Association's Annual Conference in New Orleans. ■■

LC Contributing Authority Records through Linked Systems Project

On May 13, 1988, the Library of Congress (LC) Serial Record Division began contributing new and changed authority records to the OCLC authority file using OCLC's Linked Systems Project (LSP) authorities implementation.

Records created or changed by the division are related to LC's CONSER cataloging activities and can be identified by the National Union Catalog symbol DLC-S in field 040 of the authority record.

With the addition of LC, four OCLC/National Coordinated Cataloging Operations (NACO) institutions are now creating or changing authority records in the OCLC authority file. They include Indiana University Libraries; the Slavic and East European Library at the University of Illinois, Urbana–Champaign; and OCLC's online data quality control section. The new or edited records are transmitted online to LC.

The LSP involves computer-to-computer links between the Library of Congress, Research Library Information Network (RLIN), and OCLC. The National Coordinated Cataloging Operations Program (formerly the Name Authority Cooperative Project) is the initial phase of the applications component of LSP. The program will eventually include transfer of bibliographic information between networks. ■■

Personal Bibliographic Software Announces *Pro-Cite* 1.4

Personal Bibliographic Software (PBS) has announced the release of *Pro-Cite* version 1.4 for IBM personal computers and compatibles. *Pro-Cite* is a database management system designed to manage references and format bibliographies automatically.

Pro-Cite 1.4 offers users many options for building a personal database. The program includes twenty predefined work forms such as journal, book, and dissertation and six forms users can design for specific needs. After a form has been chosen, users can enter information or, using *Biblio-Links*, automatically transfer records retrieved from an online database into *Pro-Cite*, where records can be searched, sorted, edited, indexed, and formatted into citations according to any bibliographic style.

This version of *Pro-Cite* offers many new features that make the program more versatile and efficient. These new features include the removal of copy protection and a rewritten, comprehensive manual. *Pro-Cite* 1.4 includes special medical and chemical disks containing sample scientific databases, NLM and ACS journal authority lists, and punctuation files containing dates, names, and updated stylesheets for biomedical and chemical journals. Other features include improved support for ANSI standard format of printing and the ability to limit the "find and replace" feature to specific fields for handling complex changes to the database. Users can also model new work forms after existing ones.

Pro-Cite automatically formats bibliographies according to many standard punctuation styles. Punctuation for ANSI, APA, MLA, Science magazine, and more than twenty other formats are included. The program also helps users modify existing punctuation files or design their own.

Other PBS products for IBM personal computers and compatibles include *Pro-Search*, a specialized front-end search aid program for easy searching of BRS and Dialog online database services, and *Biblio-Links* to BRS, Dialog, MEDLARS, USMARC, STN, OCLC, and RLIN. *Pro-Cite* and *Biblio-Links* to BRS, Dialog, and MEDLARS are also available for the Macintosh.

Pro-Cite 1.4 is available for $395. Upgrades to *Pro-Cite* 1.4 from 1.2 (or lower) are $95, and upgrades from *Pro-Cite* 1.3 are $45. Free customer support and a thirty-day return policy are available for all PBS products. ■■

National Newspaper Index Available on CD-ROM

Information Access Company has begun delivering its widely used *National Newspaper Index* (*NNI*) on InfoTrac (CD-ROM format). Several thousand public and academic libraries currently offer *NNI* to their patrons in a microfilm format.

National Newspaper Index provides three years plus the current year of indexing to the *Wall Street Journal*, *New York Times*, *Washington Post*, *Los Angeles Times*, and *Christian Science Monitor*. All indexing is done by Information Access Company indexers and editors, which results in consistent subject headings and language throughout the database. ■■

Nominations Sought for Second NCLIS Recognition Award

The U.S. National Commission on Libraries and Information Science (NCLIS) requests nominations for the second year of an annual award to honor initiative in improving and promoting the nation's library and information services. The award, established in 1987, recognizes the best initiative taken by an individual or nongovernmental, nonlibrary organization in improving and promoting library and information services in the previous calendar year. The second NCLIS Recognition Award will be presented in Washington, D.C., in spring 1989.

NCLIS is a permanent, independent agency of the federal government established by Public Law 91-345 in 1970 to advise both Congress and the president on library and information service needs of the nation.

Nominees for the NCLIS award must be American citizens or nongovernmental, nonlibrary organizations, including busi-

nesses, trade unions, charitable institutions, and voluntary associations or groups. The initiative that improved or promoted library and information services must have been performed within the United States or its territories.

Nomination forms and additional information are available from Recognition Awards, U.S. National Commission on Libraries and Information Science, 1111 18th St., NW, Ste. 310, Washington, D.C. 20036. The closing date for submission of entries is January 13, 1989. ■■

OCLC Acquires Forest Press, Publisher of Dewey Decimal Classification

OCLC Online Computer Library Center has acquired the rights to the Dewey Decimal Classification (DDC) system and the assets of its publisher, Forest Press of Albany, N.Y., from the Lake Placid Education Foundation.

The DDC is the world's most widely used classification system for library materials. An estimated 200,000 libraries in more than 135 countries use DDC in English or one of its thirty foreign-language translations.

Melvil Dewey created his innovative classification system in 1873 and first published it in 1876. He established Forest Press in 1911 to edit, publish, and distribute the classification. Since then, the DDC system has been continuously revised and expanded through numerous editions to keep pace with the ever-expanding realm of human knowledge.

OCLC will explore publishing electronic versions of the DDC, as well as continuing the ongoing revision and publication in print form, and Forest Press offices will remain in Albany, N.Y. ■■

100th Installation of NOTIS

NOTIS Systems has announced the 100th installation of its library automation software package, at Indiana University. The system was installed on an IBM model 3084 in a shared environment.

Indiana University Libraries have a collection of more than 4.6 million volumes in a system of more than thirty libraries on nine campuses statewide. A prototype catalog has been loaded with approximately 1 million records.

Indiana University becomes the 83d academic institution to join the growing NOTIS-user family that includes corporate, special, and public libraries of all sizes throughout North and South America.

Indiana University is also the 12th NOTIS System installation for 1988. ■■

CLSI Now Providing UNIX-based Systems to Small Libraries

CLSI has announced the *Series 1050 System*, developed to meet the needs of small libraries with limited budgets. The *1050 System's* industry-standard UNIX operating system, using CLSI's tested, full-function application software, provides the same capability as CLSI's *LIBS 100 Systems* for large libraries. The *1050* is an automation system for libraries needing up to twenty-four terminals and with approximately 100,000 or fewer titles.

The system operates on an Altos 2000 computer, manufactured by Altos Computer Systems in San Jose, California. The basic software package for the CLSI *1050 System* provides modules for database management, cataloging, circulation control, and can include the online public access catalog, CL-CAT. Optional modules are available for the automation of acquisitions, networking, serials control, and reserve book room.

The *1050 System* is under two feet high, eight inches wide, weighs less than seventy pounds, and can operate in a regular office environment. Small libraries can automate for less than $40,000, depending on the software modules chosen, the number of terminals needed, and the size of their collections.

Lease programs for CLSI's *Series 1050 System* are also available. ■■

Yale Signs with Blackwell North America for Authority Control

The Yale University Library has signed a contract with Blackwell North America under which Blackwell will apply authority control to Yale's MARC file of approxi-

mately 780,000 records in preparation for loading the records into the library's online public access catalog. Blackwell delivered the library's edited bibliographic file and related authority records in August 1988, whereupon they were loaded into the library's NOTIS system.

Blackwell North America specializes in the supply of North American books and bibliographic support services worldwide. The technical services division of Blackwell is a pioneer in the area of automated authority control. Blackwell's service provides up-to-date Library of Congress authority control for names, series, uniform titles, and subjects in MARC records. In addition, library-specific LC authority files are provided for use as cross-references in online catalogs. ■■

Gaylord Introduces SuperCAT

Gaylord Information Systems (GIS) has announced SuperCAT: The Cataloger's Powerstation. SuperCAT is a CD-based, stand-alone cataloging workstation incorporating all the features of the GIS Spectrum 400 product, with a number of additions.

Version 3.0 of SuperCAT includes LC MARC English—all bibliographic formats—on two compact discs, with an optional third disc containing all formats of LC MARC foreign. It has the COMPARE feature, which compares similar or related records and highlights differences—the user chooses the most appropriate record. Other features include

- cataloging session statistics;
- user-defined "power keys" to reduce repetitive command entry;
- new books list generation;
- volume and copy number generation, including broken sets; and
- enhanced output flexibility.

These add to such standard GIS cataloging features as format-specific templates for original cataloging, color monitor support, professional documentation, and a MARC/BISAC link to create a BISAC-format order from a MARC record.

For a free demo diskette and quick reference card, write to GIS SuperCAT, P.O. Box 4901, Syracuse, N.Y. 13221-4901; or call, toll-free, 1-800-345-5330. ■■

OCLC Demonstrates Apple Macintosh-compatible Version of its Search CD450 Reference Products

OCLC is testing a prototype version of its Search CD450 CD-ROM reference system designed for operation with the Apple Macintosh personal computer. The prototype was demonstrated at the Annual Conference of the American Library Association in New Orleans. The new Macintosh-compatible version takes advantage of icons and menus, producing simplified intuitive searching for both experienced and novice searchers.

The Macintosh-compatible version of Search CD450, which will be available in

Twenty Years Ago in JOLA

Historically, compression techniques for word coding have been designed for both encoding and use by humans. [This article] . . . described . . . some codes requiring computers for practical encoding usable by humans. As files grow larger and directory code generation becomes more demanding, it is likely that alphanumeric concessions to human readers will be eliminated in favor of more efficient use of the code space. The codes presented here, however, appear quite useful for many present applications in information retrieval.

William R. Nugent, "Compression Word Coding Techniques for Information Retrieval," *JOLA* 1, no.4:260 (Dec. 1968).
Contributed by Michael Gorman.

late fall 1988, will work with all reference databases offered in the OCLC Search CD450 product line, currently numbering fourteen.

The Search CD450 CD-ROM reference system currently is available for use only on IBM compatibles.

Order forms and pricing information for the Search CD450 System and the Macintosh-compatible version are available from OCLC participating network offices or the OCLC Electronic Publishing and Information Delivery Division through toll-free numbers: 1-800-848-5878, in Canada 1-800-533-8201. In Europe contact the OCLC Europe office in Birmingham, England: 021 236 3224. ■■

Eyring Announces Impression

Eyring has announced the availability of a new automated product for libraries called *Impression*. This product is designed to store images in a cost-effective and compact manner.

Impression is a PC-based, stand-alone document archival and retrieval system, providing online patron access to valuable materials without the disadvantages of excess handling of fragile originals. The system uses conventional magnetic media on IBM PCs or compatibles. The storage capacity is more than 1,000 five-by-seven images on twenty megabytes of hard disk. The images can also be accompanied by text entered by the library or archives and is searchable by multiple search keys determined by the library.

Potential library applications include the storage and retrieval of images like photographs, historical records, manuscripts, maps, schematics, etc. The product was originally developed to store instructions and technical diagrams for the aerospace industry. ■■

Statement of Ownership and Management

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Recent Publications

Book Reviews

Desmarais, Norman. *Acquisitions Systems for Libraries.* The Essential Guide to the Library IBM PC Series, V.11. Westport, Conn.: Meckler, 1988. 246p. spiral-bound, $29.95 (ISBN 0-88736-185-4).

Computer software packages designed to assist in automating technical service tasks continue to grow in number; and the acquisitions process is no exception. Many vendors offer online assistance in ordering and claiming. Also, database management packages are becoming increasingly trustworthy in the area of automating acquisitions. The possibility of bringing all phases of acquisitions activity together in one system, however, is still an attractive ideal. Large integrated library systems offer many services to their users, and PC systems are in the process of matching these services. PC systems developed for acquisitions are analyzed in this work.

Ten commercially available acquisitions systems are described and compared by Desmarais in this volume. These acquisitions systems perform fund accounting as well as standard acquisitions tasks using an IBM PC/XT/AT or compatibles.

The first chapter covers issues important in planning an automation project or in reorganizing an entire acquisitions process. Issues covered are ordering, fund accounting, receiving/paying, claims, inquiry, management, reports, interfaces, screen displays, and costs. Each issue is discussed clearly, and questions applicable to automating a particular task are presented. The chapter closes with a checklist of features for each issue.

Chapters two through eleven present the acquisitions systems Desmarais has chosen to analyze. The specific features of each system are identified in flush-left italic headings. Then, whenever possible, these features are arranged by the issues discussed in chapter one, allowing the reader to remain constantly aware of the questions that need to be answered before successfully applying the system to acquisitions tasks in a particular library.

Each system is presented according to its own structure; therefore, the chapters are different in organization as well as in text. One chapter may begin with an explanation of the ordering capabilities of a system, while the next may begin with fund accounting or management. The strength of this organization is that each system is presented independently from the others, making the reader aware of exactly how the producers expect the system to react to the acqusitions process. The weakness of the organization is that the reader is given only the producer's viewpoint. There are no examples from Desmarais verifying that a function works as described or that the system performed well during a specific test.

The chapters covering the systems always include the specifications for the system, the price, and the producer. Desmarais also provides the reader with examples of screen displays and reports for eight of the systems presented.

Chapter twelve presents five electronic ordering systems developed by vendors. These systems are presented briefly, giving the order procedure followed by whatever features distinguish the system. The specifications for each system are at the end of the chapter. As these systems do not offer a complete list of acquisitions functions, they are not studied as completely as those in chapters two through eleven.

Chapter thirteen is a conspectus in which Desmarais compares the features offered in chapters two through eleven. He uses the issues discussed in chapter one to organize this chapter. The last three pages contain a chart in which the features of each system

are plotted against the checklist of features from chapter one. If the reader is using the volume to assist in the purchase of software, the chart assists in keeping track of the systems that meet the specifications desired. For instance, if the reader is unable to remember which systems override default claims, the chart makes it clear that four of the systems will provide this feature.

In his conclusion Desmarais discusses possible future developments in acquisitions systems. CD-ROM drives, the BISAC standards, and the impact of these technologies are included within this section.

The index is disappointing. The terms listed appear to represent only the material from the vendors. There are only four *see references* and no *see also references*. The checklist of features (83 terms) used in chapter one and the conspectus contain many of the terms I looked for in the index. Only nine are carried there, and many appear as related terms. For instance, "automatic transfer to new fiscal year" is not in the index. The index entry is " 'fiscal year changeover' *see* 'year-end procedure.' "

As the title of the series suggests, this volume is a guide, and I recommend it for personal collections and libraries beginning to investigate the automation of acquisitions procedures. I would hesitate to consider it a necessity for library technology collections because information about the systems changes quickly and the format, in my opinion, is not conducive to the study of acquisitions.—*Carol M. Kelley, Texas Tech University Libraries, Lubbock.* ■■

Developing Microcomputer Work Areas in Academic Libraries. Ed. by Jeannine Uppgard. Small Computers in Libraries, no.5. Westport, Conn.: Meckler, 1988. 124p. $37.50 (ISBN 0-88736-233-8).

According to a variety of recent management studies, organizations typically follow four phases of development as they introduce and assimilate new technology (see, for example, F. W. McFarlan, and K. L. McKenney's book, *Corporate Information Systems Management*, Irwin, 1983). First, they identify the technology and make an initial investment. Second, success at the early stage leads to increased interest, a rapid and substantial additional investment, and widespread experimentation throughout the organization in the application of the technology. Third, as the technology and its use become better known, management begins carefully to weigh costs, identify areas of waste and inefficiency, and exert fiscal and other controls to ensure that the application of the technology meets the overall goals and priorities of the organization. Finally, as the technology matures, its use becomes routinized and fully integrated within the organization and the stage is set for the introduction of new or related technology.

Developing Microcomputer Work Areas in Academic Libraries presents five case studies that illustrate important aspects of the first two stages—initial investment and then proliferation and experimentation—in the development of microcomputer technology for patron access and use in academic libraries. The studies are drawn from five state institutions: University of Wisconsin–Parkside, State University of New York at Geneseo, Raymond Walters College at the University of Cincinnati, California Polytechnic State University, and Rhode Island College. A concluding essay by Peggy Seiden of Carnegie-Mellon University provides a concise, cogent, and thorough analysis of the concerns that library managers—like those writing the case studies—need to address as they take more thorough control of the microcomputer technology and ply it to meet overall library goals and priorities.

The case studies in this volume present a wide, yet familiar range of variation in the pace of and responsibility for the development of public microcomputer clusters. The leading-edge libraries in the group (Wisconsin, SUNY) followed their initial investments in microcomputers with a rapid development of the public clusters as early as 1982. These libraries, however, displayed much uncertainty about the contribution of the clusters to the mission of the wider organization. In the extreme case (SUNY), the library held little responsibility for the cluster, which developed under the auspices of the campus academic computing department and was located in the library for reasons of convenience and secu-

rity. Librarians in this case worried about being cast in the role of microcomputer support specialists and devoted much attention to the efficient circulation of software used in the cluster. In the Wisconsin case, the public cluster emerged initially as a work area for students and faculty. Later, it changed to an instructional facility, in which the library finally began to develop a program of bibliographic instruction.

The other libraries studied in this volume (Cincinnati, California, and Rhode Island) waited to implement the microcomputer technology and so found themselves as "close followers" of the leading-edge institutions. California Polytechnic State University waited longest and installed its laboratory during 1986. These libraries all assumed responsibility for the microcomputer clusters and folded them directly into the fabric of existing library programs. A cluster thus serves now as an extension of the media services department in one case (Cincinnati), as a component of a curriculum resource center in another (Rhode Island), and, in still another case (California), as a mechanism for meeting the library's mission to support computer-aided instruction. In each of these three cases, a primary concern of the librarians managing the clusters has been to articulate principles of hardware and software selection.

Seiden, in her concluding essay, does not try to summarize or theorize the experiences described in the case studies. However, she does provide a valuable, general, and disciplined conceptual framework for bringing under library management control the kinds of microcomputer clusters described in this volume. Among the management concerns she addresses are the relationships among the library, the campus computers center, and the university administration; the relationships between the library and the various academic departments; the service objectives of the library; funding sources and budgeting procedures; hardware and software acquisition and maintenance policies; the practice of cataloging and circulating software; and staffing and other ongoing ways of supporting patron use of the technology.

Developing Microcomputer Work Areas in Academic Libraries is a slender volume, and the editor herself has contributed one-third of the book (forty pages) in the form of an annotated bibliography of related publications, a directory of library microcomputer installations, and an index. The book's principal value, however, lies in the case studies and concluding essay. Together they help provide a sturdy frame of reference for those of us, each in our own institutions, who are examining the ways that microcomputer technology has emerged and spread and who are now focusing on those particular ways the technology can best be harnessed for the benefit of the library and its patrons.—*Donald J. Waters, Yale University Library, New Haven, Connecticut.* ■■

Hildreth, Charles R. *Library Automation in North America: A Reassessment of the Impact of New Technologies on Networking*. Munich and New York, N.Y.: Saur, 1987. 196p. $35 (ISBN 3-598-10735-8).

As a routine selector of professional materials for a collection supporting a library science program, I am most interested in monographs covering the subjects of library management or automation of library functions. When I first picked up Hildreth's book, I was struck with the rather average (i.e., mediocre) print format utilized by the publisher. Following the reading and, in fact, study of the topics presented, however, I am delighted to observe that the quality of the content presented by Hildreth far outstrips the quality of the printing and format used by the publisher. Overall, the book is well organized, factual, timely, and one that I highly recommend for the desk of every librarian interested in the evolution of library automation during the past two decades.

While many of us have participated in the advances made in library automation and are still engaged in implementation or planning for future automated applications in libraries, we seldom have the opportunity to step back and assess where we have been or reflect upon why events evolved as they did. Gaining a clearer view of the immediate past can help us project the possi-

ble directions of library automation for the next decade. Hildreth's *Library Automation in North America* does much to place the complex world of library automation in perspective.

The work is divided into three major parts, each of which provides relevant information regarding library automation in North America. Part 1 presents an overview of library automation and computer-based networking in North America. This section is an excellent capsule history of events and objectives of automation from the 1970s through and including the mid-1980s. This section outlines why users' information needs have been set aside to accomplish the "less complex" issues surrounding the development of bibliographic records. The concept of a national network and the reasons for its eventual failure are discussed. Issues regarding centralized state or regional library systems and the loss of control for setting local priorities, plus forces for and against centralization and commercialization of the network environment, are well detailed. The author notes that in the migration to a decentralized environment

> "two trends at least are irreversible: more and more computer processing power will be brought within the budget range of all sizes of libraries, and librarians will increasingly be driven by the urge toward self determination and control to exploit locally available technology to solve local problems."

He notes that the forces for and against centralized or decentralized systems are leading to a new pluralistic multilayered library networking environment. Hildreth rightly observes that "it is no longer accurate, if it ever was, to hold up OCLC's centralized star-configured network system of the early 1980s as the paradigm of library networks in the U.S." and in "today's competitive mixed library environment, the utilities no longer dominate in the development and distribution of automation products and services."

Part 2 of Hildreth's work provides a current assessment of bibliographic utilities and library networks. The major systems, participants, and organizational patterns are discussed. This section presents a profile of each of the major bibliographic utilities—OCLC, RLIN, WLN, and UTLAS—and outlines their organizational status, governance, and funding patterns. Composition of membership, program activities, products and services, and affiliations through state and local networks are discussed. Data ownership and use policies are compared for the four utilities.

Alternatives to the traditional bibliographic utilities are also noted, and the origins and evolution of regional and state library networks are outlined. The influence of state library agencies is also highlighted in this section.

Part 2 also includes a discussion of cataloging and networking support services available from the commercial sector. Examples are presented regarding use of local systems beyond the traditional automation of local functions to encompass activities associated with a shared-system environment whereby local systems become mini-utilities serving libraries within a discrete region. Support options for recon are reviewed, and it is noted that the four major utilities no longer stand as the only sources for recon or traditional cataloging support services.

The national libraries and the national programs associated with the Library of Congress and the National Library of Canada are covered, and the evolution of planning from a national network to a nationwide network is succinctly stated. The major impacts on library developments of MARC, the bibliographic services offered by the Library of Congress, the Network Advisory Committee, and the Council on Library Resources are presented.

Part 3 of Hildreth's book emphasizes the importance and role of automated systems and services in local libraries. It includes a review of integrated multifunction library systems. This section includes a discussion of market trends, the impact of both turnkey systems and library-developed systems, and the potential market strengths for these systems in the U.S. and Canada. Microcomputers and the impact of related products in the world of library applications are noted. This market, though barely five years old, had achieved placement of over 190,000 microcomputers in American libraries by 1985. Finally, public and end-

user services are reviewed and discussed.

Library Automation in North America is an important work. It contains a table of contents and a list of acronyms but is weakened by the lack of an index. It is a book that will help the reader quickly identify issues related to technology, networking, and rationales for implementation of systems in varying library environments.

The fast advancement of technology and associated issues in this field will mean a short half-life for any work of this nature; however, this cannot be avoided. Even if the work is partially obsolete or dated within a very short time, it will continue to provide a relevant and succinct view of automation-related developments from the 1970s through the mid-1980s. It contains an excellent bibliography and an appendix, which compares answers to five fundamental questions posed to the four major utilities that support library networking in North America. For those interested in networking and library automation, I highly recommend this work for reading and as a reference source in your personal library.—*Don L. Tolliver, Kent State University, Ohio.* ■■

The Library Microcomputer Environment: Management Issues. Ed. by Sheila S. Intner and Jane Anne Hannigan. Phoenix and New York: Oryx, 1988. 258p. paper, $27.50 (ISBN 0-89774-229-X).

Originally intending to publish a collection of articles on developing, organizing, and managing a collection of microcomputer software, the editors decided to expand the focus to include several aspects of what they refer to as the "library microcomputer environment." After reading the book, I believe the editors would have been wise to stick with their original concept. Those articles that serve that original concept are not only individually excellent but work together in support of a common purpose. Those articles that were added in pursuit of the larger picture detract from the book as a whole without making a compensatory contribution.

The articles are arranged in three parts: "Traditional Considerations: Microcomputer Software as a New Material Form for Libraries." "The Nontraditional Character of Microcomputer Software," and "Newer Impacts of Software upon Libraries."

Part 1 begins with Sheila S. Intner's contribution, "Developing Software Collections." The article is a well-organized and comprehensive set of questions to be asked when a library is considering developing a collection of microcomputer software. The information in the article is up-to-date and accurate, and Intner does a good job of conveying to the reader the nature of microcomputer software and the differences between software and other materials a library may choose to collect. Many of her recommendations and suggestions, particularly the five "short rules for success" with which she ends the article, represent excellent and appropriate advice for any person with collection development responsibilities, regardless of the medium under consideration.

The next article, Nancy B. Olson's "History of Organizing Microcomputer Software," describes how rules for descriptive cataloging are developed and chronicles the evolution of chapter nine of the *Anglo-American Cataloging Rules*, second edition. While some will probably find it useful and perhaps even interesting to have these meetings and discussions documented in this way, I feel the article contributes little to the book.

The next article, "Organizing the Collection: State of the Art" by Jean Weihs, has the information the previous article lacks. Weihs provides a readable and interesting discussion of the key topics relating to organizing a collection of microcomputer software: descriptive cataloging, subject cataloging, and storage of the collection. In each case, she focuses on the issues instead of the process.

The final article in part 1 is "Collection Use: Reference Work with Hardware and Software," by Elizabeth Futas. This article complements Intner's article in that it is a comprehensive discussion about using microcomputer hardware and software to provide reference service. Futas discusses a wide range of reference issues as they relate to the use of microcomputers, including citizen literacy, privacy, fees for use, document delivery, and the reference function itself. The information is timely and interesting, and the topic is thoroughly covered.

Part 2 gets off to an excellent start with Patrick R. Dewey's comprehensive and authoritative survey of the review sources for microcomputer software, "Looking at Review Sources." In addition to providing notes about specific review sources, Dewey discusses the use of reviews in making selection decisions and offers sound advice.

In contrast, Jonathan S. Intner's article, "Beasts in a Box: How to Choose Microcomputer Hardware," lacks focus and contains too much jargon and irrelevant information. It is incomprehensible to the uninitiated and of no interest to the knowledgeable.

Perhaps a bit more scholarly in approach than the book calls for, Pamela Reekes McKirdy's "Copyright Issues for Microcomputer Collections" is, nevertheless, an excellent review of the issue of copyright as it applies to microcomputer software. Most of the article is a review of court cases dealing with specific aspects of copyright and software. Throughout, McKirdy relates the discussion to other aspects of the copyright issue as it affects libraries. All in all, this is one of the best articles in the book. In addition to a selected bibliography, McKirdy provides a case table for the cases cited in the text.

The next two articles deal with specific software packages, and, while interesting and well written, they seem out of place in this book. "The UNIX Environment and Its Contribution to Management," by John A. Scigliano and Barry A. Centini, is well done. The authors manage to communicate not only the essential facts about UNIX but some of its aura as well. James D. Anderson uses his article, "Information Organization Based on Textual Analysis (IOTA): Instructional Programs for Database Design," to describe the intriguing IOTA software. IOTA is a microcomputer program designed to help people learn about database design and related issues. The article is not only useful for learning about IOTA but also serves as a decent miniintroduction to the subject of database design.

Part 3 begins with a puzzling article by Roger B. Wyatt, "CD-ROM and Satellite Linkages within the Context of Technological Change." The article attempts to deal with two unrelated "subtechnologies" and does justice to neither. Wyatt is clearly knowledgeable, but the article just does not work.

Much more relevant is Marlyn Kemper's "Local Area Networking: The Management Problem." This article offers accurate information and clear, positive recommendations about what can be a mysterious and confusing subject for those unfamiliar with LANs.

Jane Anne Hannigan's "An Expanded Managerial Role in a Microcomputer Environment" should be the first article in the book. Clear and authoritative, it is an excellent introduction to most of the issue that other articles discuss in more detail.

The last article in the book, Kay E. Vandergrift's "Management Problems of Documentation, Tutorials, and the Training Process," is a thorough overview of a subject that too often receives only lip service. Well written and interesting, it is full of useful insights and solid recommendations.

The afterword by Harold Borko, "Information Technology—A Look Toward the Future," though somewhat superficial, offers several interesting observations concerning the future of computer technology and libraries.

The index, compiled by Linda Webster, is unfortunately rather inconsistent and incomplete. Apparently, each article was indexed separately and then the entries were interfiled. Consequently, the index does not allow one to pursue a specific topic through all of the articles.

The majority of the articles are insightful and well written, but the book as a whole suffers from a lack of editorial direction. A minor, but telling, example of this lack is the fact that, although most of the articles include references and bibliographies, the format of the citations varies from article to article. I recommend purchase of this book by any library considering developing a collection of microcomputer software.—*George Rickerson, University of Missouri, Columbia.* ■■

Strickland-Hodge, Barry, Barbara Allan, and Brian Livesey. *Information Technology and Health Care.* Brookfield, Vt.: Gower, 1988. 202p. $50.50 (ISBN 0-566-05190-7).

This descriptive work is comprised of fifteen chapters divided into three main sections: Medical Information and Its Users, The Software, and The Hardware. The authors, Barry Strickland-Hodge, Barbara Allan, and Brian Livesey, are all experienced writers in the field of information technology and have done an excellent job of conveying their expertise to the reader.

The first part of the book is a bit tedious for those unfamiliar with England's structured health care system. The flow of information in the National Health Service (NHS) is described, as is the way in which technology can improve this transmission of information to both health providers and consumers. All readers, however, should be able to find some similarities between the NHS and their own individual setting.

Further discussion in part 1 revolves around the various types of information users and the kind of information each requires. As outlined by several reports mentioned in the book, the use of computer technology to provide relevant information should lead directly to improvements in diagnosis, patient care, and preventive medicine.

It is encouraging to see that a full chapter is devoted to the major group of people needing health information—the patient. This is of particular interest since patient education is a timely and important topic.

In an ideal system information would be readily available at a number of access points (doctor's office, pharmacy, library, etc.), and informed patients could assume an active role in their own health care. Realistically speaking, provision of information to the patient does not occur in a consistent manner. Since the flow of information to the patient has not improved greatly over the years, the authors stress the need to employ available technology to aid in this endeavor. Examples of technology already in place to help the individual are provided.

Sections 2 and 3 will prove especially useful to the person considering the purchase of computer equipment or to one who already has access to a machine but little or no background knowledge of the intricacies of software and hardware.

Section 2 begins with a simple explanation of what software is and the two kinds needed—operating software and applications programs. Further consideration is given to software relevant to medical applications, including generalized software packages; numerical, learning, and expert software; and specialist packages.

A clear and concise overview presents information on what the various applications packages will do, what is available, the features contained in each, and the applications that can be made of the package. In addition, guidelines are given for what to consider when buying a package.

The real strength of the volume lies in section 3, which describes computer hardware and what it does in understandable terms—not an easy task. The authors included this practical section to enable readers to describe any hardware problems in appropriate terms, saving both time and money. Rest assured that sooner or later (emphasis on sooner) a problem will develop with the hardware. When a breakdown occurs, it is imperative to accurately describe the difficulty to the internal or external computer expert. Correct terminology is the greatest ally one can have in communicating problems to these people.

This valuable part, beginning with a fascinating account of the development of computers, bears reading and rereading. Answers are given for everything you ever wanted to know about computers but were afraid to ask. ASCII coding, the CPU, RAM, ROM, and magnetic and floppy disks are but a few of the topics covered. Tables comparing the three types of computers and storage capacities of $5^1/_4$-inch floppy disks are helpful.

The main criticism of the volume is its high cost (the discovery of a blank page was especially disconcerting considering the price). In these times of shrinking budgets, it is difficult to recommend the purchase of this work when so much of the information can be found elsewhere; however, since the book includes some history of the NHS as well as information technology, it could be a useful addition to a university health library collection.—*Linda Ordogh, Health*

Sciences Library, McGill University, Montreal, Canada. ■■

Software Reviews

The Searcher's Toolkit. Personal Bibliographic Software, Inc., P. O. Box 4250, Ann Arbor MI 48106.

Hardware/Software Requirements: *Biblio-Links:* are the same requirements as *Pro-Cite*, below. *Pro-Search:* IBM PC with two double-sided disk drives. IBM XT or AT with one double-sided disk drive and one fixed-disk drive or a compatible computer. Texas Instruments Professional Computer is supported. Minimum of 256K RAM shortage, supporting DOS version 2.0 or a later version. Minimum of 320K is required if using DOS 3.0 or a later version. Hayes Smartmodem 300, 1200, 1200B, or 2400 or any acoustic modem. Additional modems are supported. IBM-compatible modem cable. Monochrome or color monitor. Printer is optional. *Pro-Cite:* IBM PC, XT, or AT or any 100 percent compatible computer. IBM Personal System/2 (any model) with at least 320K RAM. DOS Version 2.0 or later. Printer is optional. Macintosh 512Ke, Macintosh Plus, SE or II. 512K minimum with System 4.1 or higher. Hard disk recommended or two floppy disk drives.

The Searcher's Toolkit, a comprehensive bibliographic management system developed by Personal Bibliographic Software, is comprised of three separate yet cooperative programs: *Biblio-Link*, *Pro-Search*, and *Pro-Cite*. Although each program is run independently, the maximum benefits of this "scholar's workstation" are more readily realized when all three programs are integrated.

These programs are not new and have been repeatedly reviewed, often under former names, so the following chronology may help to dispel any confusion.

Biblio-Link will transfer records from online sources into a user-created *Pro-Cite* database. *Pro-Search* is a front-end online searching aid. Originally known as *In-Search*, and then *Pro-Search*, it was first produced by the Menlo Corporation. Personal Bibliographic Software began marketing it in 1986, and version 1.07 was released in May 1988. *Pro-Cite* is a highly sophisticated database management program designed especially to manipulate bibliographic and textual data that has either been downloaded from *Pro-Search* and transferred from another online source (via *Biblio-Link*) or entered manually. It first entered the market as *Professional Bibliographic System* and was later known as *Personal Bibliographic System*. Version 1.4 was released in August 1988.

Biblio-Links

Biblio-Link transfers records from various online sources into a *Pro-Cite* database created by the user. A separate *Biblio-Link* program is required to transport records from each online source. Currently *Biblio-Links* are available to transfer records from BRS, Dialog, MEDLARS, NOTIS, LS/2000, MUMS, OCLC, RLIN, SCORPIO, USMARC, and STN International. Each program costs $195, and additional *Biblio-Links* are being developed by PBS.

Records downloaded from an online database must be saved in a tagged field format in order for *Biblio-Link* to transfer the records into a *Pro-Cite* database. For example, the reviewers downloaded Dialog records with tagged fields, so first they saved the downloaded records in Format 4 and then used the specific *Biblio-Link* program designed to work with Dialog records. Dialog 2 databases with field tags that are recognized by the current version of *Biblio-Link* have not been updated since November 1986. The program, however, does enable the user to add new Dialog databases and field tags with minimal difficulty.

The Dialog-specific *Biblio-Link* program does what it claims to do, although it did take several calls to the very patient PBS customer service department to sort out some initial difficulties. The manual adequately describes the program installation and start-up procedures, in addition to providing a tutorial, but omits some (perhaps)

obvious but important directions for any but the most practiced DOS experts to get going readily.

Pro-Search

Recently, the new 1.07 version of *Pro-Search* was released. Only minor revisions have been made to the previous 1.05 version. New features include 2400-baud access to BRS and Dialog; improved dialing and connection to services in support of computers with faster clock speeds; support of user-defined formats (UDFs) and the TAG option high-level mode; access to the special NEWS database on BRS, in both high-level and native modes; an improved accounting feature that can keep track of costs for multiple file searching, as in Dialog's *OneSearch* feature; and direct-dial access to BRS. The cost to update *Pro-Search* version 1.05 to 1.07 is $45.

Pro-Search functions admirably as a communications software, a search aid, and an accounting program. Orignially developed as a search aid for Dialog, it now offers maximum support for BRS and Dialog. Although up to twenty other online services can be dialed up via the online service directory, only BRS and Dialog are automatically programmed to include the automatic log-on feature (one key stroke). Log-on macros can be stored for automatic entry into other services with a minimum of programming, although this was not attempted by the reviewers. Also, the accounting feature—which keeps track of each search session and creates invoices and a variety of monthly reports— is only available for recording BRS and Dialog searches.

Pro-Search offers two searching modes, Native Mode and High-Level Interface. Native Mode assumes familiarity with Dialog and BRS commands while offering many search-enhancing features such as typing ahead of the system; saving search strategies as well as entire searches to disk files; entering search strategies before going online; editing searches from a buffer, a temporary memory, from which they can be printed as well as saved to disk; on-screen access to the Dialog Blue Sheets and BRS Aid Pages via a function key; and a cross-emulation feature that enables Dialog to be searched using BRS commands and vice versa. All of the above-mentioned features are easily engaged and well explained in the documentation. Adequate on-screen help is also available.

The High-Level Interface requires little familiarity with the searching process in general or the individual vagaries of BRS and Dialog. High-Level Interface includes the features available in Native Mode, although it is devoted solely to supporting searches in BRS and Dialog, As the great equalizer, High-Level Interface attempts to narrow the gap between searching Dialog and BRS by essentially treating them as one system. This mode presumes the user has little or no knowledge of the individual databases, so much of the program is focused on database selection. It does this in the following way.

Four category disks are included with the program: "Art and Social Sci" (arts, education, and social sciences); "Bio and Medicine" (biology and medicine); "Business" (business, government, and news); and "Engineering & Sci" (engineering, mathematics, and physical sciences). After choosing the High-Level Interface mode in which to search, the user is presented with a database selection screen from which one of the above-mentioned categories is chosen, as well as a specific subject to be searched within that category. This selection produces an on-screen "card catalog" display containing one "card" for each database in BRS and Dialog. The cards are arranged alphabetically within subject; BRS and Dialog databases are interfiled. Each card contains a brief description of the database, including charges. The searcher can scroll through the entire card catalog, which represents all of the available BRS and Dialog databases. Cards for the same database offered by both BRS and Dialog are adjacent to each other. This is very useful when comparing the costs of searching in one service relative to the other. Even for experienced searchers, this card catalog is a convenient way to become familiar with BRS and Dialog databases. The necessary category disks, which include the database choices, are updated quarterly at a yearly cost of $150. It is advisable to supplement these updates with changes reported in Dialog's

Chronolog and BRS' *Bulletin*. The currency of the database descriptions on both the database selection screen and the data sheet screen is dependent on the regular disk updates.

Databases are chosen either via the on-screen index cards or a direct select command where new databases that do not appear on the category disks can be selected for searching. After a database is selected, a search screen appears containing four columns for entering information. The first column is for set numbers that appear on the left side where up to ninety-eight sets can be entered on the screen before going online. The "search keywords and phrases," the second column in which to enter the search terms, is limited to fifty characters per line. The third column is the "index selected" column, which contains the name of the field or paragraph in which the term(s) in that particular set is (are) to be searched. Finally, the last column on the screen is the "hits found" column, which displays postings for each set.

Although at times cumbersome, the High-Level Interface offers much support for the novice searcher. Search terms can be typed directly onto the screen in the "search keywords and phrases" column, but choosing additional indexes and limiting or sorting features requires calling on additional menus where highighted choices are transferred to the search screen. These extra steps can bog one down midsearch and prove quite costly. Experienced searchers are better off using the Native Mode.

Overall, *Pro-Search* is a very effective program. The documentation is clearly written, enabling even this inexperienced microcomputer user to load it onto a hard disk without mishap. A good working knowledge of DOS, especially when using a hard disk, is highly recommended. The special features offered in both the Native and High Level Interface modes enhance BRS and Dialog searching. Perhaps future versions will extend these special capabilities to other online services. Features such as accounting control, cross-emulation, and database selection aids would be most welcome for the many other available host systems.

Pro-Cite

Pro-Cite 1.4 is described as a "database management program designed specifically to handle bibliographic information." What does this mean? What can you do with *Pro-Cite*?

First, *Pro-Cite* allows you to store citations (up to 32,000). There are several ways to input these citations. You can do it manually by inserting the bibliographic information onto an appropriate work form. You can choose from twenty different work forms that range from books (long and short form), journals (long and short form), dissertations, and reports to manuscripts, artworks, and computer programs. These citations are stored in a database that you name. Two other ways of developing databases in *Pro-Cite* are to download results from an online database search using the appropriate *Biblio-Links* program or to "import" records from other files you might be using. It is beyond the scope of this review to go into detail about these functions; however, it is a good example of the various levels of sophistication with which *Pro-Cite* can be used.

Second, *Pro-Cite* allows you to search these databases with a powerful searching mechanism. Searches can be truncated, and Boolean operators can be used. You can perform a "quick search" (new to *Pro-Cite* 1.4), which searches author, title, and date fields only (and is claimed to be up to twenty times faster than normal searching); or you can limit your search to any of the forty-five fields that can exist in a *Pro-Cite* citation. Browsing a database or a selected list of records is a good way of reviewing a database. You can move back and forth within a database record or you can "jump" around.

Third, *Pro-Cite* allows you to print these citations in myriad styles and formats. The *Pro-Cite* options screen gives you an opportunity to define how your citations/bibliography are printed out. Do you want call numbers included? Print the index terms and the abstract field? Alphabetical order? Pages numbered? What about margins and indenting? Print to the screen, printer, or disk? Probably the most renowned aspect of

Pro-Cite is its ability to print citations in a variety of styles. The program defaults to the ANSI Standard, but the choices include the American Psychological Association, ChicagoA (for humanities), ChicagoB (for social sciences), Modern Language Association, Turabian (5th ed.), Science (developed by *Science* magazine), UMI (to order documents for the article clearinghouse of UMI), and Proof (a special style that prints the records with field abbreviations to the left). *Pro-Cite* 1.4 also includes special medical and chemical disks that include, among other things, the NLM *List of Serials* indexed for online users and punctuation for *Index Medicus* and other biomedical bibliographic formats. PBS is continuing to develop new punctuation files, and the system allows you to create your own punctuation style also. Anything you decide in the options screen is not irremediable. Changes are simple, and in seconds you can have a bibliography formatted and printed in a variety of styles.

A few other aspects of the product should be mentioned. The new *Pro-Cite* 1.4 manual is superb. It far surpasses earlier editions in clarity and readability, although it assumes a working knowledge of DOS. Margins are wide and include useful paragraph headings for quick reading. Cross-references within the text are plentiful. The table of contents is detailed, which somewhat makes up for a weak index (although this is definitely something for PBS to work on). This is important, as most users will be making constant reference to the manual. One can make some progress in *Pro-Cite* without consulting the manual, but for advanced activities, the manual is indispensable. Online help screens are also present through the use of pop-up windows. These screens work well, but the wise decision was to avoid getting too detailed online. Back to the manual for details!

Some reviewers of earlier *Pro-Cite* packages criticized them for being copy protected. They will be happy to hear that this is not the case with *Pro-Cite* 1.4.

Pro-Cite 1.4 is a wonderfully flexible program. Not only does it offer alternatives to the tedious aspects of research but it allows for the creation of such personal options as customizing bibliographies. The producers have combined the best features of online database searching and online catalogs to make it possible for the researcher to create, search, and manipulate a personal catalog, a very fitting achievement.

Summary

PBS has continually refined the components of the *Searcher's Toolkit*. Their responsiveness to suggested changes has been noted in the new versions by these reviewers. They are also to be much commended for the amount of flexibility available with each program. Users can customize each program to their own needs, and PBS is ever adding options to each program to expand its relevance to a greater number of users.

The *Searcher's Toolkit* is a successfully realized vision of a system that enables users to go beyond information identification and access to actually controlling the data they have gathered. The missing "next step" of most online systems seems to be found with this product.—*Barbara A. Burg and Ed Tallent, Harvard College Library, Cambridge, Massachusetts.* ■■

Other Recent Receipts

Listed here are books and other publications received for review that are of potential interest to LITA members. Some of these materials may be reviewed in later issues of ITAL.

The ALA Yearbook of Library and Information Services: A Review of LIbrary Events, 1987. V.13. Chicago: American Library Assn., 1988. 419p. $80 (ISBN 0-8389-0489-0).

Abell-Seddon, Brian. *Museum Catalogues: A Foundation for Computer Processing.* London: Clive Bingley, 1987. 224p. $30 (ISBN 0-85157-429-7). Dist. in the U.S. by ALA.

Bennett, George E. *Librarians in Search of Science and Identity: The Elusive Profession.* Metuchen, N.J. and London: Scarecrow, 1988. $25 (ISBN 0-8108-2075-7).

Carson, James. *Desktop Publishing and Libraries.* Los Angeles and London: Taylor Graham, 1988. 81p. paper, $24 (ISBN 0-947568-34-4).

The Future of the Public Library: Conference Proceedings, OCLC Online Computer Library Center, Inc., Dublin, Ohio, March 20–22, 1988. OCLC Library, Information, and Computer Science Series, no.10. Dublin, Ohio: OCLC, 1988. 150p. paper (ISBN 1-55653-050-1).

Future Trends in Information Science and Technology: Proceedings of the Silver Jubilee Conference of the City University's Department of Information Science. Ed. by P. A. Yates-Mercer. London and Los Angeles: Taylor Graham, 1988. 123p. paper, $35 (ISBN 0-947568-20-4).

Influencing the System Designer, Online Public Access to Library Files: Third National Conference: The Proceedings of a Conference Held at the University of Bath 12–15 September 1987. Ed. by Lorcan Dempsey. Oxford: Elsevier, 1988. 163p. paper, $45 (ISBN 0-946395-31-4).

Kesner, Richard M. *Information Systems: A Strategic Approach to Planning and Implementation.* Chicago and London: American Library Assn., 1988. 263p. paper, $30 (ISBN 0-8389-0493-9).

Knowledge Engineering: Expert Systems and Information Retrieval. Ed. by Irene Wormell. London and Los Angeles: Taylor Graham, 1987. 182p. paper, $39 (ISBN 0-947568-30-1).

Leadership for Research Libraries: A Festschrift for Robert M. Hayes. Ed. by Anne Woodsworth and Barbara von Wahlde. Metuchen, N.J., and London: Scarecrow, 1988. 255p. $25 (ISBN 0-8108-2129-X).

Libraries and the Search for Academic Excellence. Ed. by Patricia Senn Breivik and Robert Wedgeworth. Metuchen, N.J., and London: Scarecrow, 1988. 213p. $25 (ISBN 0-8108-2157-5).

Library Lit. 17: The Best of 1986. Ed. by Bill Katz. Metuchen, N.J., and London: Scarecrow, 1988. 368p. $27.50 (ISBN 0-8108-2089-7).

Macintoshed Libraries. Ed. by Edward J. Valauskas. Cupertino, Calif.: Apple Library Users Group, 1988. 77p. Free from Apple Computer, Inc., 10381 Bandley Dr., Cupertino, CA 95014.

New Horizons for the Information Profession: Meeting the Challenge of Change, Proceedings of the Annual Conference of the Institute of Information Scientists, University of Warwick, 1987. Ed. by Hilary Dyer and Gwyneth Tseng. Los Angeles and London: Taylor Graham, 1988. 225p. paper, $34 (ISBN 0-947568-32-8).

Rowley, Jennifer E. *The Basics of Information Technology.* London: Clive Bingley, 1988. 146p. $20 (ISBN 0-85157-396-7). Dist. in the U.S. by ALA.

Sieburth, Janice F. *Online Search Services in the Academic Library: Planning, Management, and Operation.* Chicago and London: American Library Assn., 1988. 331p. paper, $30 (ISBN 0-8389-0490-4).

Text Retrieval: An Introduction. Ed. by Ian Rowlands. London and Los Angeles: Taylor Graham, 1987. 80p. paper, $28 (ISBN 0-947568-24-7).

Thierauf, Robert J. *Effective Information Centers: Guidelines for MIS and IC Managers.* New York: Quorum Books, 1988. 263p. $39.95 (ISBN 0-89930-308-0).

Paris, Marion. *Library School Closings: Four Case Studies.* Metuchen, N.J., and London: Scarecrow, 1988. 168p. $20 (ISBN 0-8108-2130-3).

Sitzman, Glenn L. *African Libraries.* Metuchen, N.J., and London: Scarecrow, 1988. 486p. $49.50 (ISBN 0-8108-2093-5).

Townley, Charles T. *Human Relations in Library Network Development.* Library Professional Publications. Hamden, Conn.: Shoe String, 1988. 161p. $25 (ISBN 0-208-02086-1).

Weatherford, John W. *Librarians' Agreements: Bargaining for a Heterogeneous Profession.* Metuchen, N.J., and London: Scarecrow, 1988. 302p. $29.50 (ISBN 0-8108-2073-0). ■■

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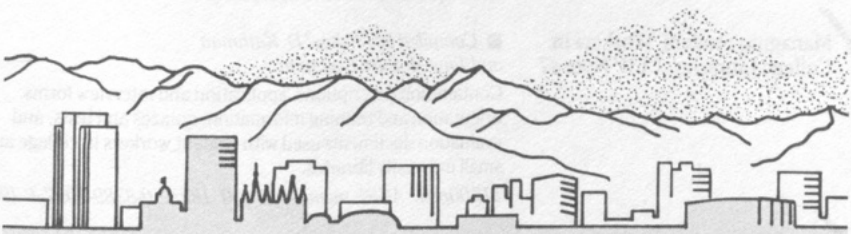

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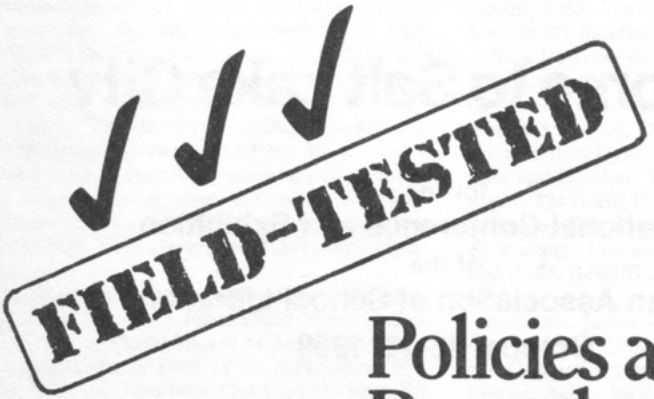

Policies and Procedures

College Library Information Packets (CLIP Notes)

Designed to collect basic data and sample documents which college and small university libraries can use to establish or refine specific services or operations.

✓ Managing Student Workers in College Libraries CLIP Note #7

■ *Compiled by Michael D. Kathman and Jane McGurn Kathman*

Contains job descriptions, application and interview forms, orientation and training information, quizzes and tests, and evaluation documents used with student workers in college and small university libraries.

$17.00pbk.; ACRL member $14.00 182p. 0-8389-7097-4 1986

✓ Special Collections in College Libraries CLIP Note #6

■ *Compiled by Christine Erdmann*

Sample documents from college libraries on projects, publicity, financial support, archives, preservation, and use policies.

$18.00pbk.; ACRL member $15.00 95p. 0-8389-7004-4 1986

✓ Mission Statements for College Libraries CLIP Note #5

■ *Compiled by Larry Hardesty, Jamie Hastreiter, and David Henderson*

Provides guidance to college libraries seeking to develop or refine their statement of purpose. Contains philosophical statements outlining the purposes of selected college libraries.

$20.00pbk.; ACRL member $15.00 107p. 0-8389-6944-5 1985

✓ Online Bibliographic Database Searching in College Libraries CLIP Note #4

■ *Compiled by David Carlson and P. Grady Morein*

"...making our college and university students cognizant of online services is a must. To those charged with making such services available on the nation's campuses this inexpensive guide is likewise a must." *(Online)*

$19.00pbk.; ACRL member $15.00 132p. 0-8389-6624-1 1983

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Letters

To the Editor:

To find a parallel to research on the application of expert systems to cataloging (*ITAL*, June 1988), one must look to Laputa and the "project for extracting sunbeams out of cucumbers."

Any cataloging problem that can be solved by an expert system can be solved more quickly by a cataloger; if a cataloger is baffled, an expert system can do no better. Since original cataloging has been much reduced by the availability of reliable cataloging data from many sources, the use of expert systems in cataloging can never be cost-effective. Those researchers who advocate changing cataloging rules in order to suit their work have got the problem exactly the wrong way round.

This research *may* benefit AI: it will produce nothing of value to catalogers or libraries.—*C. D. Robinson, Information Resources Supervisor, Ontario Hydro Corporate Library, Toronto, Ontario.* ■■

Information Technology and Libraries Index to Volume 7 (1988)

Compiled by Kieth C. Wright

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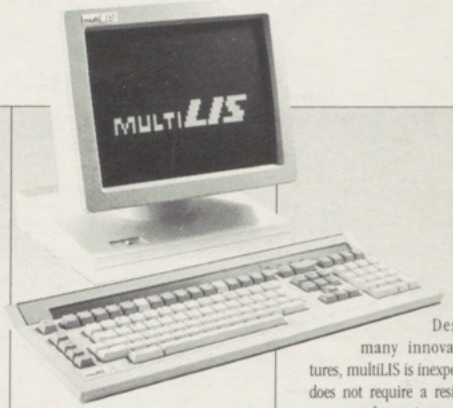

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[1] VMS is a registered trade mark of Digital Equipment Corporation

[2] Unix is a registered trade mark of AT&T

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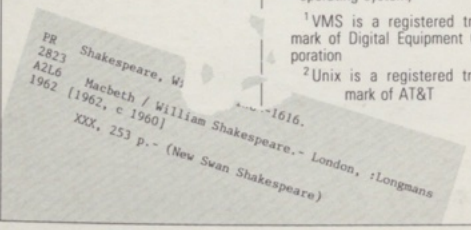

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