

Electronic Resources: A Wolf in Sheep's Clothing?¹

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This article examines the impact of electronic technology on libraries and scholarship. It focuses on some of the challenges of using electronic resources in research libraries, which include the cost of acquiring electronic formats and the effect that such expenditures have on other library services and collection development practices. The article also explores how electronic resources have changed the way students and scholars conduct research. The goal of this essay is not to criticize or condemn electronic formats but, rather, to illustrate that electronic technology is simply one tool, among others, for the dissemination of information. As such, electronic resources should complement rather than replace other formats.



Evolutionary electronic technologies, including powerful and inexpensive personal computers, scanners, the Internet, the World Wide Web, Telnet, electronic mail, and other advances are rapidly changing the library's approach to collection development and the storage and retrieval of information. Advances in hardware and software for the digitization of information have made electronic publishing a viable format for scholarly communication. The rapid success of electronic resources has raised expectations among publishers, librarians, and scholars for such formats. The technology is developing so quickly that it is difficult to ascertain what impact future electronic resources will have on libraries. In "The Changing Nature of Collection Management in Research Libraries," Joseph Branin, Frances Groen, and Suzanne Thorin wrote that "technical advances in digitization are truly revolutionizing the

way scholarly information is published, organized and maintained, and both the scope and extent of this change are difficult to comprehend and manage."² The authors also stated that because scholarly communication is changing daily, it is difficult to predict what will happen in five to ten years.

Although digital technology does benefit library collections and services, it also creates major challenges to the future vitality and health of research libraries.

The rapid success of electronic resources raises many misconceptions about their capabilities. There is the unsubstantiated presumption that all information will be universally accessible to everyone via electronic resources. Another expectation is that electronic formats are (or will be) cheaper than paper publications. Furthermore, some assume

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that electronic formats are superior to paper publications.

This article examines the impact of electronic technology on libraries and scholarship. It focuses on some of the drawbacks of using electronic resources in research libraries, including the cost of acquiring electronic formats and its effect on other library services and collection development practices. The article also explores how electronic resources have changed the way students and scholars conduct research. The goal of this essay is not to criticize or condemn electronic formats. Rather, it intends to show that electronic technology is simply one tool, among others, that can be used in the dissemination of information. As such, electronic resources should complement rather than replace all other formats.

Electronic formats have many advantages. First, they are more versatile than paper publications. Second, using full-text or key word indexing, they provide excellent searching capabilities. Unlike paper publications, these formats allow simultaneous user access. In addition, information can generally be accessed from remote locations, such as an office, home, or dorm room. This technology enhances the collections of research libraries by providing patrons with access to information that is not available in, or is more accessible through, hard copy. Therefore, it should come as no surprise that most research libraries have embraced this technology.

Although digital technology does benefit library collections and services, it also creates major challenges to the future vitality and health of research libraries. Ironically, widespread use of electronic resources in academic libraries may result in more restricted access to information. Many electronic products have license agreements that severely limit how this information can be used, particularly in the area of interlibrary loan. Depending on how copyright and fair use laws are revised and modified for digital technologies, it is possible that libraries will have to implement restrictive policies on how

electronic resources are used in their collections and by whom.³ Thus, librarians must carefully consider the impact that restricted use will have on the future of research collections.

A second major challenge to the vitality of research libraries is that, although they are racing to keep up with the latest technology, they also are defending their future existence in the electronic age. Professors and students now have options other than the library, such as the Web and the Internet, to access information. These new information technologies have led some people to question the value or need of "traditional" libraries. A 1996 survey showed that Americans between the ages of 18 and 24 do not support maintaining or building new libraries; instead, they believe libraries will be of little value in the digital future.⁴ Writing for the Council on Library and Information Resources in 1999, Abbey Smith noted that "digitization often raises expectations of benefits, cost reductions, and efficiencies that can be illusory, and, if not viewed realistically, have the potential to put at risk the collections and services libraries have provided for decades."⁵ Such expectations for electronic resources can indeed have a devastating effect on the continued development of library collections. Politicians and administrators, who control funding and who already have made enormous investments in technological infrastructure for their institutions, support the idea of a virtual library based on a desire to believe that electronic information is free or cheaper than paper formats. Such beliefs would result in reduced funding for libraries. After all, if a virtual library were possible, there would be no need to store books, serials, and documents, and certainly no need to pay librarians or staff.

Unfortunately, electronic resources are often expensive. In many cases, books, serials, newspapers, and microfilm continue to be the best and most economical format to distribute and archive many types of information. Nevertheless, some librarians and administrators now place

the highest priority on the acquisition of electronic formats. Because most libraries have limited resources, expenditures for more traditional publications such as monographs and serials are cut in order to acquire electronic resources. This results in fewer resources available for subjects such as area studies, foreign languages, the humanities, and other fields that currently do not have the extensive coverage in electronic resources that the sciences do. Focusing solely on acquiring electronic resources improves access to some information but limits access to other, equally important, publications that are not digitized.

Even when specialized electronic resources are available, they are often extremely expensive, particularly when one looks at the cost-per-user ratio. For example, in the field of Russian studies, a growing number of vendors offer electronic databases. These databases primarily offer full-text access to newspapers and journals from the region and range in price from about \$2,000 to \$23,000 annually.⁶ The sales pitch of many vendors includes the statement that their Russian database costs substantially less than other databases such as *Lexis-Nexis' Academic Universe*. What they fail to acknowledge is the fact that at U.S. universities, the user population for a Russian-language database is going to be substantially smaller than the user population for a general product such as *Academic Universe*. To illustrate this point, there are approximately 26,155 students and faculty members at the University of Kansas (KU). About three hundred have the language skills and the need to access specialized Russian or Slavic studies resources. Database A, a general information database that could be used by everyone at KU, costs \$80,000 per year. This cost can be broken down to \$3.06 per user per year based on the potential audience for the resource. Database B, a specialized Russian database, costs \$23,000 per year. If this cost is divided among the three hundred potential users of this resource, it is \$76.67 per user per year. Although

the vendor is correct in arguing that its database is cheaper in total dollars than other databases, the cost per user can be extremely high, making it difficult for universities, even those with strong international studies programs, to justify the acquisition of specialized databases. Ironically, the very nature of research is such that most resources will have only a few targeted, specialist users and the problem of high cost-per-user electronic products will continue to grow, particularly if the institution plans to support serious in-depth research by its students and faculty.

There appears to be a growing uniformity developing among libraries regarding electronic resources offered. One need only look at the electronic resources that most ARL libraries offer to see that these institutions generally purchase similar electronic materials. This indicates that these products constitute "core" library materials. Unfortunately, it also means that as more and more collection development money is used for the purchase of electronic resources, the distinctive character of individual research libraries will be lost as each institution offers its patrons access to the same materials. Care must be taken to ensure that the unique character of a research library is maintained. We must work to continue to develop library collections that support the total teaching and research mission of the university.

The emphasis placed on electronic technology over more traditional resources is not limited to higher education. In a recent poll, U.S. teachers ranked computer skills and media technology "as more 'essential' than the study of European history, biology, chemistry and physics...and than reading modern American writers such as Steinbeck and Hemingway or classics such as Plato and Shakespeare."⁷ Unfortunately, schools are dropping traditional courses, such as art and music programs, to fund technology, even though there are no valid studies that prove such technology enhances a child's ability to learn.⁸ The long-term

implications of such priorities are provocative.

The Impact of Electronic Resources on Research

Access to electronic resources has already influenced and changed the way that students and scholars conduct research and use libraries. As mentioned above, electronic databases and indexes allow a patron to search a vast amount of information quickly. For example, a researcher can conduct an extensive literature search using multivolume resources, such as the *MLA Bibliography*, in a matter of minutes. After being introduced to electronic resources, most patrons embrace the technology and expect to conduct all of their research online using electronic indexes and full-text databases. They often are

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disappointed to learn that not all scholarly materials are available electronically. As noted earlier, in the field of Slavic studies, a small, but growing, number of electronic resources are available. However, the preponderance of research must be conducted using traditional paper and film formats. This comes as a surprise to many, particularly younger students in the field who have used electronic resources for other course work and research. On several occasions, students have requested assistance in changing the focus of their research to a topic that could be searched using only electronic sources. This trend toward using electronic resources exclusively should be cause for concern about the direction of scholarship if it now focuses exclusively on data available online. A wealth of research material is not now—and may never be—available in electronic formats. Such growing dependence on electronic resources makes one wonder if future undergraduate students will have any train-

ing or experience in conducting research with more traditional formats.

When students or scholars become fully dependent on searching online resources, what will happen when they have to conduct research in an archive or a library that is not online, or that is not covered in electronic formats? It is easy to counter with the argument that someday everything will be online. However, using the Slavic example, it is doubtful that there will ever be money available to finance the electronic conversion of all information. Simply converting the card catalogs of the Russian State Library in Moscow and the Russian National Library in St. Petersburg to an electronic format would be a major undertaking, given that the two libraries' combined holdings number more than 72 million items. The cost of converting all of these cataloged publications to a full-text digital format in a country experiencing severe economic exigencies is unthinkable for at least a generation or two.

An additional problem of electronic resources is the difficulty of identifying relevant, valid information. The Web, one of the most popular electronic resources, provides good examples of the challenge presented in identifying and accessing legitimate information. Scholars from around the globe use the Web to conduct and disseminate research. But, as we know, the Web is not limited to academic use. Individuals, social groups, politicians, eccentrics, and businesses, to name a few, also use the Web. The sheer number of sites on the Web makes it difficult to identify relevant information. Further, because of its open nature, anyone with the appropriate equipment can "publish" on the Web, even if what they are posting is inaccurate or willfully misleading. Although the Web is an excellent tool that can provide a wealth of information, because of its size and open nature, it has limitations for scholarly research.

Many people praise the Web for being very democratic. Anyone with a computer and Internet access can use it, construct home pages, and distribute elec-

tronic documents. Although this egalitarianism is a noble idea, it can create a minefield for students and scholars conducting research. In general, documents on the Web do not undergo editorial review. As a result, not all documents or information acquired on the Web are accurate. Much of what is available on the Web is, in essence, vanity publishing. Ironically, scholars who would never consider using self-published materials, as they have not undergone editorial review, often do not think twice about using information acquired on the Web. Librarians and teachers must educate students and other users to evaluate information obtained on the Web by the same standards used to evaluate other research materials.

Another problem associated with using the Web for research is the mobility of information. After a student or scholar has determined that a site provides valid information, he or she has no way to know how long the site will be available. On the other hand, when a scholar cites an archival document, the item remains available unless the archive closes or the document is destroyed. Other researchers assume that they could go to the archive to examine the document and evaluate the first scholar's interpretation. Unlike archival resources, information on the Web can migrate. Many good Web sites are shut down or move to a new location (URL). After a Web site closes, the information posted on that site may no longer be available. If a scholar cites information from a Web site, it may be impossible for others to review and evaluate his or her research.

The search process on the Web also brings up several points that need to be considered. These issues apply to the search process of other electronic formats, as well. Full-text or keyword searching provides quick access to vast quantities of information. However, the information retrieved is only as good as the source's indexing and the key words used in the search. On the Web, using the same search terms will lead you to varying results de-

pending on the search engine used (for example, Go To or Alta Vista) or the time of day the search is conducted. A single search often reveals hundreds or thousands of hits, most of which are inappropriate for the topic under consideration. The scholar must know how to use the appropriate key words and a combination of search engines to find relevant information. In an article in the *New York Times*, Steven R. Knowlton wrote that "the Internet makes readily available so much information, much of it unreliable, that students think research is far easier than it really is. As a result, educators say, students are producing superficial research papers, full of data—some of it suspect—and little thought."⁹ This illustrates that a major challenge for researchers using electronic resources is to develop a search strategy that will identify relevant information.

When conducting a search, the user must be accurate when entering the inquiry into the database. Computers will search for a term exactly as it is entered, and typographical errors could result in no hits. Surprisingly, spelling errors often result in hits. An article on search strategies for the Web reports that searching the incorrectly spelled term "mathmetics" retrieved more than two thousand hits because the creators of the documents retrieved also misspelled the word.¹⁰ This alone makes one question the validity of much of the Web as a serious research tool.

One also must consider the ramifications of using information that is possibly taken out of context. Searching the Web or a full-text database, one can download a passage or two that cover a subject. However, the passage alone may be an incomplete work. Such a search may not provide the researcher with all of the background material needed on the topic.

Publishers could use hybrid formats to improve access while still meeting the needs of users. Textbooks, for example, may best serve students in a paper format. However, publishers could provide a Web version, or include with the book a

CD-ROM version, of the text in lieu of an index. Students could use the electronic version to quickly access information but could study the paper version. Publishers would benefit from not incurring the cost of creating an index.

Cost

People are often surprised to learn that most electronic scholarly publications are not free; in fact, they frequently cost more to acquire than the paper version. Charles B. Lowry, dean of libraries at the University of Maryland College Park, and Denise A. Troll, assistant university librarian for Library Information Technology at Carnegie Mellon University, wrote that:

Too often, work on digital libraries, not to mention much theoretical discussion, proceeds without a thorough grounding in the realities of cost. There are certain assumptions which precede this state of affairs, among them the notion that digital libraries somehow will be cheaper than print libraries, perhaps even free. One suspects that this arises from the misplaced hope that digital libraries will liberate us from the difficult cost dynamics of print libraries. There is also a presumption that electronic access will mean added value to library patrons, but it begs the question if the access is at a cost patrons are unwilling to pay.¹¹

Indeed, academic librarians and patrons must carefully weigh the benefit versus the cost of electronic resources. Are we willing to pay for the added value of access (both in searching capabilities and convenience through remote access) if it comes at the cost of the breadth and scope of the research collection? Focusing all collection development funds on electronic resources will privilege some disciplines in a library's collections at the expense of others that do not extensively use digitization as a scholarly communication format.

Currently, a number of options are available to libraries for access to electronic resources. One is to own and store the information on local computers and/or by using CD-ROM products on stand-alone workstations or on a LAN (local area network). The alternative is to provide access to information that is owned and maintained by vendors or publishers through Telnet, Web-based, or direct-dial access.

One study shows that on-site storage of digital information at libraries is more expensive than storing traditional publications such as books and serials. "Based on a ten-year replacement cycle, digital storage and access will cost academic libraries sixteen times as much as print to store locally."¹² The ten-year cycle includes the replacement of computer equipment and the migration of the information to newer formats so that it continues to be accessible. Given how quickly computer equipment is evolving, ten years is a long time between upgrading hardware and refreshing the digital information.

Publishers and vendors offer remote access to electronic resources as an alternative to actual ownership of digital information. Remote access offers many advantages. First and foremost, a library will not have to maintain the equipment and incur all associated costs to store, refresh, and migrate the information. It need only supply relatively inexpensive workstations to access the resource. In addition, if a vendor maintains the information, it can be updated on a continual basis.

But there are a number of issues that librarians must consider when they pay for remote access to information. First is the user's ability to access the remote site. For example, over the past few years, the KU libraries have switched to Web interfaces to access many databases. Librarians and patrons are discovering that connect and response times can be slow. Librarians need to question paying \$80,000, or more, to a vendor when access to the database is difficult or impossible. Library

patrons expect a quick response time to electronic inquiries and will not be satisfied if they must wait several minutes simply to connect to a Web page. A published study on accessing scholarly electronic journals reports the following:

A full 55 percent of the e-journals in the sample could not be accessed on the first try by one or more of the methods listed in the directories [for example, Web, Telnet, gopher, etc.]. More than half of the access failures were due to the problems of the e-journals themselves, such as servers being down or server location changes. Moreover, about one-fifth of the e-journals had incomplete archives and almost a quarter had probably ceased publication.¹³

Incomplete electronic archives lead to a second, and major, issue concerning remote access—the purchase of “cyber vapor.” When a library subscribes to a paper or microform index, journal, or newspaper, the institution keeps the acquired issues of the publication. This ensures that the item will be available to future scholars, even if the library no longer subscribes to the title or the title ceases publication. The trend to provide access to, rather than acquire ownership of, publications means that there will only be access as long as the library is willing to pay. If a library subscribes to an electronic database for a number of years and then has to cancel its subscription because of financial problems, it is left with nothing tangible for its investment. This could lead to a situation where a library administrator might feel compelled to continue to subscribe to an electronic publication so that the library does not lose its investment. This issue is complicated by the very real possibility that electronic publications will see “captive audience” price increases similar to those in costs of scientific journals over the past decade. In fact, this is already happening. The KU libraries were notified that a subscription to a certain database would increase from

about \$24,000 in 1997 to \$250,000 in 1998. (It should be noted that the vendor did offer an alternative subscription plan for \$80,000 per year, but the database would not include all of the information in the more expensive version.) Few libraries can absorb such price increases.

Given recent developments in the library environment, publishing trends, and patron needs, the move toward providing access to information, rather than actual ownership of material, is a reality for most research libraries. However, librarians must carefully consider the implications of purchasing only access to information. Libraries will have to depend on a vendor or publisher not only to provide access, but also to archive the information. If the vendor goes out of business or decides that it is not financially viable to continue to maintain a publication, the library will lose its virtual holdings to it. Some vendors, such as East View Publications of Minneapolis, Minnesota, have come up with a workable solution. East View offers numerous Russian newspapers in electronic format. Rather than waiting six weeks to receive the paper via airmail, a person in the United States can read news reports the day they are published. Unfortunately, the subscriber will have access to this information electronically only as long as the vendor maintains the data in the computer. For archival purposes, East View offers microfilm copies of the paper at a discounted rate to electronic subscribers. This enables a library to provide immediate access to the current newspaper but also ensures that their future patrons will have access to the same publication, albeit in a slightly different format. However, this solution will not work for all electronic publications.

Librarians must take the initiative in encouraging vendors and publishers to guarantee that appropriate electronic products will be available to future generations of students and scholars in order to secure their investment. This could be done through the use of an independent third party, such as OCLC or RLG,

that would store and disseminate a resource if the vendor goes out of business or decides that it is no longer economically feasible to offer the product commercially.¹⁴ If this scenario were to occur, the database or electronic files would be transferred to the third-party site. Libraries that subscribe to the product would be assured of continued future access to the resource. However, such backup systems are only in a nascent state of development and the costs are still unknown.

Preservation

Librarians need to consider whether digitization is an appropriate format for storage and preservation. Given the rapid development of computer hardware and software upgrades, will current materials will be accessible in ten years? For example, with regard to CD-ROMS, we find that:

not that the compact disks themselves are short lived, but the hardware needed to read them is ever evolving. Support for today's technology may not be available tomorrow. What use is a disc that can last 500 years, even 100 or 50 years, if there is no machine which provides access to the information on the disc?¹⁵

By way of illustration, the U.S. government compiled the 1960 census on punch cards. The only machine that can still read the data from this census is now in the Smithsonian. A more recent example is seen in some early personal computers that are no longer produced. Often files created on such equipment can only be accessed on this equipment; current equipment is not compatible. Along with hardware is the issue of updated and revised software. Early versions of many popular word-processing programs are no longer compatible with current versions; if one does not have the earlier program available, the information originally created with the program will be very difficult or impossible to access. Any in-

formation that is stored electronically has to be constantly refreshed and migrated to maintain its integrity. This is an ongoing expense that can be costly. Each time this action takes place, there is the chance that data will be corrupted or lost.¹⁶

Currently, there are many challenges that need to be solved before on-going digital storage of information becomes cost effective for libraries.

The long-term digital preservation problem calls for a long-lived solution that does not require continual heroic effort or repeated invention of new approaches every time formats, software or hardware paradigms, document types, or record keeping practices change. The approach must be extensible, since we cannot predict future changes, and it must not require labor-intensive translation or examination of individual documents. It must handle current and future documents of unknown type in a uniform way, while being capable of evolving as necessary. Furthermore, it should allow flexible choices and tradeoffs among priorities such as access, fidelity, and ease of document management.¹⁷

Consortia of libraries and scholarly institutions can work together to use electronic resources effectively. JSTOR (Journal Storage) is one cooperative project that has promise. It is a nonprofit organization dedicated to making full use of digital technologies by providing access to and preservation of back files of important journals.¹⁸ Studies done by JSTOR participants show that this form of cooperative access and preservation is actually cheaper than storing numerous copies of the original journal in separate libraries.¹⁹ Savings are achieved through cooperation. Libraries and scholarly institutions that participate in JSTOR share in the cost of storing and refreshing the information, rather than attempting to do so individually.

The Paperless Society

It has been argued that we are moving toward a "paperless society," meaning that all information will be stored and accessed electronically. Andrew S. Grove, CEO of Intel, believes that all information can and will be stored electronically. He has written that digital information lasts forever and is "information without boundaries, fitting in with the trend toward a single, global community: it is instant, consistent with the rhythm of times—fast, fast, and faster." Further, he has written that the publishing industry has been built on "elaborate and expensive printing presses."²⁰ This last statement fails to take into account the cost of editorial review of publications and assumes that paper publication costs are based solely on physical production costs.

Recent publishing and reading trends in the United States, at least, indicate that we are not headed toward a paperless society anytime soon.

Editorial review is an expense that will occur regardless of format. Even electronic publications will need editorial review. So far, there has been no indication that electronic formats will be cheaper to acquire than hard-copy publications.²¹ Although printing equipment is an expense for paper publications, electronic formats have additional computer access and storage costs. Moreover, it should be stressed that Grove is talking about information rather than knowledge. In most cases, information probably can be best stored electronically. However, most students, scholars, and library users, in general, are not simply looking for information. The goal of a library is to provide access to knowledge. In their 1995 book, *Future Libraries: Dreams, Madness & Reality*, Walt Crawford and Michael Gorman wrote "that libraries are not wholly or even primarily about information. They are about the preservation, dissemination, and use of recorded knowledge in what-

ever form it may come so that humankind may become more knowledgeable; through knowledge reach understanding; and, as an ultimate goal, achieve wisdom."²²

In contrast to Grove's narrow view of electronic resources, Umberto Eco recently noted that, rather than moving us toward a paperless society, electronic texts have actually resulted in the increased production of printed material because we print off documents from our computers. Rather than dealing with published books and journals, we will have to cope with "tons and tons of unbound sheets of paper."²³ Eco believes that new technologies will render only some types of publications obsolete, such as multivolume encyclopedias. Most printed books that are durable, portable, and economical will continue to prosper.

Recent publishing and reading trends in the United States, at least, indicate that we are not headed toward a paperless society anytime soon. Public library book circulation increased by 15 percent between 1990 and 1991. A year later, book sales increase by almost 16 percent.²⁴ One only has to look at the phenomenal growth of the book "superstore" to see that print is not dead or dying. These stores are often open fourteen hours a day and are usually crowded. The prediction of a paperless society is premature.

Conclusion

This article has attempted to point out some of the potential limitations, costs, and problems of using electronic formats to access knowledge and information. Its goal was to take a thoughtful look at the impact that technology will have on libraries and education. Because digitization and electronic access is relatively new, it is often seen to be "better" than traditional formats such as newspapers or books. The access and storage options offered by electronic technology and digitization are exceptional in range and quantity. For many resources such as indexes, bibliographies and statistical works, digitization is the best format

available. However, the challenges and expense of digitizing all available publications are great, making the outlook for the total electronic conversion overly optimistic, given today's technology.

The belief of many people that electronic formats are superior to other formats is too simplistic. This belief is often reinforced because institutions, having invested enormous sums in creating a campuswide technology infrastructure, want to see this infrastructure maximally used in order to justify their investment. If this outlook prevails, it could have a devastating effect on the development and maintenance of library collections by diverting funds from the continuing development of unique collections. Although electronic formats offer many advantages, investing huge sums in these resources will possibly reduce the library's ability to serve its patrons as acquisition budgets are used to purchase electronic resources at the cost of acquiring books and serials. Many disciplines in the academy, particularly the humanities, continue to conduct scholarly communication through traditional formats, such as monographs. One should not consider electronic resources superior to

other formats simply because they use current technology. Library resources need to be evaluated and acquired based not on format but, instead, on content and patron and disciplinary need.

As electronic resources for the publication of information become more prevalent, perhaps the all-or-nothing attitude in support of or against them will subside. We now have many communication choices, including mail, fax, telephone, and e-mail; and we choose the right format to meet our communication needs on a daily basis. No one form is better than the other. In much the same way, publishers, librarians, scholars, and the reading public will use the appropriate format to access information with no one type superior to the other. Currently, electronic formats are best suited for resources such as indexes, full-text databases, and other publications that benefit from enhanced searching capabilities and the ability to update information on a regular basis. Other publications, such as novels, magazines, and newspapers, will probably continue to be published in inexpensive paper formats. One would be hard pressed to find a better format for a fifty-cent newspaper, which is inexpensive and easy to access.

Notes

1. An earlier edition of this paper was presented at the 1997 Globnet conference held in Warsaw, Poland, in November 1997 (available online at <http://slim.emporia.edu/globenet/globenet.htm>). An abbreviated earlier version of this article was published as "The Effects of the Digital Revolution on Libraries and Research," *NewsNet: The Newsletter of the American Association for the Advancement of Slavic Studies*, 38 (May 1998): 1-3.

2. Joseph Branin, Frances Groen, and Suzanne Thorin, "The Changing Nature of Collection Management in Research Libraries," *Library Resources & Technical Services* 44 (Jan. 2000): 26. A version is also available online at <http://www.arl.org/collect/changing.html>.

3. For an excellent examination of the issues related to copyright, fair use, and ownership of intellectual property in the digital age, see: National Research Council, Committee on Intellectual Property Rights in the Emerging Information Infrastructure, *The Digital Dilemma: Intellectual Property in the Information Age* (Washington, D.C.: National Academy Pr., 1999); also available online at http://bob.nap.edu/html/digital_dilemma/. A good overview of this extensive report can be found in Ann Okerson, ed., "The Digital Dilemma: Intellectual Property in the Information Age," *Against the Grain* 12 (June 2000): 45-54.

4. *Buildings, Books and Bytes: Libraries and Communities in the Digital Age* (Washington, D.C.: Benton Foundation, 1996), 4.

5. Abby Smith, *Why digitize?* (Washington, D.C.: Council on Library and Information Resources, 1999), iv.

6. For a good evaluation of the databases that are currently available, see: Michael Neubert, "Online News from Russia via the Internet," *Slavic & East European Information Resources* 1, no. 1 (2000): 45-67.

7. Todd Oppenheimer, "The Computer Delusion," *Atlantic Monthly* (July 1997): 46.
8. *Ibid.*, 47. In fact, people are questioning the value of having young children use computers. See, for example: Kathy Kelly, "False Promise: Parking Your Child in Front of the Computer May Seem Like a Good Idea, But Think Again," *U.S. News Online* (Sept. 25, 2000); available online at <http://www.usnews.com/usnews/issue/000925/nycu/computers.htm>.
9. Steven R. Knowlton, "How Students Get Lost in Cyberspace," *New York Times Education Life* 2 (Nov. 1997): 18.
10. Julia K. Nims and Linda Rich, "How Successfully Do Users Search the Web?" *College & Research Library News* 59 (Mar. 1998): 158.
11. Charles B. Lowry and Denise A. Troll, "Carnegie Mellon University and University Microfilms International 'Virtual Library Project,'" *Serials Librarian* 28, nos. 1/2 (1996): 160–61.
12. *Ibid.*, 165.
13. Stephen P. Harter and Hak Joon Kim, "Accessing Electronic Journals and Other E-publications: An Empirical Study," *College & Research Libraries* 57 (Sept. 1996): 454.
14. OCLC is developing Electronic Collections Online (ECO) as a way to archive digital publications. Through negotiated agreements with publishers, libraries that subscribe to ECO will continue to have access to electronic publications covered during the paid subscription period, even if the library discontinues its subscription to the title. Information on ECO is available online at <http://www.oclc.org/oclc/eco/archive.htm>.
15. Marcia Watt and Lisa Biblo, "CD-ROM Longevity: A Select Bibliography," *Conservation Administration News* (Jan. 1995): 11–13.
16. For a concise explanation of the problem, see: Howard Besser, "Digital Longevity," in *Handbook for Digital Projects: A Management Tool for Preservation and Access*, ed. Maxine K. Stitts (Andover, Mass.: Northeast Document Conservation Center, 2000), 155–65; available online at <http://www.nedcc.org/digital/dighome.htm>.
17. Jeff Rothenberg, *Avoiding Technological Quicksand: Finding a Viable Technical Foundation for Digital Preservation: A Report to the Council on Library and Information Resources* (Washington, D.C.: Council on Library and Information Resources, 1999). The publication is also available online at <http://www.clir.org/pubs/reports/rothenberg/introduction.html>. The quote in the text is taken from the executive summary of the Web version located at <http://www.clir.org/pubs/reports/rothenberg/preface.html#executive>.
18. Kevin M. Guthrie and Wendy P. Lougee, "The JSTOR Solution: Accessing and Preserving the Past," *Library Journal* (Feb. 1997): 42–44.
19. William Bowen, "JSTOR and the Economics of Scholarly Communication," in *The Economics of Information in the Networked Environment*, ed. Meredith A. Butler and Bruce R. Kingma (Washington, D.C.: ARL, 1995), 28–30.
20. Andrew S. Grove, "What Can Be Done, Will Be Done," *Forbes* 158 (Dec. 2, 1996): 193.
21. In addition, the potential for profit, at least for popular magazines, is not as high as some would believe. "Magazines are going to be losing money on the Web for years to come, says McKinsey and Co. Director Joanna Barsh following a 2½-month study done in cooperation with the Magazine Publishers of America." From David Lieberman, "Study Says Magazines Shouldn't Rush to Web, as Profit Potential Is Low," *USA Today*, 23 Oct. 2000, 3b; available online at <http://www.usatoday.com/life/cyber/tech/cti705.htm>.
22. Walt Crawford and Michael Gorman, *Future Libraries: Dreams, Madness & Reality* (Chicago: ALA, 1995), 5.
23. Umberto Eco, "Gutenberg Galaxy Expands," *Nation* 264 (Jan. 6, 1997): 35.
24. Crawford and Gorman, *Future Libraries*, 16.