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An issue editor proposes the theme and scope of a new issue, draws up a list of prospective authors and article topics, and provides short annotations of the article’s scope or else gives a statement of philosophy guiding the issue’s development. Please send your ideas or inquiries to F. W. Lancaster, Editor; Publications Office, 501 E. Daniel Street, Champaign, IL 61820-6211.
Networked Scholarly Publishing

F. W. Lancaster
Issue Editor

University of Illinois
Graduate School of Library
and Information Science
A Networked Approach to Scholarly Publishing within Universities

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Introduction

F.W. Lancaster

While I have authored several books, reports, and articles relating to electronic publishing over the last twenty years, the specific topic of this issue of Library Trends—a networked approach to scholarly publishing drew my interest in 1992 while preparing an article on the future of collection development in libraries. In compiling this issue, I have attempted to obtain contributions that look at the subject from many different perspectives.

In the first article, I review developments in electronic publishing, with special reference to the electronic journal, from the 1960s to the present.

In the next article, Tom Hickey describes the current capabilities of online journals and discusses their advantages and disadvantages as compared with print-on-paper journals. Among the major advantages of the online journal are ease and speed of publication, enhanced presentation of information (e.g., through hypertext links and color graphics), and immediacy of communication between readers and authors. He refers to possible future capabilities and mentions problems that still need to be solved before a more complete conversion from paper to electronics occurs.

Ann Bishop looks at seven online journals from a user's perspective, dealing with content, format, policies, ease of use, and general utility. She claims that the existing journals, while they still present some problems, are beginning to offer several advantages over print journals, and she identifies some requirements that scholarly network journals should satisfy in the future.
In order to succeed, the online journal must be capable of meeting the needs of both authors and readers. As Carol Tenopir points out, these needs are not always compatible. She concludes that scholarly communication can be successful without complete harmony between the needs of author and reader. This is true of the world of print on paper and can also be true of the electronic environment.

An online journal need not be considered as a medium of communication that stands on its own. Indeed, such a journal in a specialized subject area can be a central component in an online intellectual community. Teresa Harrison and Timothy Stephen discuss this phenomenon, pointing out that the electronic journal has an important role to play in facilitating the routine discourse processes of scholarly communities. Moreover, the move to this medium will change the way that scholars read, write, and do research; it will also change the form of research products.

Kenneth Arnold agrees that electronic publishing will significantly alter publication forms and may eliminate distinctions that now exist among various forms. He points out that the impediments to change are cultural rather than economic or technological.

As more and more scholarly literature becomes network-accessible, a significant problem becomes that of effective access. Stuart Weibel addresses the access issues, including the display and indexing of structural text and the relationship of existing standards for bibliographic description to emerging standards for the description of networked information resources.

Bryce Allen deals with the need for collaboration among the various academic departments, his viewpoint being primarily that of the academic library. He identifies three barriers to collaboration: clashes of organizational cultures, personal incompatibilities, and different approaches to change. He believes that academic libraries can move into a pivotal role in the generation, collection, distribution, and use of scholarly information.

Gay Dannelly addresses the issue of library resource sharing in an increasingly electronic publishing environment. She points out that the challenge facing libraries is to find organizational models, procedures, and mechanisms to enhance the ability of library users to find the information resources they need wherever they happen to be located.

One possible impediment to the rapid move to electronic publishing is the copyright issue, addressed here by Laura Gasaway. She suggests that the publication of scholarly works through university-managed networks promises to offer innovative solutions to the copyright problem and "restore the balance between the rights of authors and publishers."
Archival and preservation issues are discussed by Maynard Brichford and William Maher. They point out that preservation is more a problem of access to information than of the survival of any particular storage medium—a matter of editorial and administrative policy rather than a technical or materials issue. In dealing with the transition to electronic publishing, archivists will need to confront and employ rapidly changing technologies, face legal issues surrounding authenticity and property rights, recognize the necessity for the early incorporation of preservation measures into information systems, and serve clienteles that expect rapid access to archival holdings.

It is obvious that the acceptability of a scholarly publishing system that is network-based will depend very largely on the costs to users. Donald King and José-Marie Griffiths discuss economic factors that relate to scholarly journals in general and to their publication in electronic form in particular. They point out that we still need a more complete understanding of the effects of electronic alternatives on the systemic and economic dynamics of scholarly publishing.

In the final article, I present the results of a survey of attitudes toward networked scholarly publishing among academic administrators, concluding that universities are not yet ready to give such an enterprise high priority in funding.
The Evolution of Electronic Publishing

F. W. Lancaster

Abstract
Summarizes the development of electronic publishing since the early 1960s—when computers were used merely to produce conventional printed products—to the present move toward networked scholarly publishing.

Introduction
The scope of the term "electronic publishing" can be interpreted in many different ways. For example, it could be considered to include all forms of electronic aids to authors, from simple word processing capabilities to actual typesetting and/or mark-up tools (Pilachowski, 1993), as well as networking support to collaborative authorship and electronic communication among authors, editors, referees, and other participants in the publishing process.

Since "publishing" implies production and distribution, however, the term refers most obviously to the generation of publications in electronic form or, at least, with the aid of electronics. In this more restricted sense, electronic publishing can be considered to have evolved gradually over a period of about thirty years, the evolution having the following manifestations:

1. Use of computers to generate conventional print-on-paper publications.
   This development can be traced back to the early 1960s (e.g., the production of Index Medicus at the National Library of Medicine). The
use of electronics to print on paper is not a completely pedestrian application since it allows new capabilities such as printing on demand and even the production of customized publications tailored to individual needs.

2. The distribution of text in electronic form, where the electronic version is the exact equivalent of a paper version and may have been used to generate the paper version. For secondary publications (indexing and abstracting services), electronic distribution began early in the 1960s. For primary journals, the development occurred somewhat later. Today there is considerable activity and interest in projects that make electronically accessible the text and/or graphics of journals that are also sold in print-on-paper form. Major projects of this kind (in which the electronic version is accessible online, as CD-ROM, or as a combination of these modes) include ADONIS (Stern & Compier, 1990), Red Sage (Borman, 1993), CORE (Annual Review, 1992; Borman, 1993), and TULIP (Borman, 1993). Moreover, the full text of a significant number of journals is now made accessible online by vendors such as DIALOG.

3. Distribution in electronic form only but with the publication being little more than print on paper displayed electronically. Nevertheless, it may have various "value added" features, including search, data manipulation and alerting (through profile matching) capabilities.

4. The generation of completely new publications that exploit the true capabilities of electronics (e.g., hypertext and hypermedia, electronic analog models, motion, sound). This phase of development can actually be subdivided into:

   (a) the presentation of existing text and graphics in innovative ways (e.g., the Perseus Project) (Mylonas, 1993), and

   (b) the production of publications designed ab initio to exploit full electronic capabilities.

While these can be considered as logical steps in an evolutionary process, the actual evolution is not easy to depict since all of the steps now co-exist (i.e., the fourth phase of the evolution is already in place, but the first phase has not disappeared). Moreover, the ultimate stage (4[b]) is not yet fully realized: while some authors have produced works that were intended from conception as electronic publications (e.g., for the hypertext medium), this is by no means the norm. Some idea of the true potential of electronics in publishing can be obtained by reading in the area of "virtual reality" (e.g., Rheingold, 1991; Helsel & Roth, 1991; Pimental & Teixeira, 1993). Krueger (1983), in particular, has suggested how electronics allows completely new approaches to the presentation of information, imagination, and inspiration.
Libraries have already been profoundly influenced by the developments in electronic publishing. At the lowest level of effect, it is now commonplace for them to make electronic publications available, through online access or in CD-ROM form, and to instruct patrons in the use of these resources. Several of the larger academic libraries have gone much further by establishing departments designed to support access to publications in electronic form and to exploit their capabilities. Some of these do more than the training of users and the provision of access. For example, the Electronic Text Center at the University of Virginia Library has assumed responsibility for the SGML-tagging of certain texts that lack such encoding (Seaman, 1993). Libraries now being established may be designed from the beginning as "electronic libraries." For example, the Electronic Library at DeMontfort University at Milton Keynes (Leicestershire, England) has entered into its own negotiations with publishers to acquire text in electronic form (Arnold et al., 1993; Collier et al., 1993).

THE ELECTRONIC JOURNAL.

The term "electronic journal" is almost as ambiguous as the term "electronic publishing." A very loose definition of the term—any journal existing in an electronic format—would embrace all periodicals available electronically as well as in paper copy, including the text of periodicals accessible through online networks and those periodicals distributed in CD-ROM form.

By a more strict definition, however, an electronic journal is one created for the electronic medium and available only in this medium. If we accept a rather relaxed definition of "journal," electronic journals have existed for about twenty years—the informal newsletters produced within computer conferencing networks or even the messages of the conference itself could be loosely considered as a form of journal.

Sondak and Schwartz (1973) may have been first to conceive of a scholarly journal published in electronic form. However, they visualized the distribution of the journal to libraries as a computer-readable "archival file" rather than by online access, and distribution to individual subscribers in the form of computer-output microfiche. Senders, Anderson, and Hecht (1975), Senders (1976, 1977), Roistacher (1978), and Lancaster (1978) were among the first to discuss possible characteristics of an online "virtual" journal, and Senders, Anderson, and Hecht (1975) presented a detailed economic analysis. Roistacher (1978) and Folk (1977) also included some cost data.

The first experiment with a true scholarly journal—one with editorial standards and refereeing procedures—was conducted with a journal on mental workload within the Electronic Information Exchange
System beginning in 1979 (Turoff & Hiltz, 1982). Shortly afterward, in 1980, the British Library awarded a grant to Loughborough University to establish an experimental online journal in the area of computer human factors (Shackel, 1991). These early prototypes were not completely successful in that the journals thus established were not continued beyond the period of the experiments. Three major problems impeded the permanent establishment of electronic journals a decade or so ago: (1) not enough members of the target community (potential authors as well as potential readers) had the necessary terminals readily available to them; (2) other technological barriers—e.g., telecommunication problems, slow response, poor quality display, lack of "friendliness"—discouraged use; and (3) (and probably most important) potential authors could see no obvious rewards associated with the contribution of articles to an electronic database—i.e., no honoraria; no royalties; no evidence that such publication would carry much weight in promotion, tenure, or salary decisions; and no guarantee that the audience reached would be a large one. Nevertheless, these early experiments were valuable for the very reason that they did expose the problems that would need to be solved before a scholarly journal in electronic form could be sustained.

The probability of being able to sustain a scholarly journal solely in electronic form has increased considerably in the last decade as terminals and workstations have become more widespread, as friendlier interfaces have been developed, and as research-oriented networks have fallen into place. Many different periodicals now exist within the Internet. While the majority are rather informal newsletter-type publications (Association of Research Libraries, 1993), a handful of refereed or "lightly refereed" (Okerson, 1991) journals are operating, and others are in planning or development stages.

Existing electronic journals that can be considered as in some sense "scholarly" include Postmodern Culture (Amiran & Unsworth, 1991), Psycoloquy (Harnad, 1991), the Electronic Journal of Communication (Harrison et al., 1991), New Horizons in Adult Education (Hugo & Newell, 1991), the Journal of the International Academy of Hospitality Research (Savage, 1991), the Public Access Computer Systems Review (Bailey, 1991), and Ejournal (Jennings, 1991). In addition to these journals existing in university settings, OCLC Inc., in collaboration with the American Association for the Advancement of Science, mounted the online Online Journal of Current Clinical Trials and is in the process of implementing further online journals in the areas of nursing and electronics. Clement (1994) lists twenty-five network journals currently operational or in planning stages in the sciences alone.

All of these journals are similar in that they exist only (or, at least, primarily) in electronic form, can be accessed online, and impose
certain standards on the contents of the database. There are also differences among them. Some group papers into "issues" in much the same way that a paper journal does, while others merely add new papers to the databases as they are accepted. Some accept graphics as well as text while others do not. Some journals offer contents pages and abstracts, requiring users to request the full text if wanted, while others initially disseminate the full text to users. The majority are offered free to users, but at least two are available only on a subscription basis. Some of the online journals are merely "delivered" to users via some file server or e-mail system while others allow true interaction between user and journal. Of the existing electronic journals, the Online Journal of Current Clinical Trials appears to be the most sophisticated, offering elaborate windowing facilities, hypertext linking (including the ability to view an abstract of an item cited in an article), and graphics.

In discussing journals in electronic form, it is important to make a distinction among these new journals, established within online networks, and the print-on-paper journals that have been made accessible in electronic form by publishers either on CD-ROM or online. Projects that make the text of existing journals available on CD-ROM are primarily electronic document delivery systems. The text is stored as "bit-mapped" images of the printed journal pages achieved through optical character recognition. Bit-mapped images require rather large amounts of storage, allow terminal display that is of low quality compared with the display of computer-readable text (e.g., in ASCII format), and cannot be searched or otherwise manipulated by computer (although ancillary databases, such as indexes to and abstracts of the page images, can be). Nevertheless, the bit-mapping approach has the obvious advantage that it allows older materials to be made available in electronic form without the need for rekeying. Of course, a particular implementation can incorporate both page images (to give the reader "the feel" of the familiar journal format) and computer-readable text; this is true, for example, in the Red Sage project, which makes use of the RightPages system devised at AT&T Bell Laboratories (Story et al., 1992; Hoffman et al., 1993), and in the CORE project (Annual Review, 1992; Entlich, 1994).

When the complete text of print-on-paper journals is made accessible through online networks, the text is in ASCII format and fully searchable. Nevertheless, such journals are merely examples of print on paper made accessible electronically. The new journals referred to earlier were designed ab initio as journals in electronic form and can be given capabilities not present in the electronic manifestations of printed journals. For example, the text can be encoded with SGML
tags to improve its functionality (e.g., in the implementation of such features as windowing, hypertext, and the integration of text with graphics).

A scholarly journal in electronic form can potentially offer several advantages over one printed on paper, including:

1. More rapid publishing of research results through electronic submission of articles; network communication among authors, editors, and referees; and by the fact that contributions can be added to a database as accepted rather than held to form the next “issue.”

2. More efficient dissemination of information through the matching of articles newly accepted into databases with the interest profiles of potential readers.

3. Innovative ways of presenting research results and other forms of data and information—analog models, motion, sound, hypertext, and hypermedia linkages (including linkages among journals and other electronic resources).

4. Public peer review facilitated through the ability to link reader comments and evaluations to published articles.

5. Lower cost per successful match between article and reader.

6. Speed of publication and ease of communication lead to a more interactive journal in which one contribution may spawn rapid responses from other researchers.

Carried further, an electronic journal established within a network can assume a scholarly role that is more comprehensive than the role played by the typical journal in paper form. As Stephen and Harrison (1993) point out (and Harrison & Stephen do again in more detail later in this issue of Library Trends), it can become the central component in an electronic center of expertise and a key element in an online intellectual community.

The fact that several scholarly journals have recently emerged within the networks may give the impression that the problems faced by the prototypes of a decade or so ago have already been solved. This is not entirely true. It is still difficult to attract contributors (Savage, 1991; Jennings, 1991), and even some technological problems still exist. For example, Savage, Hugo, and Newell (1991) have reported that some of their potential subscribers or readers do not have ready access to terminals or lack institutional support for network access; Bailey (1992) points out the limitations of ASCII text files for the distribution of electronic journals and suggests that no existing software tools can do everything needed for a fully successful implementation of a scholarly journal in electronic form. Nevertheless, while Bailey identifies several problems to be solved, he sees none that is insuperable.
There is another potential obstacle that seems to have received little attention—the fact that the desires of authors and of readers may not fully coincide. The designers of electronic journals assume that most users want the ability to jump around in text (and possibly to link with other text or other publication forms), and some writers (e.g., Arnold, 1993) have suggested that a major advantage of electronic publishing is that it can deal in pieces of text rather than complete packages of text and, thus, the distinction between the journal and the monograph might no longer be meaningful. On the other hand, Tenopir (1988) has reported that, in her experience, authors and publishers have strong objections to readers being able to view segments of text out of its complete context because this threatens the integrity of their work and could lead to misinterpretation and misrepresentation. She discusses this matter further in this issue.

Electronic journals accessible through the networks are now receiving considerable attention from academic libraries. For example, one consortium has already accumulated on a server a collection of more than 600 such journals, is developing collection development policies, is taking steps to catalog the collection, and is studying many of the problems involved in providing access to a collection of this type (e.g., problems of archiving and of the incorporation of fee-based titles).

The scholarly journals recently emerging within the electronic networks have mostly been established within academic departments at the initiative of a handful of researchers. The impetus has not come from academic administrators or the university presses. Nevertheless, it is now becoming more generally recognized that:

1. The academic community has lost control over its research output since the published results of its research are not disseminated directly by the universities but by journal publishers, many of these in the for-profit sector, and copyright is usually transferred from researcher to publisher.
2. The university community is forced to buy back, from the commercial sector, its own research output at ever-escalating costs that make the university libraries a continued drain on institutional resources.
3. The existence of computer and telecommunications networks now allow us to conceive of a completely new approach to scholarly publishing, one in which the universities bypass the present journal publishers and publish the results of their own research in electronic form.

Some examples of this rumbling of discontent and the attendant call for significant change include the following:

the continuing trend toward cancellation of journal subscriptions indicates that the costs of the practice of paying scholars to
produce knowledge and then paying a second time to acquire it from publishers needs reevaluation. (Britten, 1991)

a vision of university-based electronic networked publishing is expressed by many librarians and other members of the university community in conversations about academe’s regaining control and distribution of its own intellectual output. (Okerson, 1991)

Unthinkable as it might have seemed until very recently, the idea of the academy retaking control of the bulk of scholarly publishing is being forced into consideration by the practices of the commercial publishers themselves. Their bills simply cannot be paid indefinitely, and something must give....The responsibility for the creation of an alternative scholarly communications system rests with the faculty and administrators of all major universities in this country and beyond. (Metz & Gherman, 1991)

Of course, a networked approach to disseminating the results of academic research does not necessarily imply that each institution would publish its own research output. A more likely model is one in which each university would take on the responsibility for creating and maintaining databases in a few areas in which it is recognized to be excellent. Researchers from all over the world would submit articles to be accepted into these databases in much the same way that they now submit to the publishers of paper journals, and submissions would be subjected to rigorous refereeing.

While the academy is now the center of scholarly research and of informal scholarly communication, it is not really the center of formal scholarly communication since it does not directly control its own published output. By becoming the disseminators of their own research results, the universities would become the centers of scholarly communication in the broadest sense of the term.

The final article in this issue of Library Trends presents the results of a survey of attitudes in academia toward networked electronic publishing of the results of scholarly research.

NOTES
1 For the purpose of this article, "scholarly" refers to a journal in which stringent criteria on acceptance of contributions are imposed by external referees or by an editor or editorial board.
2 Purchased from AAAS in 1994 by Chapman and Hall.
3 This is a little misleading. While free online access is allowed, other options—e.g., to receive in paper, microfiche, or diskette form—will involve a cost to recipients.

REFERENCES


Present and Future Capabilities of the Online Journal

THOMAS B. HICKEY

ABSTRACT

Electronic versions of traditional paper journals offer a number of advantages, most of which have been more than offset by the electronic journals' disadvantages. Advances in computing developed primarily for the office environment are reducing the technical disadvantages to the point where electronic formats are rapidly approaching parity of ease of use and convenience with paper.

Electronic journals are currently being developed in three main formats: simple text, page image, and structured text. Each of these formats has its own strengths and weaknesses, and there are some combinations of the three that offer interesting capabilities.

Automation is often described as automating what we currently do, which in turn changes what we do, resulting in another generation of automation. In many ways, changing what we do occurs simultaneously with the automation of an activity as users of information develop new ways to use the electronic medium. The role traditional journals play is changing as it becomes much easier for individuals to publish articles directly.

INTRODUCTION

Although it has been popular for some time to claim that the technical problems associated with the electronic delivery of journals have been solved, or are simply those of scale (Lancaster, 1978, p. 141), it is only recently that the operating systems, windowing sys-
tems, fonts, communications facilities, and computational capacities have matured enough to handle the demands placed on them by electronic journal applications.

As existing materials become electronic, there is a clear and predictable migration: the more highly used a source is and the more that currency is important, the more quickly electronic versions become available. A third criterion is ease with which the transition can be made. Following these guidelines, reference materials, such as abstracting and indexing services, were available first. These materials are highly used, require being kept current, and are relatively compact. Abstracting and indexing databases also offered relatively few problems in computerization; text with a simple structure for the bibliographic information is perfectly adequate for these databases.

Next to be transferred are reference works, such as encyclopedias, dictionaries, and handbooks. This has already happened. Even though these sources pose some of the more difficult technical problems, they are very valuable, and both online and CD-ROM versions are appearing (Budd & Williams, 1993).

Journals offer more problems. They are not as heavily used, so that conversion to electronic form has to be relatively inexpensive, but the typography of journals can be very complex. Although simple textual versions have been available for some time, fully functional journals have only become available recently, both as page image and as structured text, described later.

The final stage will be access to books electronically. Some of this is happening now in multimedia CD-ROM and online access, but the general appearance of electronic books will trail that of journals (Lacy, 1993).

DIFFERENCES BETWEEN PAPER AND ONLINE JOURNALS

Although some of the differences between online and paper journals were fairly easy to predict, such as the importance of individual articles over journal issues or even titles (Hickey, 1981) and the efficiencies of central storage and electronic mail (Folk, 1977), we are only gradually becoming aware of other differences. The differences which are currently most apparent are the relative ease of publication compared to paper, the importance of hypertext links, color graphics, and immediacy of communication with the authors.

It is now possible for sophisticated computer users connected to the Internet to obtain free software and make their information freely available to millions of people (Dallman et al., 1994). Currently, the most popular method is via the World Wide Web (CERN, 1994b). After this has been done, other users can add their own papers with only moderate effort. Thousands, if not tens of thousands, of sites are now doing this on the Internet.
The documents being put up at these sites range from what are easily recognized as journals to much looser collections of files. What they have in common are hypertext links with which the author can point to other files of interest. Another common characteristic of these documents is the extensive use of color graphics. Possibly this is simply a matter of the novelty of being able to include color in documents with relative ease, but it is rapidly becoming the norm.

Another important feature of this informal electronic publication is the immediacy of communication that can be accomplished between the author and reader. The people using these systems nearly all have electronic mail, allowing immediate feedback to the author, and new versions of papers can be published immediately after completion. This has the effect of creating new communities with the ability to discuss and comment on works in progress unknown just a few years ago.

The different economic factors associated with online journals (composed with conventional journals) have yet to have much impact on libraries and publishers, but as their use increases, this will have a profound effect as more centralized storage becomes feasible, and libraries’ role in archiving journal issues diminishes. What the impact on libraries and publishers will be of what libraries now consider “gray literature” that is now becoming so important on the Internet is impossible to predict, except that the changes will be profound.

ADVANTAGES OF ONLINE JOURNALS

The electronic format offers many advantages to both users and publishers which paper publication cannot match:

- **Customization.** Only the articles of interest are “delivered” and the user has some control over the appearance of the articles both printed and on the screen.

- **Integration with other work.** As the capabilities of computers grow, a situation is rapidly developing in which many people do most of their work at personal computers (Reinhardt, 1994). The two most important tools for scholars are probably electronic mail (e-mail) and word processing, but other activities, such as searching bibliographic databases, working with spreadsheets and, more and more, filing and creating personal databases, are all being done with personal computers. The ability to refer to articles at the same time on the same machine as other tasks are performed will become invaluable.

- **Full-text searching.** The retrieval capabilities of journals in electronic form are far better than those in paper. Every word in the article is a potential retrieval point so that even a caption of a figure can be used to find a half-remembered article.
Speed of access. Minutes or even seconds rather than hours or days.

Speed and cost of publication. Avoiding the printing and mailing process can easily drop two to three weeks off the current publication cycle. Machine-readable text from authors is gradually lowering costs and reducing time as authoring and publishing systems become better integrated (Lynch, 1994; Lacy, 1993) and, as electronic transmission is used more in the review process, additional time will be saved.

Availability. Assuming an electronic version of a document is available at all, there is a much higher probability of a user actually receiving it than in a typical library where journal issues and individual articles may be in use, in the bindery, or missing altogether.

Hypertext links. Existing journal articles contain a large number of links both within the article and to other articles. These will gradually become "hot" links in the electronic version, where a simple click on a reference will either lead one to where it was cited, to an abstract of it, or to the article itself. As articles change in response to this sort of capability, their organization may change into something more highly linked, relying on the ability to easily follow links to include references to other articles or other data sources (Manoff, 1992).

Portability. Although it is hard to improve on the portability of a photocopy of a single article, and electronic versions impose the burden of providing processing, communications, and display support, the lightness and growing ubiquity of portable computers is rapidly closing the gap between electronic sources and paper. This is especially true if one considers that a simple CD-ROM could contain several thousand articles with complete indexing and graphics. One can conceive of having a complete copy of everything one has ever read contained within a notebook computer in addition to having fairly good access to everything else on the Internet.

Less paper. Paper has many excellent qualities, but electronic versions of documents consume fewer resources and are easier to manage.

**Disadvantages of Online Journals**

Most disadvantages of online journals are rapidly, or gradually, disappearing, but there is no denying that, so far, these have overwhelmed any advantages of electronic journals over paper.

Frustrating interfaces. Anyone who has used computers at all has encountered the frustration of being incapable of accomplishing a simple task. The same sort of thing can happen to conventional library users, but it is often less obvious and frustrating, and very often there is someone available to ask what to do. Manual solutions are often more obvious and easier to remember as well.
Reliance on equipment. At least with paper, you are assured that once it is in hand, you can read it, probably indefinitely. An electronic version will not only require computer hardware, but software, and this software will have to know the format of the journal to display it.

Less permanent. Electronic versions of online journals are easy to lose, and their reliance on software and hardware makes them impermanent. This is a problem both for institutions such as libraries that might want to preserve them and for individuals that wish to maintain their own collections (Stanley, 1994).

Higher and more obvious costs. The systems needed for display and the network needed to retrieve electronic articles are added costs to the end-user. Access to electronic articles is easier to monitor than to paper collections, so there is more possibility of publishers or others collecting fees for use.

Lower quality. Although recent electronic journals may rival a photocopy of an article, few rival the original print publication, especially on computer screens. These screens all have lower resolution than paper and are usually smaller than two pages of a journal. Photographs are often scanned incorrectly, and printers have only recently reached resolutions that can be called acceptable.

Requirement to log-on. This is at least an annoyance and, as pointed out earlier, can lead to higher, or at least more immediate, costs. Requiring a password also raises a barrier to use since it requires remembering it. There are also privacy issues; electronic access is only private when designed to be so, and publishers are obviously interested in what and how much material is being used, and to some extent, by whom (Hugenholtz, 1994).

Incompatible software. Different systems tend to require different software interfaces, each of which requires some effort to develop proficiency of use.

Less material available. This is probably the most crucial problem. The source material is the key to any successful library, whether it is paper or electronic. Electronic bibliographic databases have essentially achieved parity with their paper versions in coverage, but full-text journals cover only a small percentage of what is available in paper. Until this changes, usage of electronic versions of what is available will remain low.

Network speeds remain too low. This has a chilling effect on browsing because it takes much longer to look at a new page online than to flip to a new page in a paper journal. Techniques such as prefetching pages are only partially successful in ameliorating this.

Types of Electronic Journals

Electronic journals are offered in three main formats:

1. ASCII. Simple text, no formatting or graphics
2. Image. Scanned images of the pages (facsimile)
3. **Structured Text.** Standard Generalized Markup Language (SGML)

Each has benefits, drawbacks, and rather distinctive capabilities. Structured text offers the most advantages in the long term and will be emphasized here, although page images will probably dominate over the next few years because of economic issues.

**Simple Text**

Often called ASCII (American Standard Code for Information Interchange) after the most commonly used encoding scheme or simply "full text," the text of the articles in many journals has been available electronically in this format for over a decade. Typically what is stored is the text of each article, broken into paragraphs, along with bibliographic information in a simple tagged format.

**Advantages**

- **Compact.** Since only the text is stored (no graphics or page layout information), this is the most compact format, taking only 3,000 to 5,000 bytes per page. This makes it both cheaper to store and transmit to the user than other electronic formats.
- **Relatively cheap to capture.** Often this can be done by processing the text entered during production of the journal.
- **Can be displayed on any computer terminal.** This is probably its greatest strength over other electronic formats.
- **Full text available for searching.** This would seem obvious, although when pages are treated as images rather than text, a reliable version of the full text may not be available.
- **Compatible with electronic mail and computer bulletin boards.** Textual databases are the easiest to integrate with other services, which themselves are text based (DIALOG DIRECT, 1994).

**Disadvantages**

- **Only the simplest tables and few equations can be represented adequately.** The standard fixed-pitch font with only a few special characters in it is not up to the display of much of the published literature.
- **No figures available.** The only thing stored is text.
- **No special characters displayed.** This is more a difficulty in some disciplines than others, but characters not covered by the ASCII set occur in almost all fields occasionally.
- **No formatting of the text** (e.g., no italics, bold, size changes). This is mostly an aesthetic problem, but typographic clues do provide substantial help when scanning and reading articles as well as making the page much more visually pleasing.

Although in many ways simple text is inadequate to represent many, if not most, journal articles, actual users of "full-text" documents complain
mostly about the lack of coverage of the present online journals (Everett, 1993a, 1993b).

Page Image Format
Page images are most easily thought of as facsimile images of the pages and, as a matter of fact, these are typically stored in CCITT Group 4 facsimile format because that is one of the most compact ways to store black and white scanned images of text. Conceptually, this could be expanded to include color images of pages, but current work is almost all black and white because of storage, scanning, and processing costs. In this way, it follows closely the lead of microfilm which is still almost completely black and white. This is likely to remain true because of the difficulty of representing text well in color formats, again similar to the tradeoffs in the film world of high contrast versus continuous tone and color.

Advantages
- *Easy and inexpensive to capture.* After publication, the page is scanned on a digital scanner, usually at 300 dots per inch (dpi). An alternative is to capture the image directly from the typesetting system, which results in a dramatically improved image, even at the same resolution, because the artifacts introduced by the scanning process are avoided. Figure 1 shows examples of text that have been scanned and then converted into levels of gray for display, along with somewhat equivalent examples of what structured text looks like both displayed and printed.
- *Retains the format of the original.* Since it is the original paper which is scanned, the image is a relatively faithful representation of it.

<table>
<thead>
<tr>
<th>Scanned image at 300 dpi</th>
<th>optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen display of scanned image</td>
<td>optimal</td>
</tr>
<tr>
<td>Structured text displayed on screen</td>
<td>optimal</td>
</tr>
<tr>
<td>Structured text printed at 300 dpi</td>
<td>optimal</td>
</tr>
</tbody>
</table>

Figure 1. Examples of text from different sources.
Disadvantages

- **The text is usually available only via OCR (Optical Character Recognition).** OCR is normally done from the scanned image, a surprisingly error prone process especially in scientific texts.
- **Display and printing is limited to the resolution of the original scan (normally 300 dpi).** Even though higher resolution printers are becoming common, the costs of storing and transmitting higher resolutions ensures 300 dpi capture for some time to come.
- **Color is not normally available.** The scanning process is almost always black and white, as is the transmission format.
- **Photographs are difficult to reproduce.** A scanning resolution of 300 dpi is inadequate to capture half-tone photographs.
- **Images require a large screen for adequate use online.** Since the format is that of the original paper, users have to cope with page images on the screen. Even the better screens, with over a thousand pixels across, can seldom show even a single page in its entirety and still have it easily readable.
- **Large amount of data for storage and transmission.** This is the most voluminous storage format; each page typically takes 50,000 to 100,000 bytes making it somewhat expensive to store and slow to transmit and display.
- **Lack of text.** A reliable version of the text is not normally available for manipulation.

There are currently several large projects using page images as their primary storage format, such as Red Sage (Cannon, 1994; Hoffman et al., 1993), ADONIS (Morris, 1994), Ariadne (Roes & Dijkstra, 1994), and TULIP (Willis et al., 1994; Zijlstra, 1994). By offering a fairly low cost method to publishers of getting their material in electronic form with a minimum disruption of their current procedures, this appears to be the most common format chosen by large-scale conversions. Image remains the only option for institutions such as libraries converting existing paper collections without having access to the original data.

**Structured Text Format**

Structured text, which has now practically become synonymous with SGML (Standard Generalized Markup Language) (Barron, 1989), attempts to capture the essence of documents by “marking up” the text so that the original form could be recreated, or even produce other forms and uses not thought of when the text was originally created. SGML is now often expected to have the parts of a document best represented as images, such as figures and photographs, linked
to it so that they can also be displayed. A somewhat similar and competing standard is ODA (Office Document Architecture). Nicholas and Welsch (1992) give a good summary of the differences and similarities, which for this discussion can be ignored. SGML is by far the more important of the two in scholarly publishing.

SGML is an international standard (ISO, 1986) around which several are related standards on its application, such as NISO 12083 (NISO, 1994) on formatting mathematics, is gradually growing. Other applications, such as the Text Encoding Initiative (Gaynor, 1994; Sperberg-McQueen & Burnard, 1994), are using the SGML syntax to embed full cataloging of electronic publications within the publication itself. SGML is so flexible a language that applications such as HTML (HyperText Markup Language) (Berners-Lee, 1994) use the syntax to control the display format of documents and even the appearance of the user interface for interacting with the document.

Advantages

- *The text is available for searching and manipulation.* Unlike the image format, a reliable textual form of the article is available.
- *Format is flexible.* New capabilities, such as hypertext features and multimedia, are fairly easy to incorporate. This gives publishers the expectation of having a format that will be useful for many years in the future.
- *Creates a format useful for both electronic and paper production.* This can be crucial to publishers who need to minimize costs.
- *Very readable text.* Display of the text is limited primarily by the display device so that full advantage is taken of high resolution printers and displays.
- *Equations and tables can be accommodated.* Not limited to simple text, these documents can be made capable of displaying essentially any character that can be printed.
- *Compact storage.* Not as compact as simple text, since more information is stored, but even when graphics are included, storage is only about 8,000 to 15,000 bytes per page.

Disadvantages

- *Expensive to capture if not integrated with production of paper.* Rekeying articles, including the SGML codes, is almost always too expensive to do on a production basis.
- *Relatively sophisticated software is needed for both production and display.* This has been a primary barrier to its acceptance, but the situation is rapidly improving.
• *Publishers may lose some control over the presentation format.* The flexibility noted earlier extends to the users of the material, which can fairly easily make extensive modifications to the display format, some of which (such as picking the wrong font for symbols) could actually change the meaning of the displayed text.

*Other Formats*

There are other ways of providing online journals, although most of these are built from the methods already mentioned earlier. OCLC’s Electronic Journals Online service uses SGML as its primary form of input, but the documents are formatted, using TeX (Knuth, 1984), before being sent to the client (see the Architectures section later). This allows more control over the resulting display of the document, including reviewing the formatting for errors, before it is released into the database for general viewing but also requires a proprietary client to be installed by the user. Fortunately, because OCLC’s source documents are in SGML, it is possible to support nonproprietary clients as well, although at some reduction in display fidelity to the original.

Another version of the electronic journal we have been actively experimenting with at OCLC is a mixed architecture. This system will allow a single client communicating with one or more servers to display image journals, HTML, and preformatted SGML journals all in one interface.

The CORE project (Weibel, 1994) is another example of a mixed system designed to explore the tradeoffs among the different formats. The American Chemical Society database has both structured text which has been converted to SGML as well as page images of all the articles. This has the advantage of being able to use SGML for the display of most of the text, and relying on the page images for some of the more difficult text, such as equations and complex tables.

Page description languages (PDLs), such as Adobe’s PostScript (Adobe, 1985) and PDF (Portable Document Format) (Adobe, 1993), are similar to image databases in that formatted pages are displayed to the user but are text-, rather than facsimile-, based. These are attractive because it is very easy to capture them during the typesetting process. PostScript is especially easy to capture since it is what is used by many typesetting systems, and Adobe sells a converter program to turn most PostScript files into PDF files. One disadvantage of these is that either the page has to be stored as an actual image, which loses much of the compactness and device independence of the PDL, or a proprietary viewer has to be installed on the user’s workstation. This makes PDLs most useful as a delivery format within a closed group of users.
So what is the best format to use? That, of course, is not a simple question to answer since the answer depends on so many factors and the whole system needs to be considered, but there are some generalizations that can be offered.

Simple ASCII text is extremely useful for searching and selection, but its inability to capture the richness of the original relegates it to markets such as law which have few figures or typographic clues. It is now mostly seen as an interim step to full SGML.

If the original text of the journal is not in a format easily converted into SGML, then page images are practically the only reasonable solution. The cost of rekeying data into SGML simply for electronic publication is prohibitive.

SGML offers the most flexibility both for today's electronic journals and for whatever possible products and services will be available in the future. If SGML is used in the original production of the journal, then the added costs are small compared to the benefit of having a version of the journal which can serve as a permanent archive and feed into an array of services.

ARCHITECTURES

One of the most talked about changes in computer software over the last few years has been the movement to a client-server architecture. The library world has been at the forefront of this with the development of the NISO Z39.50 standard for information retrieval (Lynch, 1991). Figure 2 shows a diagram of the basic elements of a client-server electronics journal. Clients and servers are both com-

Figure 2. Client server computing.
puter programs. The client typically resides on the user's personal computer, while the server resides at some remote location. The programs communicate over a telecommunications network using a well-defined, usually standard, protocol. The client is responsible for displaying the information it retrieves from the server. The server is responsible for controlling access to the information, recording usage statistics, and performing the computation needed to retrieve the information the client is going to display.

The most commonly used client in general use is undoubtedly NCSA's Mosaic interface (NCSA, 1994). This client is able to speak several different protocols so that it can connect to different types of servers. For use as an electronic publishing vehicle, its native HyperText Transfer Protocol (HTTP) (CERN, 1994a) is the most used protocol for communication with servers. The information itself is transmitted in HTML (as mentioned above, this is an SGML variant), which the client interprets and displays as text and graphics on the user's screen or printer. The importance of clients and servers to users of electronic journals is that the development of the standard protocols allows a single client to connect to many different servers. This nearly eliminates the problem of having to use a different interface for each service one connects to because a single interface program may be able to connect to all the services one needs.

RAPIDLY DISAPPEARING PROBLEMS

Much of the technology to deliver electronic journals has been in place for some time. It is interesting to speculate on why there has not been more push from publishers and libraries to offer these to patrons.

The answer is simple—cost. Although pieces of a system could all be demonstrated, the costs of delivering an electronic version to patrons were more expensive, from the capture of the material by the publisher, to the system needed in libraries to support it, and the type of hardware that it would take to make the material useful to end-users. As noted in the earlier discussion, electronic journals offer some substantial impediments to their use, and simply offering a clumsy alternative to photocopies at a higher price has limited appeal.

In many ways, offering journals in SGML with graphics is ideal from the user's perspective in that the resulting system integrates well with other computer applications. SGML tagging, however, requires a substantial investment by the publisher. To be cost effective, publishers need to change their production system so that SGML is used to produce both the paper and electronic versions. An alternative electronic version is to simply scan the existing paper
version and manage the images rather than the text. In the past, this has been expensive because of the large amount of storage that images take (typically twenty times the space of the text). Decreases in storage and transmission costs have now reached the point where such images can be handled economically, offering an attractive way for publishers to start distributing their materials electronically.

We are now approaching the point, if it has not already been passed, where managing and storing such images electronically is cheaper than managing and storing the paper version, and we can therefore expect a fairly rapid migration to electronic access.

The computing environment that materials are being delivered to today is dramatically different than it was just a few years ago. Microsoft Windows has enjoyed enormous success, screens are larger, users are accustomed to fairly complicated computer applications, and the Internet has become a household word.

REMAINING PROBLEMS

As noted earlier, cost is by far the most important factor that needs to improve. The simple increase in processor speed, computer memory, and communication capacities should ensure that. There is always a large social inertia which slows the adoption of innovation, but this author expects the switch to electronic access to journals to be fairly rapid. It is possible that, over a single decade, we will switch from paper as our major access to the journal literature to electronic and online access. Whether that will occur over the next decade is difficult to predict, but most indications point to that (Hunter, 1994).

There are some problems that are not going to go away, even given a continued rapid drop in hardware costs. As our databases get larger, retrieval of documents will become more and more of a problem. Online journals are more difficult to browse than paper journals—or at least more difficult than browsing a paper journal once you have gotten your hands on it—and this will take a long time to fix.

Display of equations and tables is still weak in structured text versions of articles. The difficulties of formatting text to arbitrarily sized windows on a user's workstation are only now beginning to be addressed, and, if the difficulties encountered in the batch systems currently used by publishers are any indication at all, these problems, along with associated font and page layout problems, will be with us for the indefinite future.

Although overall cost of a journal delivery system will certainly be cheaper than the current paper system (or else it won't be adopted at all), payment for the system is far from being worked out. It will
probably be some combination of subscriptions and payment for individual articles, but what the mix will be is unknown. The growing importance of what was, in the past, called "gray literature" cannot be ignored here, as in the long term we may see a major change in how most articles are published.

**Future Directions**

The success of HTML in empowering the document to control the user's interface with the addition of links, buttons, maps, and text entry fields, has been a key to the success of Mosaic and the WWW and suggests a trend which can only grow and become more powerful. The document itself can contain a user interface. This allows tremendous flexibility in the types of information that can be displayed and interacted with.

Linkages among documents will become even more pervasive. As this happens in commercial publications, the links will also become more intelligent and stable so that the user is only occasionally disappointed to find nothing when trying a promising link. The speed of networks will increase to the point where browsing becomes more feasible. Displays will gradually become larger and have more resolution. The ideal here is probably something the size of a desktop with 300 dpi, which is years, maybe decades, away for the typical user.

Image databases will dominate the commercial and library sector, since it will take many years for publishers to switch to full use of structured text. We are only now seeing the first of this, with publishers that started investigating the possibilities of SGML several years ago. In the longer term, structured text offers so many advantages that it is expected to dominate newly published material.

Lynch (1994) offers an excellent presentation of the impact of network access to publications on several different types of organizations that produce information. Libraries are likely to be as affected as any of the publishers (Line, 1994; Piggot, 1993; Woodward, 1994). As more and more of the documents that libraries have traditionally collected, organized, stored, and provided access to become available instantly over the Internet, what is the purpose of the library? Of course libraries offer many more services than simply access to the published literature (Reich & Weiser, 1994), but certainly this access forms the core of their services.

What will not disappear will be the librarian's role in guiding users through the increasing number of information sources. Whether this person will be called a "librarian" and work in a library is less clear.
CONCLUSION

The main barriers to access to electronic journals are now primarily economic. There are also, of course, social barriers in acceptance, the time it takes publishers to become familiar with the technologies and start to use them, and the time it takes to develop usable software and make it widely available. Although display on the screen is not as good as paper, it is possible to build systems which, at the very least, will print paper versions of journal articles at a user's site that compare very favorably with good photocopies.

The connectivity to computer networks and the hardware and software needed for adequate article display are rapidly becoming commonplace. As soon as journal articles are placed online and pricing mechanisms that make the articles attractive are available, users will quickly learn to make use of them.

REFERENCES


ABSTRACT

This article presents an assessment of scholarly network journals from the reader's point of view. The author subscribed to seven journals that are published primarily on the Internet and reviewed the nature of the journals' contents, format, and policies. This review forms the basis of the author's assessment of the ease of use and usefulness of current network journals. While network journals present a number of problems, they have also begun to include features which offer readers an advantage over print journals. The article concludes with a brief discussion of requirements for future scholarly network journals. The discussion is based on current technology and industry trends and on preliminary results from focus group interviews conducted by the author and others with engineering faculty and students. Focus group participants discussed the nature of their journal use and their preferences for the networked digital library of journals that is currently being developed at the University of Illinois.

INTRODUCTION

As readers, we expect scholarly journals to meet certain standards and to possess certain predictable characteristics. We turn to them as trusted and stable sources of research reports, creative works, and current news. We expect published contributions to meet agreed-upon standards of quality. Conventions of format and structure facilitate legibility and comprehension as well as the ability to quickly locate particular segments of text. The unique appearance of a particular
journal also facilitates use by establishing a dependable familiarity. Through our reading of journals, too, we gradually develop a sense of the extent and limits of our scholarly community, and it is on the basis of this understanding of the discourse of the community that we make our particular contributions to scholarship through publication in those same journals. We create private archives of pertinent articles and assume that accurate copies of material published in the past can be obtained. An existing access apparatus is in place to help us augment our personal archives. When we think of scholarly journals we also implicitly include in our thinking the expectation that we will be able to identify journals and individual papers using standard bibliographic tools. Through our relationships with publishers, vendors, libraries, and colleagues, we know how to obtain copies of journal material on a regular basis. And yet, for all its familiarity and utility, print does not optimally serve certain aspects of scholarly communication. Dissemination is too slow. Materials—the volumes of paper and ink—are expensive and their acquisition environmentally destructive, and the expense may impose barriers for scholars outside the mainstream. Nor, where the print format is concerned, is access to previously published material necessarily easy or guaranteed. Further, interaction among readers and authors is limited in print and often constrictingly formal; the familiar ritual of the letters column, for instance, with its typical reader's rebuke and author's brief rebuttal, might better serve the advance of knowledge if conducted through a public forum where constraints on space and time were less severe.

For these reasons and many others, the number of scholarly journals that appear primarily, or only, on the Internet is rising, and analysis of the implications of this trend continues to receive attention in the literature of library and information science (e.g., Clement, 1994; Peek, 1994; Peek et al., in press; Schaffner, 1994). In what manner and how successfully do these electronic journals accommodate the needs and traditional expectations of the reader? This author set out to identify and access a number of scholarly journals available over the Internet in order to assess their usefulness and usability from the reader's point of view. The experiences are those of the relative novice—very familiar with some network services and very ill at ease with others. The author's working knowledge of the Internet has been acquired piecemeal as practical needs arose—spending several hours a day on e-mail and occasional use of electronic bulletin boards. The author is familiar with simple network navigation tools like Gopher and NCSA Mosaic and subscribes to three online newsletters which are delivered via listservs. Even so, on those rare occasions when there is a need to ftp files from remote computers, the author still tends to rely on print or human guides. The author has never before
subscribed to a scholarly electronic journal and so had few preconceptions when undertaking this task.

It is difficult to identify with certainty the exact number of scholarly electronic journals in existence. Due to the rapidly changing electronic landscape, the difficulty of precisely categorizing publications in the new medium, varying definitions of "scholarly," and the lack of complete descriptive data from journal producers, it is highly unlikely that any existing directory can lay legitimate claim to being comprehensive, current, and accurate.\(^1\) For the purposes of this exploration, an attempt was made to identify a representative sample of scholarly network journals, in a range of disciplines, to serve as a basis for comparative study. A "scholarly network journal" was defined as a publication that appears periodically, includes refereed contributions representing original scholarship, and is accessible exclusively or primarily via the Internet.

One current Internet directory, *On Internet 94*, includes entries for thirty electronic journals that appear to fit this definition of a scholarly networked journal. Seven of these journals were selected for further investigation:

1. *EJournal*
2. *Electronic Journal of Communication/La Revue Electronique de Communication*
4. *Flora Online*
5. *Journal of Extension*
6. *Journal of the International Academy of Hospitality Research*
7. *Postmodern Culture*.

Using the information provided in the *On Internet 94* entries for these journals, an attempt was made to access and subscribe to each one over a two-day period. If the author was unable to access a particular journal with the information given (either because the information was no longer current or the host site was not accessible at that particular point in time), an attempt was made to locate the journal online by browsing the Internet, chiefly via gopher. Once each journal was accessed, an attempt was made to obtain the table of contents of the current issue and at least one paper from that issue, identify back issues, retrieve an archived paper or issue, and locate published information about the journal that would help in understanding its purpose, policies, and use.

In the course of these activities, this author was struck by the variation among the journals in a number of areas that affect a potential reader's use of them. One important influence on use is awareness
and ease of access. How easy is it for potential readers to become aware of the journal's existence in the first place and then to obtain access to current and previous issues? To gauge awareness, this author checked to see if the journals were included in standard sources that people might use to identify or locate print journals and articles (OCLC, Ulrich's International Periodicals Directory, Current Contents, and Wilsonline). While tools devoted exclusively to electronic journals exist, as noted earlier, it is this author's assumption that electronic journals will not enter the mainstream of bibliographic control and hence not reach the maximum number of potential readers unless these journals are also included in more readily available traditional sources. Ease of access was gauged directly by attempting to subscribe to the electronic journals. Another area that affects use is the nature of the journal's contents—i.e., the type and amount of material published. In perusing the sample of network journals, the range of material published was identified and the extent to which scholarly contributions seem to mirror the length and depth of the papers published in print journals was noted. Policies related to content—nature of journal administration, the reviewing process, and copyright treatment—were also noted.

The third major area explored was usability. Noted in particular were the extensiveness and helpfulness of instructions provided to users and the general "readability" of the entire journal, the latter construed as a combination of aesthetic appeal and the existence of such features as tend to aid typical reading activities (scanning text both forward and back; jumping to a particular article; getting a sense of an article's scope or approach by the perusal of an abstract; and so forth). Readability thus is based on the clarity of layout of the journal, its typographic conventions, and the existence of formatting features which aid in searching and browsing. The final area explored was the extent to which the journals capitalized on their electronic format to offer features (typically not possible in print journals), that might offer readers important improvements in scholarly communication. Such features might include automatic links to related materials, keyword searching in journal archives, the inclusion of multimedia material, the incorporation of reader responses and other features aimed at facilitating the reader's participation in the scholarly community represented by a journal's set of readers, and the "unbundling" of journal issues so that individual articles may be identified and retrieved.

The intent of this article is to portray, from the reader's point of view, the current landscape of scholarly network journals based on an informal investigation of seven journals from a range of disciplines. Examples of how these pioneers in electronic publishing are faring
in terms of reader awareness and access; usefulness of content; usability; and new functionality are presented and discussed. Conclusions about the ideal characteristics of network scholarly journals are drawn from this review as well as from evidence of current trends in network applications and the publishing industry. Finally, in order to place these conclusions back into a framework emphasizing the reader's point of view, selected preliminary results are presented from focus group discussions on journal use that were recently conducted with faculty and students at the University of Illinois in order to help in the design of a networked digital library of engineering journals.

**READER AWARENESS AND ACCESS**

*Ulrich's International Periodicals Directory* is a standard source for scholars who need to identify journals on a particular subject, verify a journal's existence or discover where it is indexed, or obtain bibliographic data on a journal or the information required to contact a journal editor. Of the network journals investigated, only *Journal of Extension* and *Postmodern Culture* are listed in the 1994-1995 edition of *Ulrich's*. Another traditional tool for alerting readers to the existence of journals that might interest them is OCLC, which allows people to, among other things, identify journals on a particular topic or verify bibliographic data so that a needed journal can be located in a particular library collection. All of the networked scholarly journals investigated in this study were found in OCLC with the exception of the *Electronic Journal of Differential Equations*. The records provided the traditional elements of bibliographic data such as title, publisher's name, ISSN number, frequency, price, existence in other formats, and start date. In keeping with the traditional function of the library catalog, the OCLC records allowed the user to locate the journals in the local library collection, but they did not generally provide information that would allow the reader to locate and obtain the journals outside of the library itself. Most described the mode of access (the 500 field) in only general terms—e.g., "electronic mail on BITNET and Internet." The records for the *Electronic Journal of Communication* and the *Journal of the International Academy of Hospitality Research*, however, included the network address for placing a subscription. The *Journal of Extension* record was even more helpful, providing both the address and command that would be used to subscribe to the journal.

Inclusion in standard indexing and abstracting sources would also greatly increase access to the articles published in scholarly networked journals. Scholars trying to identify or locate journal articles often initiate their searches in general sources that span disciplines, such as *Current Contents*, *Carl Uncover*, or the *Wilsonline* databases. None of the electronic journals under investigation was found in these
sources with the exception of the *Journal of Extension* for which citations were found in Carl Uncover. According to information provided in directories or in the journals themselves, several of the network journals investigated are, however, included in indexing and abstracting services devoted to particular disciplines. The *Electronic Journal of Communication*, for example, is indexed in *ComIndex*, an electronic index covering communications journals, and *Postmodern Culture* is included in the *MLA Bibliography*.

While the lack of systematic coverage of scholarly network journals is illogical from the reader's point of view, it perhaps makes sense from the perspective of the producers of these bibliographic tools. Electronic journal publishers may not have initiated relationships with the producers. Readers may not have put pressure on them to include electronic journals, so there may as yet be no competitive advantage in doing so. The producers of bibliographic tools may not consider electronic journals to be worthy of inclusion. If producers derive a substantial portion of their revenues from the delivery of the identified document to the scholar who is unable to obtain the needed article locally, they may not have designed the appropriate process for deriving income from the delivery of the full text of electronic journal articles to readers. Perhaps it simply seems counterintuitive to the producers of indexing and abstracting databases to provide electronic access to records and articles for journals that are already directly accessible to scholars in electronic form.

It is clear that scholars attempting to identify journals and journal papers of interest are less likely to discover electronic than print material if they limit themselves to traditional awareness tools. Scholarly network journals have not yet entered the mainstream of bibliographic control. They are best represented in directories explicitly devoted to providing information about material available on computer networks and, further, are likely to be brought to the attention of potential readers via the network itself. Those scholars who already browse the network or read network journals or newsletters are much more likely to be made aware of the existence of electronic journals and articles since electronic journals are announced and discussed in listservs and in existing electronic journals and are stored in network sites. Libraries, perhaps because of the pressure to serve the information needs of a specific and local scholarly community by collecting material regardless of format, have incorporated network journals more systematically into their record systems than have commercial indexing and abstracting services. Thus today's scholar is required, for the most part, to complete an additional search in order
to identify both print and electronic records of scholarship. Yet such an additional search is itself unlikely to be conducted in the absence of prior knowledge that the pertinent tools exist. Electronic journals thus present two obvious obstacles when considered from the standpoint of scholars with articles to place. Scholars may not be at all aware of electronic outlets for their work and, further, they may be reluctant to offer their work through a medium whose readership may be perceived to be too limited.

Once identified, how do readers access scholarly journals on the Internet? An exploration of the subscription and access process made plain that there is no single approach to the distribution of network journal issues and that gaining access can be frustrating. Some journals are available only through listservs. Others may be stored at ftp, gopher, or World Wide Web sites (or some combination of these). In some cases, the reader's subscription initiates an alerting service, in which an e-mail message automatically notifies the reader of new contributions or even sends new contributions directly to the subscriber. Individual contributions may be made available as they appear, or they may be bundled into issues. All of the journals examined provided some form of network access to previous issues. Some online archives allow readers to find and read individual papers, while others only allow entire issues to be accessed and perused. Some archives are set up as searchable databases, allowing, for example, the text of papers to be searched by keywords. Some journals augment the online archive by making journal papers or issues available in paper, microfiche, or disk formats.

It is difficult to state categorically which access mechanism is "easier" or most effective, as this depends in part on the scholar's networking experience, hardware and software capabilities, and personal preferences. In some cases, a scholar may subscribe to a network journal and access current and previous issues within minutes without leaving the computer. This offers a substantial improvement over the time and effort needed to access print journals, which could entail a delay of months after a personal subscription is entered, or which requires a trip to the library and the use of disparate access tools—e.g., catalogs and indexes. Technical difficulties in accessing network journals may lead, in other cases, to significant delays and great frustration. Such problems may stem from the scholar's lack of expertise or tools, from inadequate instructions, or from breakdowns in network processes. It should be noted that cost was not a barrier to access in the author's case since basic network access to all of the journals reviewed is offered free of charge (the *Journal of the International Academy of Hospitality Research* formerly operated with a subscription fee, but this was recently dropped).
Two examples will illustrate the typical user experiences in attempting to access network scholarly journals. *Ejournal* provides a model of ease and efficiency. All activity is conducted via a listserv with simple commands that are well explained and that immediately return the expected results. Upon sending a subscription message to *Ejournal*, the author received an e-mail response indicating that issues would be automatically e-mailed as they were produced. Following posted instructions, the command “get ejrnl contents” was sent. This returned an easy to read list of all back issues arranged like a table of contents, with a brief abstract describing each issue and instructions for ordering desired issues. A particular back issue was then easily and quickly obtained by sending the message “get ejournal vln2” to the listserv.

*Flora Online* provided more options for access but presented a host of roadblocks as well. First an attempt was made to access the journal at its advertised Gopher site, which, unfortunately, was “down” and therefore not responding to connection requests that day. Next was tried connecting to the listed ftp site, doing so with some trepidation since this author is relatively unfamiliar with ftp commands. After successfully accessing and navigating the ftp site, the author was dismayed to find that *Flora Online* was no longer stored there (the new ftp address was posted, but, because of the lack of expertise in browsing ftp sites at the time, the author did not find this vital piece of information). A search of gopher space for the keyword “flora” eventually landed at a Gopher site providing information about the journal, including a list of back issues, the superseded ftp address, and a phone number to dial in to the TAXACOM BBS that houses the journal archives as well as an assortment of related data communications services for systematic biology. Unfortunately, attempts to dial in via the posted number also failed. Several days later, while browsing gopher space for another journal, the author happened upon a new ftp site address—at Cornell—for the TAXACOM service. After connecting to the new ftp site and downloading the readme file, it was learned that Cornell also maintained a Gopher site which provided access to issues of *Flora Online*. It was then possible to connect to the Cornell gopher and, finally, get access to complete and current information about the journal and the related TAXACOM services, and to read published issues of *Flora Online*.

Access to published contents in fixed media (microforms, diskettes, paper) is also treated in a variety of ways by existing scholarly network journals. The treatment of physical storage in non-network formats deserves attention because of its impact on scholars in their dual role as readers and contributors in the information cycle. The availability of print-on-paper versions of scholarly articles provides intellectual access for potential readers who lack network tools and skills.
And ubiquitous access is necessary to ensure that published work is communicated and subjected to the scrutiny of the entire scholarly community. Paper copies of journals also allow scholars to construct a personal collection of easily accessible items that are stored, arranged and rearranged, retrieved, and shared without dependence on intervening computer technology. Finally, paper journals have historically served as the mechanism by which authenticity is guaranteed and work is preserved for the future.

How do network journals approach the provision of access to their contents in fixed media? The guiding assumption of most of the journals examined seemed to be that scholars would read material online using their own discretion and equipment to produce paper copies for personal use on demand. Most of the journals appear to be accessible only over the network; physically fixed copies are not widely provided by producers. Ejournal, for example, only provides "authenticated paper copy from our read-only archive for use by academic deans or others." An anthology of essays from Postmodern Culture has been published as a traditional print monograph by Oxford University Press. Disk subscriptions to Postmodern Culture and Flora Online are available for a fee, allowing access for non-networked scholars and some further guarantee that material will be preserved into the future. In the online information provided, Flora Online goes so far as to warn librarians to refresh their disks every five to seven years. Readers are also warned:

Computerized files are easily changed. "Authorized" versions of original TAXACOM text or computer files are only available from TAXACOM itself (or from TAXACOM distribution diskettes of "Flora Online"); second-hand files may well have been modified for better or worse, and researchers should be skeptical of the integrity of any electronic publication obtained through an intermediary.

The Journal of Extension is unusual among network journals in that it takes over as the primary distribution mechanism (supplemented by UMI microform and reprints) for a previously print-only journal. Its sponsoring body, the Cooperative Extension System, notes that it is experimenting to discover whether there is an absolute need to provide print issues in the traditional manner.

The Electronic Journal of Differential Equations offers a special challenge to access. Due, presumably, to its need to facilitate the viewing of equations, it is stored only in PostScript and other richly formatted versions, meaning that online reading is impossible without special viewers. Scholars are encouraged to download and print papers in order to read them. So while the journal is accessed almost exclusively over the net, individual printing of papers is probably the norm.
Sensitive to the need to supply broader access and archival storage, however, the editors note that in order to preserve the scholarly record for posterity and provide copies for interlibrary loan, a hard copy of the journal exists in the libraries at two institutions which sponsor the journal as well as at the Library of Congress.

The copyright statements attached to all of the network journals examined also fostered archiving and access (see Table 1). A number of them explicitly noted that either electronic or print copies could be reproduced and disseminated by individual readers or libraries. Restrictions included the demand that copies be used for noncommercial purposes, that material not be altered in any manner, and that appropriate acknowledgment of the material's source be provided.

**Nature of Contents**

A scholar's use of network journals is, naturally, affected by the nature of the journals' contents. Readers of print journals expect, ideally, to obtain access to a large volume of high quality substantive contributions. All the journals this author examined claimed to exert more rigorous quality control over contributions than is generally found in, say, the typical print newsletter or newsgroup posting. Nonetheless, the journals varied considerably in the type and amount of material they published. Some network journals published issues that consisted solely of scholarly papers or other substantive creative works. Others were more like print journals in that they included a diverse range of material, including editorials, reviews, announcements, and letters. And a few exhibited not only diversity but innovation, offering material not typically found in scholarly print journals. All of the journals surveyed noted that manuscripts submitted for publication were refereed. Although some did not describe the review process, quality control appears to be accomplished in the same basic manner as in print journals: by the editor(s), by editorial boards, or by individuals specifically serving as peer reviewers. Quality in print journals is also partly attributable to the reputation and practices of their institutional sponsors. The network journals examined all derived from "reputable" sources. The majority emanated from academic institutions, while several had a basis in professional organizations. Only one was affiliated with a commercial publisher. The quantity of material published varied significantly, with the number of scholarly papers published ranging from about one to a dozen per year. The papers themselves varied considerably in length and formality. The most obvious limitation in network journal contents was the inability to provide readers with the type of illustrations standard in print-on-paper journals. The nature of the contents and editorial practices of each journal reviewed is briefly described later.
TABLE 1. NETWORK JOURNAL COPYRIGHT STATEMENTS

**EJournal**
* This electronic publication and its contents are (c) copyright 1994 by *
* EJournal_. Permission is hereby granted to give away the journal and its *
* contents, but no one may “own” it. Any and all financial interest is hereby* *
* assigned to the acknowledged authors of individual texts. This notification* *
* must accompany all distribution of EJournal.

*Electronic Journal of Communication/La Revue Électronique de Communication*
Articles are protected by copyright (c) by the Communication Institute for Online Scholarship (ISSN # 1183-5656). Articles may be reproduced, with acknowledgment, for non-profit personal and scholarly purposes. Permission must be obtained for commercial uses.

*Electronic Journal of Differential Equations*
Copyrights are transferred to and are property of the publisher, who allows making copies of articles provided that articles are not modified and that copies are not sold.

*Flora Online*
Whether directly indicated as such or not, TAXACOM text files are made available to the systematic community with the assumption that they will not be sold for profit and that secondary distribution will be without modification.

*Journal of the International Academy of Hospitality Research*
This journal is registered with the Copyright Clearance Center, Inc., 27 Congress Street, Salem, MA 01970, USA. Duplication is permitted for academic or research purposes but not for commercial purposes. Libraries are permitted to distribute the journal electronically to institutional faculty, students and employees via local area networks or institutional mainframe computers.

*Journal of Extension*
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*Postmodern Culture*
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Postmodern Culture, supported by North Carolina State University and published by Oxford University Press, is one of the few existing network journals associated with a commercial publisher. Its contents represent the high end of both quantity and quality. It is published three times a year; the May 1994 issue contained six essays, three poems by a MacArthur award winner, a column on pop culture, six reviews, and about fifty announcements related to new books and journals, calls for papers, available research grants, and so on. The lead essay included all the scholarly trappings of the typical paper in a print journal: it contained over 13,000 words and was followed by sixty-eight footnotes. With two co-editors, a managing editor, and an editorial board of thirty-four members, the editorial staff of Postmodern Culture also appears to be on a par with that of traditional print journals, though it seems to be able to accomplish its work more efficiently: author instructions note that the review process takes only about six to eight weeks.

The Electronic Journal of Communication/La Revue Électronique de Communication is published quarterly and seems, similarly, to disseminate a relatively high volume of substantive contributions. Contributions, however, are apparently limited to scholarly papers. The issue published as volume 4, number 1 (1994) contained four papers and an editor's introduction. One paper was 4,500 words in length and included seventeen references; another was over 20,000 words long and was followed by 175 references. Although it has a permanent editorial staff from the two primary academic institutions which sponsor the journal, each issue has a guest editor, and it is this editor who puts together a group of reviewers to assess submitted manuscripts.

The Electronic Journal of Differential Equations (EJDE) also limits its contents to scholarly papers. The paper the author downloaded was published in September 1994 and represented the seventh paper appearing in the journal for that year. Printed as a PostScript file, the paper ran fourteen single-spaced pages in length and included fifteen references. In its statement of scope, EJDE notes that it "will accept only first-rate original work, subject to as rigid a peer review process as is applied by the finest of today's journals." The peer review process is not further explained, beyond the note that papers were "referreed," but the editorial staff of the journal is substantial. EJDE has three managing editors and an editorial board of twenty-six members from a wide variety of reputable academic institutions.

Other journals examined published shorter papers, as is perhaps typical in their respective disciplines. Two of these emanated from professional organizations. The Journal of the International Academy of Hospitality Research (JIAHR) publishes issues consisting of single papers which appear after having been "judged of sufficient quality."
The journal is published for the academy by the Scholarly Communications Project of Virginia Polytechnic Institute and State University. The editor is supported by an editorial board comprised of fourteen members and a slate of independent reviewers. Only eight issues have appeared since November 1990. Issue eight, released in June 1993, contained a research report consisting of 3,000 words and thirteen references.

The *Journal of Extension* is the official refereed publication of the Cooperative Extension System. It is overseen by an editor and an assistant editor, a twenty member board of directors, and an editorial committee of twenty members. The editorial committee members are responsible for reviewing submitted manuscripts. The journal offers readers a variety of contents. The October 1994 issue (vol. 32, no. 3) included four papers labeled as "feature articles" and one as "research in brief." These ranged from 1,000 to 4,000 words, and most of them included several references. The other eight contributions in that issue were labeled "commentary," "ideas at work" (e.g., descriptions of projects), or "tools of the trade" (e.g., descriptions of relevant reference books, software, and research instruments) and averaged about 1,000 words each.

Two of the journals reviewed were notable for their inclusion of unusual contents. Their founders sought specifically to improve scholarly communication by incorporating material not common in print journals due to the fetters of the paper format or traditional scholarly conventions. *Flora Online*, published by the Clinton Herbarium of the Buffalo Museum of Science, is one network journal that provides an outlet for contents not typically found in print journals. Each issue encompasses a single contribution; the twenty-six issues that have appeared since 1987 include, along with more standard research reports, a range of data-intensive and compiled works—such as species lists and taxonomic works—as well as computer programs for herbarium management and data analysis. Recognizing the advantages of computer-based communication, the journal also publishes textual works that have appeared previously in print formats and which might benefit from having the keyword search capability that computers offer. The review process is also not typical; contributions are reviewed exclusively by the journal's editor (who also serves as the sysop for TAXACOM), unless he decides that they need to be sent out for any additional review.

Another publication offering a change from the standard scholarly fare is *EJournal*, a network journal for humanists whose editor and managing editor are associated with the English department at the State University of New York at Albany. *EJournal* has published about fourteen principal essays since 1991. The editors proclaim their
intentions with an unusual degree of verve, noting "we try to be a little more direct and lively than many paper publications, and considerably less hasty and ephemeral than most postings to unreviewed electronic spaces." *EJournal* has a board of advisors whose six members are well known in the field of electronic communications. The editors seem to encourage experimentation in both tone and format, accepting contributions in the form of essays (a term deliberately chosen to get away from the standard stuffiness of the academic paper), reviews, editorial comments, news items (e.g., project announcements), and reader-response letters. True to form, published essays average about 4,000 words and typically include few cited references. *EJournal*'s review process is also somewhat less formal than in some print journals. The editor makes a first cut on submissions and then sends the most promising manuscripts (estimated by the editor to be fewer than half of those received) to the journal's panel of about twenty consulting editors for further review. Upon a favorable response, the editor then summarizes their comments and communicates with the author regarding needed revisions.

The diversity of contents of the scholarly network journals reviewed suggests that potential readers will discover substantive material that has been subjected to some form of quality control by editors associated with reputable, primarily academic, organizations. On the other hand, no general expectations as to the type or quantity of material published should be formed by potential readers. Though the nature of the material published varies along disciplinary boundaries, as might be expected, journal contents seem also to depend on the inclinations of individual editors to a somewhat greater degree than is typical in print academic journals.

**Ease of Use**

In subscribing to and accessing back issues of network scholarly journals, this author experienced difficulties related to a lack of computing and networking expertise, the constraints of hardware and software, and the lack of current access information. But other barriers to easy use also exist. Basic access modes (e.g., Gopher, listserv, ftp, Mosaic) vary across journals, and there is little standardization in the specific organizing principles and access commands associated with different journals using a particular mode. Ease of use is hampered, then, because scholars cannot predict in advance how to get hold of a particular journal and must learn how to use multiple access modes and mechanisms (granted, in some cases the availability of multiple access modes facilitates ease of use in that scholars may choose the mode that they generally find easiest to use and are given alternatives for working around access barriers that may arise in a particular
situation). Some journals employ organizing principles and access mechanisms that are simple to understand and use, while others require more cognitive effort from the reader's point of view. The headings in a gopher menu for a particular journal, for example, may be more or less informative, and they may be arranged more or less logically. The number of steps required before a reader can actually view a particular back issue of a network journal varies, too, as does the simplicity of the commands required for completing the process.

One striking difference encountered in network journals is the amount and helpfulness of instructions offered to readers. This is perhaps the most important factor determining ease of use. Some journals offer scant instructions which assume substantial knowledge of computer and network use and, therefore, either leave out basic information or employ terms likely to confuse networking novices. Others offer full documentation and instructions easily comprehended by network novices. Some journals require readers to hunt for, and through, a separate set of instructions when they need help, while others seem to provide instructions at exactly those points where the reader is likely to get stuck. Some journals go beyond the provision of information about the existence of various access modes and mechanisms to offer instruction in their use, such as how to access and retrieve journal issues using ftp protocols. Some journals provide the e-mail addresses or even telephone numbers of support staff for users who need individual help.

The first critical juncture for communicating with the new reader comes with the response generated by a subscription request. The *Journal of the International Academy of Hospitality Research* returns the generic listserv subscription announcement, several screens in length, replete with typos. The announcement states that the subscription to the list has been accepted and provides the address for sending messages to all people subscribing to the list, as well as the address for sending commands to the listserv. Instructions are provided for signing off the list and for retrieving the index of the list's archived contributions. A note warns: "This list is confidential. You should not publicly mention its existence, or forward copies of information you have obtained from it to third parties." Subscribers are also warned that other people may determine that they are signed on to the list by issuing a command that returns the names and e-mail addresses of all subscribers. Finally, instructions are given for obtaining a file with more information on listserv commands. Such generic announcements do little to orient and inform the new journal subscriber. This author wondered, for example, whether the list was the same as the journal, whether accessing the archive meant accessing other people's messages or journal issues, and why the existence of a journal should be
kept confidential. No information was provided about how new journal issues would be announced or distributed and no information about what the journal was about or what it was like was divulged.

Other welcome messages were friendlier and more informative. In response to a subscription request to the *Electronic Journal of Differential Equations*, for example, the following response was received:

Welcome to the Electronic Journal of Differential Equations. Your name has been added to our Subscriber List. We will send abstracts as soon as new articles are accepted for publication.

Subscription related messages should be sent to:

subs@ejde.math.swt.edu

Thanks for your interest in the EJDE.

Julio G. Dix
Co-Managing Editor

While this message didn't tell me everything needed, at least it was not confusing. The welcome message provided by *Ejournal* was a customized version of the generic listserv announcement that was made much more informative with a few simple modifications and additions. After stating that the listserv subscription had been accepted, the following appeared: “Welcome. You are indeed a subscriber to *EJournal*. You will get issues when they are ready for sending.” Also helpful were clearly stated instructions for identifying back issues and finding out more about the journal:

You can learn about previous issues of the journal by sending the command GET EJRNRL CONTENTS to Albany's ListServ, LISTSERV@ALBNYVM1.

The April 1992, statement of *EJournal*’s purpose and policies is available in Volume 2, Number 1 of the journal. You can get that issue by sending the command GET EJRNRL V2N1 to LISTSERV@ALBNYVM1.

Not only are these instructions stated clearly, they are easy to follow and they work.

At the other end of the spectrum, *Postmodern Culture* eschews the generic message altogether and provides the new subscriber with a wealth of relevant and helpful information for getting acquainted with the journal and its practices. After confirming acceptance of the subscription, the message continues:

Dear Subscriber,

Welcome to *Postmodern Culture*, an electronic journal of literary and cultural studies published by Oxford University Press and supported by North Carolina State University. *Postmodern
Culture is distributed free of charge to more than 3,400 electronic-mail subscribers in more than 40 countries, and it is distributed on disk and microfiche for a fee. If you are a student or faculty member at a college or university, we hope you will encourage your institution’s library to subscribe to Postmodern Culture either by electronic mail (if the means exist to make the journal available to patrons in that format) or on disk or fiche.

Enclosed are some introductory instructions and information concerning the journal. Please read and then save this message, as you may want to refer to it in the future.

Following this introduction is about six pages of information describing the goals and format of Postmodern Culture, the mechanisms for obtaining back issues, and detailed instructions for retrieving journal files though various access modes (such as Gopher and ftp). Because of its clarity and obvious relevance to the needs of the new subscriber, the amount of information provided was not annoying or overwhelming. Editorial staff members’ names, job titles, and e-mail addresses are provided, along with the postal address for the journal. A note from the staff invites the “terminally frustrated” to send e-mail describing their problems, and they promise to try to help.

The Journal of Extension is also notable for the extent and quality of its instructions. The welcome message acknowledges the subscription, describes the journal, and presents simple instructions for unsubscribing, for joining a listserv set up for readers to comment on the journal, and for obtaining information about accessing journal issues or submitting articles. The file containing access information was easily retrieved. It provided simple instructions for obtaining announcements of new issues; accessing an online catalog of the journal’s archives; retrieving journal articles, sections, or issues; obtaining the journal’s user guide; and searching the journal archive by keyword. Though the reader of the Journal of Extension must step through a series of commands to access journal contents, the commands are simple to use, allow great flexibility in retrieval, and consistently produce the expected results. The instructions themselves are exceptionally comprehensive, lucid, and well placed. The very existence of a user guide signals the journal producers’ commitment to providing assistance to the novice networker.

Another basic component of ease of use is what might loosely be called readability. Print-on-paper journals offer the benefits of a reading technology well honed over centuries of use. They offer usability advantages over today’s network publications based on both their physical format and their display features. Useful features abound. The
print journal’s page layout, print quality, text structuring and formatting features, graphical capabilities, and locational devices like tables of contents, footers, and page numbers all work together to improve navigation and comprehension. In addition, readers’ familiarity with the conventions and capabilities of print journals facilitates usability. As has often been noted, print journals seem to provide, compared to electronic journals, a format better suited to many scholars’ typical work habits, allowing them to read more comfortably, skim and browse in a nonlinear fashion, locate a particular piece of information quickly, and make marginal notes (see Dillon, 1994, for a good overview of the ergonomic aspects of information use and implications for electronic systems). These processes may eventually be accomplished equally well in the digital realm, but print-on-paper technology is the preferred option for many scholars today given entrenched habits and the current limitations of computer hardware and networking applications.

What features are offered by today’s scholarly network journals, then, in their efforts to foster on-screen readability? They largely follow the conventions of print journals in their basic organization and design, employing such features as a masthead, table of contents, abstracts preceding the body of papers, headers and subheaders to divide papers into sections, and bibliographic references—formatted according to standard style guides—at the end of papers. These conventions are, however, instantiated and combined in a variety of ways. In the case of Electronic Journal of Communication/La Revue Électronique de Communication, for example, the table of contents for an issue appears as a separate document and includes abstracts and retrieval instructions for each contribution as well as the editor’s introduction to that issue. The reader obtains desired papers individually; the complete issue is not formally constituted and displayed on the producer’s end; instead, readers put it together as they will, at their own discretion. The Journal of the International Association of Hospitality Research offers issues comprised of single papers. Nonetheless, the contents and format of each issue mimic those of the typical print journal. For a particular issue, the journal masthead is followed by some simple descriptive information about the journal and its staff. Next to appear is a table of contents that lists the associated page numbers for each section of the paper published in that issue; subsequently listed in the contents are standard sections which apparently appear in each issue, such as instructions to authors and information on retrieving back issues. The contents page is followed by the paper abstract, the text of the paper, and the standard supplementary sections. EJournal issues follow print journal conventions even more closely. A complete issue is delivered to the reader, and it begins with a masthead, journal
information, and a table of contents for the issue. Next comes the lead essay, followed by shorter articles, editorial notes, and further information about the journal and its staff. As this set of examples illustrates, network journal readers will encounter many familiar devices but cannot expect to encounter the various pieces of a journal packaged in a completely standardized or familiar manner. Variety exists across network journals, and the basic conventions of print journals are not uniformly adopted in the network realm.

Network journals distributed in ASCII format are severely limited in their ability to offer the kind of visual variety that assists reader comprehension and navigation and lessens fatigue. Nonetheless, they do make efforts to introduce visual cues and graphic features, and conventions in this realm are arising. For example, Postmodern Culture uses the following conventions to simulate print-on-paper text formatting:

- underline (for titles)
- *boldfacing* (for emphasis)
- %italics% (for foreign words)
- ^superscript^ (for note numbers)

*Flora Online* suggests using all capital letters to replace underlining so as not to interfere with keyword searching. Simple tables for the presentation of data can be accommodated in network journals; attractive easy-to-read tables appeared in *Journal of Extension* and the *Journal of the International Association of Hospitality Research*. Issue sections are divided in some network journals by strings of asterisks or other special characters to help the reader who is skimming through the issue in search of a particular portion; one journal refers to this simple navigation tool as “bookmarks.” Boxes constructed with special characters are used in some journals to draw the reader’s attention to important announcements. A number of the network journals provided extensive guidelines for manuscript preparation in order to achieve consistency in the layout and formatting of their publications.

Network journals vary in their choice of devices for labeling document segments. When combined with a table of contents, labeling document segments facilitates the process of jumping or scrolling to a particular part of a paper or issue. It also provides a mechanism for scholars who wish to cite network journal papers. *EJournal*, for example, intermittently displays line numbers in square brackets on the right-hand margin of the text and its table of contents lists the line numbers for each article. *Postmodern Culture* displays paragraph numbers in square brackets at the left-hand margin. Each of the substantial number of announcements that appear in each issue is similarly numbered, and the announcements section is preceded by its
own table of contents. One journal employed page numbers, labeling both the beginning and end of each page; another lacked any kind of numerical labeling of document segments, a fact which, of course, would render citing its contributions problematic.

One is forced to conclude that the reader of ASCII-based network journals is subject to severe aesthetic deprivation and ergonomic difficulties. Reading these ASCII journals is tiring and tiresome. Nonetheless, some ASCII-based journals are more attractively formatted than others and ease the online reading process by displaying documents with plenty of white space, making effective use of simple techniques for highlighting and organizing text such as centering lines, capitalization, ASCII cues for underlining and emphasis, and "sidebars" outlined with boxes drawn with special characters. Navigation and browsing are assisted by numbering and other visual markers, though admittedly these features do not compensate for the frustration of having to scroll linearly through entire documents. The more extensively that abstracts and tables of contents are used at each stage of the retrieval process and are associated with different sections of a network journal, the easier it is for the reader to acquire the kind of overview of the contents, and the sense of getting oriented, that are easily accomplished with paper journals simply by holding them in your hands and skimming or flipping through them. Contents listings are also critical to the reader who is trying to identify and locate items quickly, especially in those journals that publish lengthy issues.

Screen reading, of course, is made easier when journals are available in richer formats. PostScript viewers allow the display of electronic journal papers with all of the visual variety (e.g., numerous fonts and font sizes, equations, graphics) found in print-on-paper journals. The HTML version of *Postmodern Culture* that is viewed with Mosaic accommodates the display of all manner of images and allows the kind of jumping around in a document that more closely approximates the navigational ease that print journal readers enjoy. Moreover, direct links between, for example, an endnote number in the body of the paper and the text of that specific endnote actually improve the efficiency of the digital reader's jumps.

**Enhanced Functionality**

This exploration of scholarly network journals uncovered several ways in which current online publications have capitalized on their electronic format to offer readers significant benefits. Network journal contents have been enhanced by the incorporation of material which was impossible to include in print publications, such as the herbarium management software provided by *Flora Online*. Some journals included features that could conceivably be viewed as transforming
the nature of scholarly communication, such as *EJournal*'s aggressive solicitation and presentation of its readers' responses. Journals have also experimented with altering the traditional scholarly publishing cycle by allowing authors to revise their contributions and then making the new versions easily accessible to readers. *Flora Online* labels and stores subsequent versions of material it publishes, while *EJournal* distributes "substantial counterstatements" to its published essays as supplements to the original work and is even willing to experiment with retracting published texts. Such alterations in the speed and ease with which journal contributors and readers can communicate among themselves augment one's sense of active participation in the scholarly community represented by a journal's set of readers.

Several journals represent only one part of a suite of related services offered to subscribers. The other services offered are specifically aimed at facilitating alternative forms of communication; a common example is the provision of a companion discussion list to allow informal discussion of topics and issues presented in the journal. One example of a network journal that belongs to a family of scholarly communication services is the *Electronic Journal of Communication/La Revue Électronique de Communication*. The journal is part of Comserve, which is operated by the Communication Institute for Online Scholarship at Rensselaer Polytechnic Institute. Other services available through Comserve are listservs devoted to announcements of new job opportunities and books in the field, as well as previews of research in progress. Comserve also maintains an online library of textual resources, such as bibliographies and syllabi, and invites subscribers to include their name, e-mail address, and interests in the system's subscriber white pages. *Postmodern Culture* offers a mechanism for online interaction among scholars that is especially innovative in its approach to enlarging and enlivening the scholarly communication process. Its PMC-MOO provides a text-based virtual reality environment in which subscribers can interact in real time in a manner similar to that experienced in popular multi-user games like Dungeons and Dragons.

Some scholarly network journals enhance the usability of their contents by taking advantage of computer-based mechanisms for search and navigation. Journals accessed through World Wide Web pages allow the reader to make instant links from one point in a document to another. *Postmodern Culture* (http://jefferson.village.virginia.edu/pmc), as noted earlier, allows readers to jump directly from endnote numbers in the text to the endnotes themselves. Those journals available at gopher sites may facilitate the kind of serendipitous identification of other relevant material that scholars sometimes enjoy in browsing library shelves, publishers' catalogs, or online bibliographic databases and catalogs. This can occur because gopher sites may house a
collection of network journals or other information resources that are relevant to a particular topic or discipline; readers accessing the target network journal at such a gopher site may notice other items that look interesting to them. Several of the journals examined extend the usability of their contents by supporting keyword searching in their journal archives. In the Journal of Extension, for example, readers may enter uncontrolled terms in their search query. Citations, abstracts, and retrieval instructions for articles which contain keywords matching the reader's query are returned in descending order of relevance, and the relevancy rating of each article is displayed. This capability offers readers a substantial improvement in their ability to quickly locate particular papers.

This author also encountered evidence of enhancements in dissemination offered by scholarly network journals. Simple reduction in the time required to publish material is one advantage that electronic journals have over their print counterparts. EJournal and Postmodern Culture both explicitly noted their relatively quick turnaround time in the review, production, and distribution of published material. Time savings may accrue due to the speed of network transmission of documents, the lack of need for physical production, and the conscious decision to publish articles as they appear rather than waiting for a number of papers to be collected as an issue.

Another improvement in the dissemination of scholarly journals that is implemented in many network publications is the use of an alerting function that automatically sends an e-mail announcement of new journal issues to all subscribers. In those cases where the issues themselves are not e-mailed directly to subscribers, the situation is analogous to that of a scholar who regularly reads a journal to which she does not carry a personal subscription. The improvement comes, then, because the scholar does not have to visit the library to discover whether the journal has arrived and whether it holds anything of interest. While some libraries offer a similar alerting service, the practice is not universal and, in any case, may lack the reliability and comprehensiveness which computer-based services are able to provide. The "unbundling" of journal issues, so that individual journal sections or articles may be identified and retrieved, also offers enhanced functionality for readers, providing them with more control over, and flexibility in, the dissemination process. Scholars may easily browse journal archives and retrieve only those items of interest, assembling them into the package that best meets their needs at a particular point in time.

While some of the current enhancements offered by network journals may be viewed as efficiency gains as opposed to powerful transformations of the scholarly process, it is sometimes difficult to draw
the line between these two types of impacts. At what point is a gain in efficiency so great that it actually permits scholars to accomplish something that they could not or would not have accomplished in the past? The accumulation and integration of individual enhancements may also engender a transformation that could not be attributable to any individual gain. Speedier dissemination of the results of scholarship, more immediate and informal interaction among scholars, increased integration of scholarly products that formally appeared through separate channels of communication, and the potential to greatly increase the number and diversity of "subscribers" (if access barriers—in terms of awareness, cost, and technology—are kept low) all work together to alter the nature of scholarly communication and reshape the activities of a scholarly community.

CONCLUSION: A VIEW TO THE FUTURE

In reviewing a sample of scholarly journals available primarily on the Internet from the reader's point of view, a number of key problems have been identified. The greatest barriers to use for many scholars will arise in the areas of awareness and access. Network journals have not yet entered the mainstream of bibliographic control; many scholars, therefore, remain ignorant of their very existence. And even after journals are identified, access to them is often hindered by several factors. Current and accurate instructions for subscribing to or retrieving network journals are neither consistently nor widely available. The vagaries and volatility of network-based communication contribute to the inability to successfully access a desired publication in a reliable manner. Scholars who lack the computing and networking expertise and tools required by the variety of systems used to store, distribute, and display network journals will be frustrated in their attempts to locate and obtain desired material.

Critical problems also exist in the basic usability of current network journals. While the lack of consistent conformance to the conventions of assembling and displaying print-on-paper journals is not necessarily a flaw, greater attention to establishing appropriate conventions for network journals, and informing readers about them, are certainly needed. Network journals can only do so much to support comprehension and navigation for on-screen readers of ASCII-based publications; unfortunately, some journals make inadequate use of available options and offer readers documents that are poorly designed. Ease of use is also greatly hampered in many publications by the lack of clear, complete, and well-placed instructions.

Compared to their print counterparts, the network journals reviewed here all seemed to provide readers with material of acceptable, and in some cases impressive, quality. Yet content is limited in
several important ways. The disciplinary scope of network journals is currently biased toward the humanities and social sciences, where, perhaps, commercial and priority concerns are less pressing and the inability to display illustrations and special characters is a less serious drawback. The quantity of scholarly contributions currently produced by some network journals is also limited, with some publications offering a significantly smaller number of contributions than the reader of print journals has come to expect. While a number of instances in which network journals offered their readers significant improvements over the speed and functionality that accompany the production and distribution of print journals were identified, the degree to which network journals have taken advantage of the capabilities of computers and networks varies considerably, and it is safe to say that many of the possibilities remain virtually untapped.

It appears that we are at a critical juncture in the history of the networked dissemination of scholarly work. The journals reviewed here represent pioneers on this frontier. Several trends in policy and technology have converged in a manner that suggests that a more radical transformation of scholarly communication is imminent. Convinced that a viable market for network journals exist, and that business transactions on the Internet can be made both allowable and secure, a greater number of commercial publishers are beginning to enter the network journal marketplace. MIT Press, for example, has announced its intent to offer personal and institutional subscriptions to a peer-reviewed electronic journal called Chicago Journal of Theoretical Computer Science (Fisher, 1994). OCLC has also announced a new slate of fee-based electronic journal offerings. Based on the experience that has been gained to this point with both commercial and noncommercial electronic publishing ventures, it appears that more commercial publishers feel that issues of awareness, quality, archiving, and subscription procedures can now be adequately dealt with and, further, that a competitive advantage exists for publishers who offer readers the enhanced capabilities inherent in network publishing.

Other recent efforts have concentrated on pushing the boundaries of current technology and the new capabilities it offers. Project Muse at Johns Hopkins University Press begins to test the possibilities of networked hypermedia journal publication (Pathak, 1994). A prototype system accessed through the World Wide Web (http://muse.mse.jhu.edu) consists of current issues of three scholarly journals published by the press. Features of the system include author, title, and subject indexes, Boolean searching, hypertext links within the documents, and the incorporation of both illustrations and voice annotations. The World Wide Web and Mosaic have spawned another departure from previous patterns of scholarly communication in that
more scholars, researchers, and artists seem to be "publishing" their own material by mounting personal or workgroup homepages, thus making their work publicly available to a broader audience more quickly than in the past. Because such homepages often include links to other material that are somehow meaningful to their creators, they embed the scholar's or artist's own work within the broader, yet personalized, context of the field and suggest that new forms of invisible colleges or online scholarly communities may arise in the future.

We can also envision the future of network journals by re-examining scholars' needs and preferences within the framework of new technological developments. Olsen (1994) interviewed about fifty scholars in chemistry, sociology, and English language and literature about their reasons and strategies for locating journal literature, their methods of reading, and perceived strengths and weaknesses of print and electronic journal publication. Their responses allowed her to formulate requirements for an electronic journal system. Based on her findings, Olsen advocates the development of mechanisms to support: display of graphics, reduction of strain and discomfort from screen reading, effective skimming and scanning, serendipitous discovery, improvements over current computer search capabilities, the manipulation of documents, access to the literature from one's home or office, reduced lag time in publication, and the ability to create personal document collections. In terms of the current state of scholarly publishing on the net, virtually all of these requirements remain unmet or too dependent on technology and financial resources that are unavailable to many scholars.

Focus group interviews conducted by a group of researchers, including the author, also reveal a user-based vision of the ideal system of network journals that is far from the realities of current systems. The interviews were conducted at the University of Illinois with about eighteen faculty members, graduate students, and undergraduates in various engineering disciplines. The focus groups were conducted in order to inform the development of a digital library testbed that will consist primarily of engineering journals. While the behaviors and needs surrounding the identification and reading of journal articles varied considerably among the three user groups, their responses clearly suggested the network journal features that would be most beneficial, overall, to members of the engineering community. Participants in our discussions were most anxious for network journals to provide them with the ability to:

- see "real" page images, exactly as they appear in print versions of a particular journal (as scholars often locate material by remembering its relative position and general appearance, make initial judgments
These findings corroborate those of Olsen and offer further guidance on the optimal design of scholarly network journals—optimal, that is, from the reader’s point of view.

NOTES

1 Sources for identifying electronic journals that I came across in the course of my investigation take the form of directories, Internet sites where electronic periodicals are collected, and listservs where new electronic journals are announced. These include:


A CICNet gopher site established as a central site for collecting electronic periodicals. It allows users to see a listing of titles and access the actual issues (gopher.cic.net).

VPIEJ-L, a listserv devoted to the discussion of issues related to electronic journal publishing; new network journals are described in some postings. To subscribe, send e-mail with subscribe message to: listserv@vtml.cc.vt.edu

The lack of complete and current data on scholarly network journals is the impetus behind NewJour, a listserv on which people are invited to announce their planned or newly issued electronic networked journals and newsletters. Further, the NewJour-L support group intends to develop a worksheet to collect bibliographic, content, and access data from the editors of the new publications. This effort is coordinated through the Association of Research Libraries. It was described in note #47 of the "Announcements and Advertisements" section of Postmodern Culture, vol. 4, no. 3 (May 1994). To subscribe, send e-mail to: majordomo@ccat.sas.upenn.edu with the message: subscribe newjour-l Firstname Lastname.

Unattributed quotations used throughout this paper were taken from the basic information that accompanied each network journal issue.

Other members of the research team are S. Leigh Star, Laura Neumann, Emily Ignacio, and Pauline Cochrane. The team is part of the NSF/NASA/ARPA sponsored Digital Library Initiative project currently underway at the University of Illinois at Urbana-Champaign under the direction of PI Bruce Schatz. Preliminary results from the focus group interviews are available as working papers on the homepage set up for our digital library project, whose title is "Building the Interspace: Digital Library Infrastructure for a University Engineering Community" (http://www.grainger.uiuc.edu/dli).

REFERENCES


Authors and Readers: The Keys to Success or Failure for Electronic Publishing

CAROL TENOPIR

ABSTRACT
Although there are many possible links and ways to join them in the publishing chain for scholarly journal articles, the first and last links are always authors and readers. Unless it satisfies the motivations and goals of both authors and readers, electronic publishing cannot completely succeed. One of the most frequently cited advantages of electronic publishing is the loss of distinction between readers and authors and the shared motivation of both to have more opportunities for collaboration. Unfortunately, many goals of authors and readers are not shared. Authors are primarily motivated by career advancement and long-term contributions to their discipline, readers by keeping up in their field and work-related tasks. Many other factors enter into the process as well—some of which coincide while others conflict.

INTRODUCTION
The process of electronic publishing on commercial online systems traditionally involves many interrelated, but mostly separate, parts. These parts may be depicted as steps leading to a completed search request or, more commonly, as links that together form an information generation and use chain. Each component is dependent on the others, and together the whole leads to something greater than the parts.

Like a value chain within a company's operations, an information generation/use chain forms a system of interdependent activities,
connected by linkages. All of these linked activities must be coordinated, because the way each linked activity is performed affects the cost or effectiveness of the other activities (Porter & Millar, 1985).

Williams (1990) describes seven links in the information-generation-database use chain that focuses on the people responsible at each link: (1) author/originator, (2) primary publisher, (3) secondary publisher/database producer, (4) tertiary publisher/online vendor, (5) gateway, (6) searcher/analyst, and (7) end-user/requestor.

Anderson (1993) identifies four crucial links in the electronic information delivery chain: (1) authors, (2) publishers, (3) libraries, and (4) readers. Distribution is assumed to be via the Internet from publishers to readers or from publishers through libraries to readers. This echoes earlier work by King, McDonald, and Roderer (1981) on the separate, but interrelated, roles of authors, publishers, libraries, and readers in scientific communication through scientific print journals.

Schauder (1994) describes these links as “dependency patterns.” In print publishing, he identifies three patterns: (1) author to publisher to vendor to librarian to reader, (2) author to publisher to reader, and (3) author to publisher to vendor to reader. In every case, the author and reader are dependent on the publisher as the key link in conveying information, although other links may also be present.

In electronic publishing, Schauder expands the possible patterns to fifteen variations incorporating, in various permutations, the links of author, publisher, vendor, librarian, consortium (of publisher/vendor, publisher/vendor/librarian, publisher/librarian, or vendor/librarian), and reader. Unlike print publishing, the publisher is not involved in every pattern. The pattern may be directly from author to reader, or it may be from author to vendor to reader, or from author to library/vendor consortium to reader. Four of the fifteen dependency patterns exclude publishers. When a publisher is involved it may be only as part of a consortium.

An elaborate traditional publishing structure has developed that includes publishers, printers, indexers, database vendors, subscription agents, libraries, microfilmers, back issue dealers, cataloging utilities, and interlibrary loan networks, in addition to authors and readers (Potter, 1986). Other possible parts of the structure include reviewers and editors.

These many “intervening agents” between authors and readers have proliferated over the years. Potter points out that, historically, journals grew out of personal correspondence among scientists, but today “with the sheer number of journals, the complexities of serials, and the sociological baggage involved in publishing, an elaborate structure has been built to provide the channel that connects the author and reader” (p. 20).
All of the descriptions of the links or structure recognize the separate, but interrelated, functionaries in the electronic transfer of information. In all cases, the functionaries begin with the intellectual creator (the author) and end with the reader or user. This is, of course, the essence of any type of oral, written, or electronic knowledge dissemination—the linking of creators, or creators' ideas, with readers. As Potter (1986) succinctly puts it, "the situation today, as volatile as it may seem to us, is still essentially a reader looking for an author and an author looking for a reader" (p. 20).

**CHANGING ROLES OF PUBLISHERS**

What is unique about electronic publishing of scientific journals is the wide variety of ways the links can be connected to achieve this ultimate purpose. New ways of linking authors more directly to readers have developed as networks such as the Internet and Bitnet often replace the formal role of vendors, distributors, or publishers. The networks usually play a more passive and less formal role than traditional vendors or publishers in linking authors to readers.

Much of the dissemination of scholarly journals on these networks today bypasses formal publishers, although this is beginning to change. After an extensive survey of scholarly electronic publishing efforts, Schauder (1994) concluded that, as of mid-1993, most of the publishing on networks such as the Internet are noncommercial enterprises. Most efforts are dependent on volunteer effort and institutional or personal subsidies of money, labor, or facilities.

Widespread commercial electronic publishing ventures over the Internet by not-for-profit and by for-profit organizations may soon be coming, however. The early involvement of OCLC in conjunction with the American Association for the Advancement of Science (AAAS) and pilot projects by commercial scholarly publishers, such as Elsevier, foreshadow future developments.

Many proponents of electronic publishing call for a downplaying of publishers' roles (or even the elimination of publishers as we now know them) as a way to bring authors and readers closer. Certainly the lines among publishers, authors, and readers are blurring in electronic publishing or, as Anderson (1993) points out, "the boundaries between the players—authors, publishers, libraries, readers—have become very fluid and permeable" (p. 88).

By eliminating traditional commercial publishers in scholarly publishing that emanates from academe, Okerson (1992b) sees the solution to a range of long-term problems. These problems are fundamental to traditional scholarly publishing through the commercial sector and include high costs and loss of ownership.
Publishing outside academia, to the extent that it happens today, is unfortunate for users. The obvious reason is well documented: journals coming from university presses or learned societies cost anywhere from two to twenty times less per page than comparable for-profit journals. That is the smaller misfortune, however. The far greater one is loss of ownership. Through the conventions of scholarly publishing, the author routinely assigns copyright to the publisher, who legally becomes the new owner of the authored material for fifty years plus. That is, the academic institution is assigning most of its scholarship outside of academia, for a lifetime (Okerson, 1992b, p. 171).

Other advantages to the elimination of middlemen are cited by proponents of a new model for electronic scholarly publishing. These include faster transmission from author to reader (Arms, 1992); a way to circumvent exorbitant prices of serials (Bailey, 1992); providing equal access for all scholars (Okerson, 1992a); and breaking out of a biased and closed review system (Judson, 1994).

Not everyone agrees that publishers should be eliminated in the electronic publishing chain. The advantages and commitment that formal publishing brings are historical and far-reaching. They touch all parts of the publishing process, including the soliciting and evaluation of quality manuscripts; supervising the refereeing function; editing and advising authors of needed changes; copyediting final drafts; disseminating issues on a regular schedule; and protecting copyright. The formality and regularity of the process brings legitimacy and constancy to scholarly journals.

Even publishers agree that the role of the publisher is very likely to change, however, including the long-stable relationships between publishers and writers and those between publishers and readers (Kaplan, 1993). Scholarly publishing is especially ripe for change, and the role of the publisher may be taken on by universities or other players outside the mainstream of traditional publishing.

More emphasis is likely to be placed on the marketing and promotion role of these publishers. With the likely continued proliferation of published materials in an electronic environment, even scholarly publishers can bring an increased effort in identifying markets, linking author’s ideas to appropriate readers, and serving as clearinghouses (Kaplan, 1993; Horowitz & Curtis, 1982).

Other possible expanded roles for publishers (and librarians) are as enforcers of an author’s individual copyright, as developers of better access and display software, as providers of better links among related research, and as maintainers of quality over time by including errata or updated information alongside older articles.
COMMON GOALS?

Ultimately, the key to success of any electronic publication lies with the two predominant players that appear first and last in all the variety of models. Authors must be willing to write and readers must feel compelled to read what is written. Kaplan (1993) depicts the relationship between authors and readers as a constant that “has not changed since the first writings were rendered as cave markings” (p. 158).

Downplaying or eliminating publishers' roles revolves around the widely held belief that authors and readers share all of their goals in common and that these common goals are in conflict with the goals of commercial publishers. Authors and readers are depicted as integrated units as electronic journals “shift the emphasis of scholarship...from the single author to the corporate author [which is made up of] writers and their readers” (Amiran et al., 1991, p. 36).

Certainly authors and readers share some goals, but in reality are they now, or can they ever be, a single unified entity? Is this unification necessary for success of electronic publishing? An examination of their respective motivations and goals concerning scholarly publications may help answer this question.

AUTHORS' GOALS

The motivation to publish in scholarly journals has been examined often, long before electronic journals were a reality or even a possibility. The two primary motivating factors of scholarly authors are: (1) recognition for career advancement, including tenure, promotion, and salary increases (“publish-or-perish”); and (2) the desire to contribute to the body of knowledge in a field or to the archive of the scholarly knowledge in a field and to be recognized for their contribution by their peers. Several studies in the last fifteen years have shown that these are still the primary motivating factors of authors.

ACADEMIC ADVANCEMENT

Griffiths et al. (1991), in a study for the National Science Foundation, examined all aspects of scientific communication. Regarding authors, they estimated that over 600,000 scholarly articles were published in the United States in 1990, up from 489,000 in 1985 and 382,000 in 1977 (pp. 4-7). The number of articles published per scientist in U.S. journals is actually decreasing, however, from 0.155 in 1977, 0.114 in 1985, to 0.104 in 1990.

Although the Griffiths et al. study focused on nonacademic scientists, they compared their findings with earlier work which found that approximately 70 percent of professionals from research universities had articles published in the two-year period 1986-1987. This is far
greater than the number of nonacademics who write, as scientists and engineers in companies and government agencies wrote only an average of 0.05 articles per year in the late 1980s. Adding in the articles written by academics in these disciplines increases the number per year to between 1.5 and 3.1 articles per author (pp. 4-7).

Griffiths et al. (1991) conclude that "these data confirm that academicians publish for external purposes, far more than scientists and engineers from industry and government" (pp. 4-7). This coincides with Price's (1975) observations thirty years before that scientists (mainly in academe) "want to write but not read" and the "technologist" (mainly in industry and government) "wants to read but not write." Since far more academicians publish, the motivation of academic recognition and advancement through tenure and promotion must surely be a major goal in scholarly publishing.

This goal is not new—the term "publish-or-perish" was first used by Wilson in 1940—and academic institutions usually weigh tenure and promotion decisions most heavily on research output. A 1986 survey by the American Council of Learned Societies (cited by Lubans, 1987) found that 29 percent of academic scholars felt the pressure to publish was "extremely strong," while an additional 31 percent felt it was "strong."

In his review of the literature that describes motivations and problems with academic pressure to produce, Schauder (1994) concludes:

> the need by academics to publish in recognized refereed journals is a very important factor supporting the continuation and growth of formal academic publishing. It might be even more important than the need to read such journals. An academic with a poor publishing record is deemed to be underperforming.

(p. 83)

Schauder's survey of 743 senior academics in Australia, the United States, and the United Kingdom reinforced the perception that career advancement is a major motivator for academic authors. He found that 82 percent felt the publishing of professional articles was "important" to advancement in their careers, while an additional 14 percent felt such publishing was of "some importance" to their careers (p. 90).

The goal of publication as an advancement mechanism may not yet be served by electronic journals, as universities are slow to recognize their scholarly potential. One of the earliest attempts at developing a refereed scholarly electronic journal was the *Mental Workload* journal of the Electronic Information Exchange System (EIES) (Turoff & Hiltz, 1982). A main reason for failure was the unwillingness of authors to contribute to a journal that promised no recognition in tenure or promotion decisions, no royalties, and no role in advancing their reputations or careers.
A small study by Shamp (1992) reinforced the reluctance of universities to recognize electronic journals. He surveyed eighty-five academic users of Comserve, a communications electronic discussion group on Bitnet, to discover factors influencing their willingness to contribute articles to scholarly electronic journals. Of the respondents who were assistant, associate, or full professors, 77 percent "did not believe their institutions would accept electronic publication as evidence of scholarly productivity" (p. 301).

The success of electronic journals surely rests on the number and quality of the articles submitted and published. The early adopters of technology that Shamp surveyed are the most likely candidates to submit electronic articles, yet:

sixty percent of the respondent's decisions to submit were in line with their perceptions of their universities’ policy on electronic publication—22.1% said their university would accept and that they would submit while 37.1% thought their university would not accept and they would not submit. No respondents indicated they would not submit when they believed their university would accept the publication. (p. 301)

**Peer Review/Refereeing**

The author's goal of academic advancement may be met by inculcating the accepted practice of peer review/refereeing into scholarly electronic journals and ensuring that this is understood and accepted by academic decision makers. The editors of the successful electronic (and peer reviewed) journal *Postmodern Culture* report having trouble getting contributions from junior faculty because tenure committees fail to recognize the legitimacy of electronic publications (Amiran et al., 1991, p. 38). It must be conveyed to these decision makers that:

Institutional legitimation is a matter of the peer-review process and not a question of the medium in which peer-reviewed work is distributed. An electronic journal that uses methods as careful and reviewers as qualified as those used by responsible print journals ought to be considered a valid form of professional publication. (pp. 38-39)

A study by Seiler and Raben (1981) provides an early view of the challenge of fostering such acceptance. They surveyed attitudes toward refereed electronic journals by 677 assistant, associate, and full professors in U.S. academic institutions that have graduate programs. Respondents were asked to envision publications that were available only through computer networks but were national in scope, were in their subject specialty, and were refereed. Given this scenario (futuristic in 1981), 52 percent of the respondents:

considered electronic publication equivalent to print publication.
A sizable minority, however, either believed it inferior (37
percent) or would totally disregard it (6 percent). There was virtually no support (1 percent) for the idea that electronic publication is superior to print publication as a basis for promotion. (p. 81)

Not surprisingly, in schools oriented toward teaching, a higher percentage of the respondents believed the electronic medium for journals would be equal, or superior, to print for promotion to full professor than was true for schools oriented toward research (62 percent to 42) (Seiler & Raben, 1981, p. 81).

Nowhere is the peer review issue more important and more discussed than in the medical and biomedical fields. Health-service professors publish more refereed articles in their careers than any other scientists (Griffiths et al., 1991, pp. 4-7), and the amount and prestige of these publications is essential for competitive external funding as well as academic success. Much of the discussion has centered upon the problems of a peer review system for grant proposals and journal articles that uses potential competitors as reviewers in a highly competitive scientific environment. Recently, discussions have focused on the role of peer review in electronic journals as well.

The International Committee of Medical Journal Editors recently added a statement about electronic publication to their "Uniform Requirements for Manuscripts submitted to Biomedical Journals" (Flanagin et al., 1992). They wanted to convey to authors, editors, academicians, and institutions their belief that:

Scientific reports disseminated through an electronic journal—especially one that publishes original, peer-reviewed, and copyright-protected articles—should be considered "published" material and thus held to the same standards that apply to information published in conventional print journals. (p. 2374)

When it works as it should, peer review is an essential ingredient of ensuring that only the best quality papers get published. It provides decision makers at universities with a criterion for quality that they can accept without question. It thus serves the academic author’s primary motivation.

But merely bringing the old processes of print into an electronic world may not serve the interests of all authors or of all readers. Judson (1994) surveyed the troubled history of peer review in medicine—a process that is dominated by an old boy network and conflicting interests and competition, where the best work doesn’t always get into print. Merely moving this old system into a new delivery medium would not solve fundamental problems, but there is the possibility of a better peer review system in the future with the more open environment that electronic publishing will bring. He sees hope in the future as:
A new generation of journal editors will arise who have grown up with electronic editing and publishing. In 10 years' time, although procedures will be followed that some journals will still label "refereeing" or "journal peer review," these procedures will be startlingly different from those put into place in the years after the second world war; which, despite their brief history, seem so monolithic and unchangeable today....[T]he transformation will open up the processes by which scientists judge each other's work, making them less anonymous, capricious, rigid, and subject to abuse, and more thorough, responsible, and accountable. (Judson, 1994, p. 94)

In many less competitive disciplines, it may be a long time before this new vision serves the advancement goals of authors. It does, however, clearly serve the next major goal of authors—that of contributing to the knowledge base of their field.

CONTRIBUTING TO KNOWLEDGE

While motivation for advancement may be a pragmatic view of authoring, a more idealistic view is that an author's prime goal is to contribute to the knowledge of his or her discipline. Ideally this is not a one-way or a one-step process, but an iterative communication process with peers and beyond. These peers form at least some of the body of readers of scholarly work (but not all).

Anderson (1993) quotes Harnad's (1992) expression of the loftier communication/contribution goal:

Surely the motive of the true scholar/scientist is to advance human inquiry. And, just as surely, such an enterprise is and always has been a collective, cumulative and collaborative one: Scholars publish in order to inform their peers of their findings and, equally important, to be informed by them in turn, to interact with them, in the cycles of reciprocal influence that constitute an evolving body of scholarly research. In a word, the purpose of scholarly publication is communication—with peers, and for posterity. (pp. 91-93)

Feedback can be instantaneous and from a wide group of readers. Implied in this communication function is the frequently mentioned advantage of becoming closer to readers and of fostering more collaboration, which is already beginning to change the fundamental nature of research.

Authors will be able to enter into a dialogue or "dialectic" with readers as research and writing evolve through continuous interaction (Lederberg, 1993). A "collaboratory" electronic community, as expounded by Wulf (1993), is composed of scientists who both cooperate and compete and who do their own reviewing in an open manner "that concatenates publication and responses" (Judson, 1994).
In the ideal view, electronic publications will include all evolving versions of an article, from preliminary to revised (replacing the old preprint function). In a more revolutionary mode, it could also include all comments from referees; all criticism and suggestions from readers; rebuttals, corrections, and retractions; and perhaps even raw data (Judson, 1994).

With this cooperation among peers, electronic publishing facilitates the long-term functions of the scholarly invisible college. Writing evolves from an idea, to a research or conference report, to a preprint, to a formally published article, all with peer involvement and cooperation. Invisible colleges, by definition, are exclusive groups, as graphically described by Price (1975) in *Science Since Babylon*:

[Scientists] get by in what are now called "invisible colleges" of little groups of peers. They are small societies of everybody who is anybody in each little particular specialty. These groups are very efficient for their purpose and, somewhere along the line, people eventually write up their work so that graduate students can read it and get to the research front. By the time it gets published, however, it is so old that all the good research juice has been squeezed out of it, so it is not worth reading if you are really in the business at the research front. (pp. 126-27)

Electronic communication facilitates more timely access to the small peer group of invisible college members, which is clearly an advantage to authors within the college. Expanding it to include other peers who were previously left out of the college, particularly those in other countries who may not be able to attend professional conferences, should assist researchers as well. Electronic communication has the potential of opening up the invisible college to a much wider world of readers going beyond research peers. This includes students, researchers in other disciplines, readers outside of academia, and any interested layperson. Surely this is an advantage to readers or new authors who are now included in a process that once excluded them, but is it an advantage to authors who are already members of the more exclusive peer group?

This is perhaps an unanswerable question, as cogent arguments can be made on both sides. From the purely selfish perspective of an individual author, too much feedback, especially from those with little depth of knowledge in a subject specialty, may not serve the goals of authors as much as the ideal view proposes. Widespread distribution of referee's comments or disagreements from anyone who wishes to post them, may discourage some authors from publishing.

Even Harnad, an early creator and proponent of electronic journals, is described by *Scientific American* as:
no populist. Unlike Internet evangelists who view the network as the ultimate equalizer for dismantling hierarchy, Harnad is an unabashed academic snob. The best thinkers in a field, he believes, should have access to one another, undisturbed by the noise of crowds milling outside the ivory tower. (Stix, 1994, p. 109)

Perhaps it is wise to keep communication and publishing separate at some level. King (1991) advises viewing the process and products separately because "just because researchers use e-mail frequently for informal communications does not mean that e-mail will become the publishing medium of preference for formal publication" (p. 6). Invisible colleges are one type of informal communication means, wider-open lists and bulletin boards are others.

PUBLISHING FOR POSTERITY

Communicating with contemporary readers is not the only motive in formal scholarly publishing. An author's goal may be to ensure a place for himself or herself for posterity—to make a journal contribution that becomes part of a discipline's future knowledge base or to ensure personal fame and recognition in his or her field. This process may be independent of contemporary readers, as an author looks ahead to his or her place in history. For this purpose, the process of writing and publishing are essential to the work of a scientific scholar, but a wide readership of contemporaries is not (Schauder, 1994).

Taken to an extreme, authors and readers might be completely separated. According to Garcia (1994):

The view that texts are meant for audiences and thus that an audience, either actual or imagined, is a necessary condition of texts is one of those assumptions that, even if seldom explicitly stated, is generally implicitly accepted in the pertinent literature. Recently this view has come under fire, however, from some authors who claim that their business is not with an audience at all. Practitioners of the nouveau roman, such as Alain Robbe-Grillet, believe that for a writer the aim is to write, and whether what the writer writes is read or not is actually unimportant....From this point of view, an audience is neither necessary nor important for the author, and if that is so, then its consideration could neither be necessary nor important for the existence or understanding of a text. (pp. 731-32)

He goes on to argue that there is always at least one audience for every publication—the author is the audience for his or her own work. We have to assume that this extreme view is limited to fiction or philosophy and is not true in scientific publishing, but authors may not have an audience clearly in mind when they write. The needs of readers may be inconsequential when compared to the author's need to publish or the urge to record for posterity.
OTHER FACTORS

The two primary motivating factors of career advancement and contribution to the discipline are independent of the publication medium. In addition, some authors see advantages in electronic publishing that are not present in traditional print publishing. Many are more closely aligned with the needs of readers. Advantages include:

- timeliness (articles are published more quickly) (Judson, 1994)
- less pressure to condense the length of articles in order to conform to arbitrary page restrictions (DeLoughry, 1989; Judson, 1994)
- lower cost: no need to pay for publication or reprints
- increased opportunities for nontraditional writers or topics (Amiran et al., 1991)
- errata can be connected to the original text and authors who change their names can update previous publications (Seiler & Raben, 1981)

Financial reward does not seem to be an important motivating factor for authors of scholarly articles (this is probably based on the pragmatic realization that financial reward for scholarly publishing is unlikely). Only 4 percent of Schauder's (1994) respondents felt personal financial return was "important," while an additional 17 percent felt it to have "some importance" (p. 91). Seventy-six percent had never been paid for an article in a journal, while 19 percent had been charged a fee to publish in a journal at least once (p. 92).

PROTECTION OF INTELLECTUAL EFFORT

Although it is not an explicit motivating factor for publishing, protection of ideas from theft or misuse is implied if the primary goals of authors are to be achieved. It is a goal that is shared by publishers, although publishers and authors may be in conflict over who owns the published intellectual property. Protection against unauthorized copying, plagiarism, being quoted out of context, or theft of ideas concerns authors in all disciplines. Justified or not, the fear may be greater with electronic publications.

Staking a claim to a research idea before it can be formally published or claimed by someone else is more easily done electronically. In competitive fields, the desire to get credit for an idea, or process, or discovery has a long tradition. It is tied to the motivation of recognition by peers and by posterity. Although only the expression of ideas and not the ideas themselves can be copyrighted, there is a long tradition in scholarly research of granting credit to the one who first goes public with an idea. Electronic communication has changed the traditional channels of "going public" and may allow some ideas to
go public before they should (the cold fusion issue is a good example). More cautious researchers may be penalized.

On the other hand, casual mention in an electronic forum may not be considered staking a claim by some readers. To protect a researcher's interest, all readers must be made aware that "using someone's ideas that have been articulated in a casual manner on a listserv without ascription, or taking credit for another's work is intellectual theft" (Hauptman & Motin, 1994, p. 9).

If authors' prime motivators of academic advancement and securing a place for themselves in their discipline are to be met in an electronic environment, the work of an author must be clearly differentiated from the interactive comments or extensions by readers. Even in coauthored publications, the work by the authors of the institute or organization must be easily identifiable.

Copyright laws were made to protect authors' and publishers' investment of time, creativity, and capital. According to Rawlins (1993), in book publishing, that protection is eroding rapidly because "there is no long-term copy protection scheme suitable for marketable electronic books; the user can always scan the book and copy it perfectly. It will merely take longer to make the first copy" (p. 475). With electronic distribution of journals, the process is even easier as entire articles can be quickly downloaded and imported into a reader's word processor. The potential for misuse is vast.

Some of the copyright abuse in scholarly electronic communication is surely unintentional. In an interactive environment of give and take with informal looking "communications," the author of an original idea may be obscured. As lines blur among readers, authors, and publishers, a reader may make an idea his or her own or, mistakenly, an entire interactive document. In this situation, the author's motivation of self protection is not best served by informal or highly interactive electronic publications.

Outright plagiarism is a topic that is gaining renewed concern, although some say the fear is unfounded (Amiran et al., 1992). Still, downloading full articles is easy to do and "from there, it is easy to change a sentence here and there and incorporate the downloaded information into one's own research paper and claim it as one's own work. How to catch such plagiarism is a major problem" (Reichel, 1989, p. 478). Reichel calls for librarians to teach ethics of information use to students along with techniques for accessing electronic information. Plagiarism may be less of a problem with formal electronic journals that appear at regular intervals and have copyright notices clearly displayed than with e-mail communications (Bailey, 1991, as cited in Amiran et al., 1992).
The fear of having their intellectual output read out of context or quoted out of context is one that is not often articulated by authors but nonetheless may be present. Some authors fear, in particular, the capabilities offered in electronic versions of texts that make viewing small segments of texts so easy. The ability to read only chunks or paragraphs from multiple articles on a topic is seen as an advantage by readers of electronic texts but as a disadvantage by authors (Tenopir, 1988).

Involvement of a formal editorial and formal publishing function may help authors to protect themselves from copyright infringement, theft of ideas, or plagiarism. Commercial publishers and authors share a common goal in this situation. Amiran, Orr, and Unsworth (1991) quote Bailey (1991) who points out that "perhaps the situation is worst [sic] for electronic communications that bear the least resemblance to traditional printed forms.... Some print publishers are already moving into electronic text, and if they become a major force in this medium (or if software companies do), then some of these questions might eventually become moot or meaningless" (p. 44).

Readers' Goals

Clearly, not all of the goals or concerns described for authors are shared by readers. Some are in direct conflict; others may be shared in an electronic environment when they were not in a traditional print world; still others are important to both groups. Readers have their own goals as well.

Three recent extensive studies explore the needs and habits of readers of scholarly journals: Griffiths et al. (1991) and Griffiths and King (1993) provide in-depth pictures of researchers as readers of scientific and technical literature, while Olsen (1994) examines journal reading habits of professors of chemistry, sociology, and the humanities and their requirements for electronic journals.

Scientists rely on refereed journals more than any other type of literature, although the amount of reading seems to be declining since the 1970s. Scientists averaged 116 readings per year as of the late 1980s, with academic readers reading much more than others. Non-academic scientists read approximately 75 articles per year, down from 95 readings per year in 1984 and 105 readings per year in 1977 (Griffiths et al., 1991, p. 4-3).

Much of the reading is for current awareness purposes, with three-quarters of the reading occurring within six months of publication of the article. In contrast, readings "that have a significant effect on work" often come from older publications and "about 40% of readings were second-time readings with a one month lapse between readings" (Griffiths et al., 1991, p. 4-4). Reading occurs for many reasons,
including (in order of frequency): specific work activities, current awareness and professional development, and communication (Griffiths & King, 1993).

Olsen (1994) found that academic readers unanimously find journal literature to be "indispensable" to their work. They read journals for many reasons, including gathering background knowledge on a topic, current awareness, and looking for specific facts or items. Chemists use literature the most frequently—62 percent read journals every day (pp. 14-15).

When preparing to do research in a new area, preparing a grant proposal, or writing a manuscript, readers use retrospective literature as well as current articles. They scan or browse through vast amounts of material, using articles to trigger new ideas.

Olsen (1994) found that the parts of an article that are used to determine pertinence or that are ultimately read vary with the subject discipline of the reader. Chemists most often look first at the abstracts and the figures (including captions); sociologists at the abstract, introduction, conclusion, and figures; humanists scan the entire article or look at the first few paragraphs and footnotes.

When an article is deemed useful, chemists typically do not read the entire article and often read interesting parts out of sequential order. Humanists are the most likely to read the entire article in sequence, probably because articles in their fields do not have the regular structure that articles in chemistry or social sciences usually do.

Olsen's findings suggest that the concerns of authors that electronic publishing will lead to sections of their works being read out of context is something that is happening already in a print environment. Chemists and many social scientists do not read all of a print article but extract the information they need from the sections they deem useful.

However, these same scholars indicated to Olsen that skimming print does not result in context being lost. Instead, they skim to get a feeling of the whole and place the parts they are interested in into the context of the whole. They expressed concern that scrolling on a computer screen does not retain the same level of context, neither does it facilitate the browsing that is so important to them. In this instance, the concerns of academic readers mesh with those of the authors.

Olsen (1993) also suggests that scholars will embrace electronic versions but only if they serve their real fundamental needs. She concludes:

while scholars may express their purposes as "finding the comprehensive background knowledge on a topic," or "browsing to keep up to date" or "finding articles in my research areas," their
actual purposes in interacting with the literature are learning, creative thinking, and analytical thinking. This is a crucial distinction because functions such as selecting articles or browsing the latest literature appear to be tasks which a computer can be programmed to perform well, but in practice the computer performs them quickly, but not well. (p. 71)

Assuming technological barriers (hardware and access to networks) are overcome, electronic publishing serves many interests of readers. Clearly good software design that facilitates searching, scanning, and browsing are crucial elements in electronic publications from the reader’s point of view.

Low costs and pricing mechanisms that facilitate this natural behavior are also important factors. Griffiths and King (1993) found that the number of personal journal subscriptions held by scientists has declined as prices have gone up, and the price of the journal is the most important reason for not holding a personal subscription. Surely this applies to electronic journals as well.

Closer Relationships to Authors

As discussed earlier under authors, the advantage of closer relationships between authors and readers is seen as a major advantage for readers. At the simplest level, a reader’s natural impulse to interact with an author can be easily met. Comments to and from the author could be stored and viewed by others if they desired (Seiler & Raben, 1981).

At its fullest extension, a new form of cooperative collaborative writing would “entwine ideas and response to them (more ideas) in a totally new vision of the cumulative scholar’s journal” (Okerson, 1992, p. 94). Harnad (1990) calls this “scholarly skywriting”; Lederberg (1993) calls it “a dialectic”; Judson (1994) sees it as a revolution that moves scholarly work from a hierarchical model to an egalitarian one.

But readers’ goals of learning and keeping up in their field are not always best met by collaboration and interaction. As articulated by Price (1975) and demonstrated in the Griffiths et al. study (1991), not all readers want to write or even to be known to the authors they read. Anonymous reading of the experts’ polished work is still a valuable goal of many readers. They often want to annotate, underline, and make notes about an article but not for public consumption (Olsen, 1994). Traditional publishing models place a buffer between readers and authors.

Peer Review/Refereeing

Peer review serves the needs of readers by assisting as a quality filter. If it works correctly, peer review keeps the number of papers
published down to those with merit (although there are many complaints that too much is published and that the filtering function should be tighter).

Readers, especially those who are not also experienced researchers and authors, need to have confidence that what they read is accurate and authoritative. Amiran, Unsworth, and Chaski (1992) quote a proposal to establish *The Chicago Journal of Theoretical Computer Science* by Mike J. O'Donnell and Abraham Bookstein on the needs of readers of scholarly publications. Readers need to have:

a high confidence that they are all reading precisely the same article created by the author and accepted by the editor, and that this acceptance is an accurate certificate of the value of the article. The basic protocol of publication in a scholarly journal—the author freely chooses to submit an article, the editor takes the advice of several independent and anonymous referees, insists on revisions if appropriate, then accepts or rejects the article—is independent of the medium. There is no reason to change that highly successful protocol in converting from print to electronic network publication. (p. 54)

As discussed earlier, rigorous peer review is facilitated by electronic communication. More reviewers can evaluate a manuscript in less time. Reviewers' comments can be attached to electronic preprints of a manuscript before a more final version is completed. There is no reason why peer review has to be less rigorous, and, indeed it could be more rigorous. Harnad, editor of *Behavioral and Brain Sciences* and the electronic *Psycoloquy*, is an articulate proponent of rigorous peer reviewing in print and electronic journals.

In 1978, Roistacher proposed a unique way for electronic journals to serve both goals of readers—the goal to see more published and the goal to have a quality filter. He proposed imposing no limits on the amount of material published, but attaching numerical scores assigned by referees to each article. Readers could set a threshold score when they wanted to read only the best articles. Subsequent readers could attach their own scores to articles, extending the refereeing process forward in time and to a larger audience.

Rogers and Hurt (1990) provide detailed suggestions on how an electronic "Scholarly Communication System" could meet a variety of authors' and readers' goals for quantity and quality of publications. Scholars would submit papers electronically where they would be filed by subject category and would be available for readers' comments. After six months on the system, each article would be flagged for review, and authors would be notified. Authors could use the comments from readers to prepare a final draft of their article.
If an author submits a final revised copy, it would be sent for formal review, otherwise the article would be purged from the system. Review boards would place each article in one of seven categories, including:

1. original contribution to literature in a field;
2. logical extension of research in a field;
3. application of a theoretical perspective or method developed in one content area to another content area;
4. restatement or interpretation of existing research;
5. review of the status of research on a particular topic;
6. seriously flawed in research design, experimental technique, or conclusion; and
7. no scholarly contribution (p. 6).

**OTHER FACTORS**

Readers will need to be convinced that electronic publishing is superior to traditional print publishing if they are to happily make the switch (Jul, 1992). There are many indications that this is already happening in many subject disciplines and is picking up speed.

The almost complete replacement of print journals in the research areas of physics and mathematics has been well reported (Stix, 1994). Many examples of successful refereed electronic journals now exist including *Postmodern Culture*, *Psycoloquy*, and the *Electronic Journal of Combinatorics*. Others are described in other articles in this issue. The 1994 edition of the *Directory of Electronic Journals, Newsletters and Academic Discussion Lists* includes 440 electronic journals and newsletters, nearly 100 of which are peer reviewed.

As technology improves, convincing readers to make the switch becomes easier to do. In addition to the speed and convenience of delivery now present, multimedia electronic journals are beginning to provide types of information not available in print. Stix (1994) describes for the extensive audience of *Scientific American* the future look of electronic journals.

Additional factors that are important advantages to readers of electronic publishing include:

- opportunity to experiment with electronic media (Amiran et al., 1991);
- timeliness of publication (Anderson, 1993; Stix, 1994);
- location independence (Anderson, 1993);
- instant updates and revisions (Rawlins, 1993);
- better searchability (Olsen, 1994);
- ability to create own personal electronic file of articles (Olsen, 1994);
- space savings (Olsen, 1994); and
• not reliant on library collection (Stix, 1994).

CONCLUSION

Clearly some of the goals of authors and readers are in harmony. Most authors and readers, for example, want a process that allows articles to be disseminated in a timely manner. It is in both of their interests to keep the costs of creating and distributing journal articles low and to provide a system of publishing that allows widespread dissemination.

Although the primary motivation may vary, the ultimate goals of both groups are served by some sort of peer review/refereeing process that serves as a quality filter and is acknowledged as such by academic institutions and decision makers.

Many authors and readers benefit from increased feedback and connection, although this benefit is less clear for some groups. Non-academic researchers are often readers but rarely become authors. They may have neither the job incentives nor the desire to do so. Electronic communication may allow them to connect with authors or other readers on a less formal basis, however.

Other goals may never coincide. Authors value their historical place in a discipline over time, the academic and professional stature that comes with formal publishing, and the protection of their individual ideas.

Readers value the ability to access relevant information in a timely manner and use it in the ways they need to. They may want to comment on electronic texts or author’s ideas even in areas where they are on the periphery. They may want to download, alter, or keep personal files of electronic journal articles and do so at a low cost.

Still, uniting all of the goals of authors and readers may not be necessary for electronic publishing to ultimately replace print if a variety of electronic communication and publication models coexist. The goals of communication can be met with informal e-mail, more formal listervs and bulletin boards, and still more restrictive invisible colleges. The goals of collaboration and interactive publication can be met with all of the above, plus an electronic preprint function that distributes drafts for peer review and comment. Finally, the goals of recognizing quality work and ensuring importance over time can be met with rigorous formal refereed journals.

The traditional links of editors, reviewers, referees, and publishers enable this last model and allow disparate goals to coexist. Publishing has worked in a print mode without complete commonality of goals between readers and writers and it can in the electronic world as long as all important needs are met.
REFERENCES


The Electronic Journal as the Heart of an Online Scholarly Community

Teresa M. Harrison and Timothy D. Stephen

Abstract
This article examines the role of electronic academic journals within scholarly communities. Scholarly communities are best understood as discourse communities which share symbol systems as well as conventions for communication. We discuss the ways in which the network and the electronic journals it hosts can play an important role in facilitating the routine discourse processes of scholarly communities. However, we also argue that the new medium will change the way that scholars read and write, the way they do research, and the form of research products. We consider in detail our experiences with the Electronic Journal of Communication/La Revue Électronique de Communication, an electronic journal serving an online community of communication scholars and students.

Introduction
Scholarly journals serve many purposes within the academic world, the importance of which vary with the role and perspective of particular participants. For librarians, journals constitute the scholarly archive. They are the ultimate and final repositories of knowledge within academic disciplines, the court of last resort to which inquirers are referred when there is a need to answer questions about what is and is not known within a body of knowledge. For university administrators, scholarly journals represent a kind of academic score card. They provide a permanent record of individual and institutional ac—

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complishment within the knowledge-productive enterprises of the disciplines, thus helping to establish relative status within a field of competitors. For practicing scholars, academic journals function principally as channels of communication. As one form of scholarly publishing, academic journals are “part of a multiplicity of means by which communities communicate with themselves” (Lorimar, 1993, p. 212).

The recent appearance of electronic scholarly journals—academic serials that are delivered through the Internet and its associated technologies—is an innovation with implications more profound than the simple replacement of one mode of information transmission with another. The electronic scholarly journal promises to alter forever the economic, professional, organizational, and disciplinary relationships within the academic world that have been founded upon the technology of print and the medium of paper. In this article, we examine some of the implications of the network and the academic journals it supports for the practices and products of scholarly communities.

We begin this discussion by considering the qualities of community, particularly as they relate to scholarly disciplines and the role that academic journals play within scholarly communities. We then consider various ways in which the network and electronic academic journals both support and alter the development of scholarly communities. As an extended example, we discuss our experiences with the Electronic Journal of Communication/La Revue Électronique de Communication (EJC/REC), an electronic journal serving an online community of communication scholars and students.

SCHOLARLY COMMUNITIES

What is a scholarly community? Most of us have no trouble identifying what is and isn’t scholarly. But the idea of “community” presents certain problems that social scientists have grappled with for most of the last century. Traditionally, sociologists and anthropologists have regarded communities as based on geographical or physical proximity; however, the joint impact of industrialization, urbanization, and modern transportation and communication systems has diminished the usefulness of proximity in delimiting the boundaries of communities in the twentieth century. As the geographical basis of community boundaries has eroded, sociologists and anthropologists have been forced to choose between abandoning altogether the concept of community in the study of modern society or reexamining their understanding of the social features that are fundamental to the constitution of community.

In response, some theorists have suggested that communities are collectivities of like-minded individuals formed when a group
of people comes to think in roughly the same way, sharing foundational beliefs, and agreeing on important issues. But Cohen (1985) notes that most of the social collectivities we would regard as communities are characterized by deep and enduring disagreements over fundamental issues. Alternatively, he suggests that what constitutes community is not a shared set of beliefs but is rather a common symbolic system comprised of a shared set of symbols, constructs, and norms for communication through which the routine discourse activities of a people takes place. “Community itself and everything within it,” Cohen argues, “has a symbolic dimension, and, further, . . . this dimension does not exist as some kind of consensus of sentiment. Rather, it exists as something for people ‘to think with.’ The symbols of community are mental constructs: they provide people with the means to make meaning. In so doing, they also provide them with the means to express the particular meanings which the community has for them” (p. 19). Thus, what is common to the group of people who comprise a community is not a tract of physical space or uniformity in the meanings of relevant phenomena, but, again in Cohen’s terms, a “commonality of forms” (p. 20).

Members of a community use their shared symbol systems to accomplish many individual and social objectives, but one of the most important of these is to demarcate the existence of the community itself. The idea of participating in a community implies that some individuals are members while others are not. In this sense, community is a relational construct, as Cohen (1985) notes. Because communities interact with other communities, differentiation between communities through the establishment of boundaries is one purpose of symbolic activities that is essential to community building. In fact, the less concrete or physical the boundaries between communities of individuals, the more important will be the symbolic activities a group uses to assert and maintain the boundaries of their community.

Given this perspective, community continues to be a highly useful theoretical and lay concept for understanding how groups of people organize and differentiate themselves within a culture or society. Individuals belong to many different communities within the course of their personal and professional lives—some bounded by ethnicity, some by professional or organizational affiliations, and some by deep and compelling interests in particular subject matters, as for example, scholarly communities.

Some further implications of this symbol-based view of community can be recognized by noting that scholarly communities might also be described as “discourse communities.” The term “discourse community” is taken from the literature of composition studies and focuses attention on the particular conventions for written communi-
cation that characterize a group of individuals. While there is no single concise definition of discourse community, Faigley's (1985) description is one of the most complete. He tells us that a discourse community is a specialized group, such as an academic discipline, with members who “know what is worth communicating, how it can be communicated, what other members of the community are likely to know and believe to be true about certain subjects, how other members can be persuaded, and so on” (p. 238).

Discourse communities have special ways of knowing, believing, and persuading. The fact that such conventions are held in common means that experienced writers within the discourse community are able to draw upon them for knowledge about what will count as appropriate language, appropriate evidence, and appropriate reasoning. In a strong sense then, members of discourse communities know how to communicate with each other. The effectiveness of their written products is evaluated according to standards or criteria that are, at least in part, idiosyncratic to the discourse community.

Most discussions of discourse communities are based upon the assumption that members orient around its media—that is, the specific channels and genres that members use to communicate, which, it is worth pointing out, have been regarded implicitly as print-based, principally because, until recently, there has been no apparent alternative. Most scholarly communities are oriented particularly around refereed journals as channels for communication and the research article as a genre of communication. While scholars share information and debate issues at conferences and other face-to-face meetings, for most disciplines, the refereed journal is the primary “site” for communication.

New academic journals have appeared in print as individuals recognized the need for outlets for emerging research specialties or when minorities within a scholarly community have been marginalized by a dominant set of interests. In such cases the initiation of new journals has contributed to the process of building and differentiating scholarly communities. It seems likely that the network and the electronic scholarly journals it now hosts will similarly participate in certain aspects of community building within the academic world. But this new medium for communication may also stimulate more fundamental changes in the practices and products of scholarship within scholarly communities.

**Electronic Journals and Scholarly Communities**

Our perspective implies that communication is the lifeblood of a scholarly community and that, indeed, the community exists in its most physical sense where the communication takes place.
Thus, the success of an electronic academic journal will depend on the extent to which members of a disciplinary community actually use it to take part in the routine discourse processes through which knowledge is validated and distributed. Scholars who initiate electronic academic journals face the normal sociological challenges associated with establishing the legitimacy and credibility of any new journal. But they also confront a new set of challenges that derive from attempting to orient the disciplinary community to a new medium for communication and the potentially new practices to which such a medium may give rise. Whether the developers of these journals know it or not, part of their task is to find a way to extend a disciplinary community to the network or to create an entirely new online disciplinary community. It may be many years before electronic journals achieve the level of credibility and stature of their print counterparts. However, the process of legitimating electronic journals will be hastened by certain communication capabilities enabled by the technology that contribute to the growth and development of scholarly communities.

At this relatively early point in the use of the network, critics of academic networking have been justifiably concerned with dividing a disciplinary community into “haves” and “have nots” based upon members’ access to the network and the hardware and software required for using it. But, as the costs of technology continue to decline and networking diffuses throughout the academic world, it is important to consider the other side of this issue, which is that the network supports a wide range of communication activities that enable a scholarly community to embrace more of its potential and actual members in discourse than has been possible through traditional communication media. Over 1,800 online conferences (Kovacs, 1994) covering seemingly every major field of academic inquiry now create social “spaces” where members of scholarly communities distributed around the world can come to share information and interaction. Such channels enable members of established communities to maintain continuing informal ties in the absence of ongoing face-to-face communication. Such channels also create the opportunity to assemble entirely new communities of scholars who share interests that may be otherwise obscured by the segmentation of traditional disciplinary divisions.

Further, the network promises to forge closer connections to its formal channels of communication within a community. Experiments that move existing journals onto the network are just beginning. For example, some university and professional society publishers, such as the American Chemical Society (Garson, 1994), the Johns Hopkins Press’ Project MUSE (DeLoughry, 1994), and the University of California Press (Ekman & Quandt, 1994) are making available over the
Internet the contents of established journals. Moreover, some journals, such as the well-known *Online Journal of Current Clinical Trials*, have been conceived with the goal of using hypertext links to connect related articles as well as any commentary that might be attached to them (such as letters, rebuttals, and retractions) within a larger electronic archive of disciplinary work (see, e.g., Kellar, 1990). Such archives can enhance access and information retrieval, thus connecting scholars to the scholarly literature to a degree not previously possible.

Unlike print journals, electronic journals distributed through the network can be initiated with relatively little capital expenditure, which means that scholars have been economically less constrained in creating new journals. The majority of the new electronic journals have been initiated by scholars acting alone or in groups without financial assistance from publishers or professional organizations; these publications have been offered to subscribers over the network for free. It is too soon to say how long such journals can continue to be offered without an attempt to recover costs. However, the ability of the network to support grassroots publications, as well as scholars' willingness to perform both editorial and production roles without support, has made it possible for innovators to experiment with electronic journals designed to serve existing disciplinary communities and to build new interdisciplinary communities on the network. This loosening of economic constraints also means that article and journal size can vary more widely thereby allowing more individuals to participate in the scholarly conversations that journals were intended to facilitate.

When new electronic journals are complemented by other means for communication available on the network, such as dedicated listserv discussions and the various virtual reality environments that are becoming available (e.g., MOOs and MUDs), then the opportunities for involving members of an international scholarly community in disciplinary discourse are heightened considerably. Several electronic journals, such as *Surfaces*, founded by Jean-Claude Guédon and Bill Readings, and *Postmodern Culture*, edited by Eyal Amiran and John Unsworth, make use of precisely such capabilities. These channels for informal communication support the journal and its community-building enterprise by providing a context in which authors and readers can discuss works appearing in the journal, thus extending opportunities to engage in scholarly discourse. This additional contact is especially important for interdisciplinary communities, where face-to-face conferences may be expensive to attend and take place only sporadically.

Finally, the comparative increases in speed afforded by the network can also facilitate scholarly dialogue within a community. Some of the
current experiments in electronic publication are attempts to capitalize on this advantage. Harnad (1991) has argued that when manuscripts and feedback are exchanged through the network, scholarship can progress at a speed and tempo more similar to that of natural thought and speech. *Psycoloquy*, the electronic journal founded by Harnad, automates the delivery of current research reports and peer responses, reducing time lags from months to hours and preserving the interactive quality that ideally should characterize such processes. *Postmodern Culture* solicits self-nominated peer reviewers by issuing a call to all subscribers with descriptions of essays recently submitted to the journal; this both speeds up the process of peer review and opens participation to a greater number of scholars.

We have been discussing various ways in which the network and electronic journals distributed through it can contribute to the development of scholarly communities. However, it is important to recognize that this new medium may also stimulate changes in the traditional discourse practices and products of disciplines, with the corresponding potential to undermine some of the foundations upon which a community is built. One example of this is the burgeoning use of the network to facilitate preprint distribution, a practice that began in high energy physics (Broad, 1993; Taubes 1993) and is now being tried in mathematics (Rodgers et al., forthcoming), philosophy (*International Philosophical Preprint Exchange*, 1994), and economics(*Economics WPA World Wide Web Service*, 1994). Okerson (1994) reports that electronic preprint distribution in high energy physics has been so successful that the Stanford Linear Accelerator Center has recently decided to cease paper preprint distribution because more than half of them had already circulated widely on the Internet. In this case, preprint distribution appears to have the potential to eliminate the communication functions of print journals for practicing scholars. It is worth noting that relations of power are implicated in the use of any communication medium, which means that a shift in medium may also signify displacements among those who wield power, with corresponding reverberations on the social structure of the community.

Less dramatic, but equally important, are the ways in which the electronic medium can alter community discourse practices by increasing access to other symbol systems used within the community but which typically are not available through traditional print publication. This is the goal of some electronic journals that plan to provide readers with access both to text and related images as well as graphic and quantitative data. For example, the online *Journal of Statistics Education* plans to store articles within a database that will allow readers to
retrieve associated data sets and graphics as well as the text of the article (Solomon et al., 1993). Similarly, the *Journal of Fluids Engineering* will enable subscribers to read not only the results of research in an article but also will allow them to examine the raw data associated with that particular research study (Ekman & Quandt, 1994).

Others have argued that the ability to create collaborative texts on the network may play a role in changing the nature of writing and its outcome, producing a dialogic document that more faithfully reflects the interactive nature of scholarly discourse (Harrison & Stephen, 1992; Tuman, 1992). Guédon (forthcoming) suggests that the ability to incorporate comments and arguments from both readers and authors in online discussions about journal articles may itself yield a new form of scholarly product—one in which the integrity of a monological text authored by one individual is eroded, gradually giving way to the creation of an online collaborative text in which participants serve as both readers and writers. Such texts may well recover the ancient dialogic character of scholarly communication, which has always been poorly reflected in print publication.

Most new electronic journals have been developed under the assumption that articles will be downloaded and printed in order to be read. Such efforts ignore the possibility that electronic journals may be instrumental in reconfiguring more fundamental research practices within scholarly communities. In response to this potential, the *Electronic Journal of Communication/La Revue Électronique de Communication*, offered under the auspices of Comserve, will soon be accompanied by a software system that facilitates the ability of subscribers to read articles on their computer screens rather than downloading them to print. The display program attempts to overcome some of the traditional limitations of reading text on a CRT—for example, by enabling readers to move directly from text citations and footnotes to references via hypertext-style links and allowing them to annotate text in a pop-up notation space that can be saved for future inspection. We provide more information about this system below. But first a description of the electronic community of which *EJC/REC* is the heart.

**Comserve: An Electronic Community of Communication Scholars**

When James Winter of the University of Windsor and Claude Martin of the University of Montreal approached the authors in 1989 with the idea of the *Electronic Journal of Communication/La Revue Électronique de Communication*, we were apprehensive. Our experience with the Comserve project had demonstrated that people were enthusiastic about using computer networks for informal scholarly communication, but establishing a formal channel for scholarly communication
seemed a far riskier test of the ability of the networks to support scholarly communities. However, we decided ultimately that offering an electronic scholarly journal under the auspices of the Comserve project was an excellent way to experiment with a new journal and a new technology because Comserve had already established an online community of communication scholars with proven computer literacy who, if not initially receptive to the idea of an electronic journal, would at least be sufficiently technically skilled to be able to access it (see Harrison et al., 1991, for information about early design decisions).

A few words about the Comserve project are in order at this point (see Harrison & Stephen, 1992; Stephen & Harrison, 1993 for more detail). Comserve is an electronic center for scholarship in communication studies accessible entirely through computer networks. The service, which has existed since 1986, provides a growing number of resources for communication faculty and students that now include:

- **Electronic Conferences:** A suite of over thirty public and private electronic conferences addressing topics in communication scholarship. The public conferences, called “hotlines,” may be used by anyone for the purpose of discussion, advice asking/giving, posing questions, and other forms of scholarly interaction. The private conferences are reserved for relatively smaller special groups of scholars pursuing specific scholarly projects. For example, private conferences have been used by faculty and students in cooperative interuniversity course projects, by editors and authors assembling an anthology, and by an international team of over 100 researchers pursuing a common research project.

- **Electronic Teaching and Research Resources:** A resource library of over 3,000 documents containing research, teaching, and other professionally useful information. The resource library consists of bibliographies, syllabi, research instruments, conference announcements, position advertisements, electronic newsletters, and other materials deemed potentially useful to communication scholars.

- **Journals Index:** An electronic index to over fifty scholarly journals in the communication discipline. The index consists of bibliographic information for articles published in communication or related scholarly journals that may be searched by title, author, or by journal. The index, which is supplemented by a PC-based companion version, is the largest and most comprehensive index to the communication literature—either in print or electronic media.

Across the course of the last eight years, more than 40,000 faculty, students, and professionals from over 100 countries around the world have found their way to Comserve and availed themselves of its
resources. Many of these, of course, have not been affiliated with communication studies; Comserve's ongoing client population fluctuates between 7,500 and 8,000. To support international users, Comserve can respond to commands in French, Portuguese, and Spanish. We hoped that this population of computer literate scholars and students, representing more than the membership of some of our largest professional organizations, could be induced to support an electronic publication.

Since then, part of Comserve's user population has evolved into a scholarly association, which is called the "Communication Institute for Online Scholarship" (CIOS). The CIOS is a nonprofit association with approximately 250 individual and 75 institutional members, whose mission is to support the use of information technologies in the service of communication scholarship. The CIOS is the parent organization for the Comserve project; EJC/REC has now become the official scholarly journal of the CIOS.

EJC/REC is offered as a series of topically oriented issues, each of which is edited by one or more established scholars in the field who propose their own focus for the issue, form an editorial board, and solicit and review submissions. Typically, these editors are respected scholars who have demonstrated a degree of receptivity to the new medium. Editors are free to choose their own procedures for their issue, with the provision that each submission is peer reviewed. In this way, we have sought to establish credibility for EJC/REC in its early days, attract an audience for the journal as well as authors representing various subfields of communication scholarship, and disperse the burdens and risks associated with this new endeavor.

Issues of EJC/REC have attempted to exploit the speed and international advantages conferred by the electronic medium. For example, EJC/REC solicited and disseminated the first communication scholarship on the Gulf War of which we are aware. The issue on the "Gulf War and the Media" came out within eight months of the end of the war. We are also concentrating on using the journal to further internationalize the scholarly community. For example, past and future issues focus on women and the Canadian media, international communication research, and Australian communication scholarship, and editors now hail from the United States, Australia, Canada, and Finland. The journal attempts to be marginally bi-lingual; abstracts of the articles and the introduction to each issue are published in both French and English.

**Consuming Electronic Journals Electronically**

Like most other existing electronic journals, EJC/REC has been distributed through a dedicated network "list" or conference, which
announces the release of each issue. Subscribers receive a "table of contents" describing the focus of the issue, listing the articles that appear, and abstracts for each article. Members of the CIOS, or those from affiliated institutions, can obtain articles of interest by requesting the relevant files from Comserve's resource library.

More recently, however, we have undertaken the development of a software program that displays the contents of an electronic journal electronically in a way that both facilitates traditional scholarly reading practices and lays the basis for new electronically inspired scholarly practices. Virbel (1993), in discussing the development of a reading workstation designed for research in the humanities, describes the challenges involved in the process of computerizing scholarly practices: "It is obvious that reading for study and research, and the intellectual work associated with it, involves practices and methods that are centuries, even millennia, old. Some seem easily reproducible in a digital context, others less so. Most seem to need a more or less profound redefinition. Finally, the computer opens up some entirely new reading practices" (pp. 36-37). We have sought to identify some of these practices and incorporate them into the design of a software system that we hope will serve as a foundation for more sophisticated versions in the future.

The system we have created allows the reader to peruse the contents of a journal issue and engage in rudimentary, but essential, scholarly practices while the text maintains its electronic form. For example, readers choose articles of interest by clicking on the relevant title in the table of contents, which calls up the text instantly. To ascertain the interest value of the article, the system enables the reader to page immediately between sections of an article to get an overview of its focus and direction. Hypertext-style links between citations and footnotes in the text and the full references in the footnote or endnote sections enable readers to consult documentation with greater facility than is generally possible in print publication.

The system allows the reader to annotate sections of a text in a way similar to the material operations readers generally perform on paper. The reader may choose to highlight different portions of an article, the results of which will be saved for future consultations with the text. It is also possible to create a link between a section of the text and a pop-up notation space that will permit readers to make "marginal" comments that can also be saved for future inspection. If the reader desires, both the text and associated annotations may be printed at any time.
The software system further enables a few special features that should help to ease the transition to electronic journals and create the foundation for more sophisticated electronic reading technology. First, the system creates a special encrypted version of a journal issue that will ensure that the reader is receiving contents in their original "official" form. The contents of the issue proper cannot be written over. This will help to allay concerns voiced by researchers and librarians that journal articles transmitted via network may present altered versions of the texts.

Second, the ability to create hypertext-style links within the text can be eventually extended to the creation of hypertext-style links between the text of an article and other relevant texts appearing in the journal or in other journals that may be added to a cumulatively developing database. Such a feature anticipates the possibility that the literature of a discipline may be made increasingly available electronically and creates the foundation for developing an interconnected archive. We shift now to a brief technical tour of the electronic journal software.

**Markup and Display: A Software System for Electronic Publication**

Our electronic journal software system consists of two programs. One, named "Markup," is used by journal production/editorial staff to create a journal issue. A second program, named "Display," is the electronic journal display system itself—the program that is actually used by someone reading the journal.

Although more expensive technologies (such as VGA graphics and high speed CPUs) permit the inclusion of some features not available in our software (such as use of custom typefaces and scalable fonts and the inclusion of graphic images), we determined early in the design of the software to avoid incorporating features that require expensive technologies. Our design strategy was to incorporate all possible advantages that digitization can confer upon textual display (i.e., hypertext linking, word searching, etc.) without allowing the requirements of the technology to limit the journal's readership or to burden the journal's readership with the need to acquire special hardware or software. The clear trend of the last decade has been for the computing industry to introduce continuously new technologies that demand new hardware or software systems and to do so at such a staggering pace that it is no longer clear that users are interested in continually replacing working systems merely to keep up with the latest operating system, high speed processor, or other innovation. To write software that depends upon, or attempts to capitalize upon, technologies at the cutting edge may be unnecessarily expensive.
Thus we decided to work within the framework of IBM/MS-DOS text mode compatibility. This decision assured that our electronic journal is viewable on the largest possible range of computer makes and models and that its technology depends upon modes of operation that are built into virtually all computers and therefore requires no additional equipment or software. DOS text mode compatibility requires the bare minimum of computing equipment, and virtually all computer systems now manufactured for personal use retain the capability to operate in this mode.

**Primary Features of the Display Software System**

The user interface is full screen with user options available through function keys and pull-down menus arrayed on the top line of the screen. No feature of the display program depends on a mouse or other pointing device (e.g., trackball), but the program automatically recognizes when such devices are available and allows the reader to use one to control many aspects of the program’s performance (generally, opening and closing windows, moving pop-up windows, and selecting menu options). At any point in the program, the journal reader is able to obtain brief built-in help regarding operation of the program by pressing a function key. This key assignment is standardized in all of the display program’s environments (e.g., table of contents environment, article reading environment, and so on).

The top line pull-down menus contain options that allow such things as choice of color schemes to be used while displaying the journal article, a switch controlling how often the program will automatically save changes in marginal notes and underlining made by the reader, and a switch controlling whether or not a clock will be displayed in the upper right corner of all program screens. The reader is able to save configuration choices so that they need not be reset each time the program is executed. A “File” pull-down option provides a means for printing an article (with or without the user’s saved memos and underlines), the table of contents, or a file of information about article authors. When in the article reading environment, the File option also controls the way in which alterations (memo text, underlining) are saved in an article. In addition to the function key method described earlier, a “Help” pull-down option provides a way to read brief built-in context-sensitive help screens.

On starting, the program displays a custom journal masthead or “logo screen” that will be supplied by the journal editorial staff and incorporated into an issue using the “Markup” program (described later). From it, the reader can proceed to the table of contents environment, which displays information about article titles, authors,
and pagination for a complete journal issue, or to the author information environment, which displays professional information about article authors.

From the table of contents environment, readers can move into and out of the "read article environment." In this environment, readers can scroll through an article and find the next, or the most recent, citation in the article by pressing a function key.

- **Highlighting.** The reader is able to highlight text within an article. A pull-down menu allows the reader to indicate if he or she desires to view the article with or without display of any highlights. Similarly, the print option provides a way to print the article with or without highlights.

- **Embedded memos.** At any point while displaying an article, the reader can embed a memo (i.e., a textual comment) in a pop-up box by positioning the cursor on the point in the text at which the memo is relevant and then pressing a function key. A memo box will appear, and the reader can type text into it. The presence of a memo is indicated by the appearance of a marker symbol in the right margin of the text.

- **Bookmarks.** The reader can create bookmarks to facilitate quick return to a particular place in the text in a subsequent use of the Display program. The bookmark is created by positioning the cursor at the desired point in the text and pressing a function key. The reader is prompted for a brief phrase to associate with the marked spot. A directory of available bookmarks can be displayed through an option in the File pull-down menu.

- **Pop-up tables, figures, references, and notes.** The Markup program provides a way to create hypertext-style links among certain elements of an article. The software provides for four classes of elements: (1) tables; (2) figures; (3) elements of a bibliography or reference list; and (4) footnotes, reference notes, and endnotes. The mechanism for displaying these elements is the same: position the cursor on or about the location at which the material is relevant and press a function key. The relevant text appears in an appropriately labeled pop-up box which can be closed by pressing the escape key or clicking the mouse on a square in the upper left corner of the box. Pressing a function key will move the cursor to the next spot in the article at which a pop-up of any kind is available. The direction of this search (forward or backward) can be set by the reader.

- **Text searching.** The reader can find his or her way through the text by searching for any word. The reader is prompted for a search target string and can press escape to abort the operation or enter/return to process the search. A successful search positions the article so that the line containing the located text is center screen and the cursor is positioned on the first character of the word.
The Markup Software System

The Markup software system operates on journal article files in ASCII format, transforming them into a single journal issue that can be distributed with the Display software program. The Markup program itself is not distributed to end-users; it is a tool for the journal production staff to use to create an issue of an electronic journal.

The Markup program is used after the set of articles comprising a journal issue has been formatted with a text editing program. These articles must be basic ASCII text files. They can contain any element of the standard ASCII character set. The editorial staff may insert "tags" within the body of the article text to identify blocks of text that comprise endnotes, reference notes, tables, figures, and bibliographic references. These definitions are supplied by inserting tag words in the text that mark the start and stop of such blocks. The tags are processed by the Markup program to emphasize text (by giving it a unique color), to identify textual elements, and to create hypertext-style links between these elements and particular spots in the article.

The Markup software system provides four functions: (1) translation of articles to a format that protects the text from alteration by end-users and makes the text unviewable without a program capable of decrypting them, such as the Display software system (this step also involves interpretation of the tag language described previously); (2) preview of a translated article; (3) creation of a journal release by identifying other files needed for the release and constructing the author information data and table of contents data, paginating the article, and finally binding the article files to the Display software; and (4) editing the journal release data to correct mistakes or to reflect changes.

We believe that these features of a display system for electronic text represent a first step in moving from a conception of electronic journal production that is still largely based upon a print metaphor to one that is more fully electronic. Obviously there is still much more that could be done. For example, our display program will rely on ASCII characters, since the publishing community still lacks an industry-wide standard for type, graphics, and page layout (and since our abilities to program our own publication solutions are quite limited). It is possible that this problem may soon be solved by one of the many competing platform-independent systems for desktop publishing finding their way currently into the marketplace. It is also possible that one or more of these systems may enable many of the features described above in our own prototype. But at present there is no platform-independent commercial standard and none of these products appears to have won the widespread endorsement of the pub-
lishing community. In the absence of such a standard, we have opted to press ahead with our solution, recognizing that we are only making a start, but that a start is exactly what is needed.

**CONCLUSION**

Most experiments in electronic journal publication have been undertaken by volunteer scholars avidly exploring what academic computer networks have to offer to their scholarly communities; we count ourselves among this group. In doing so, the designers of electronic journals are all acting very much in the role of Henry Oldenburg in the seventeenth century, who coaxed natural scientists to share the results of their observations and experiments in the form of letters that he later published in what was then a completely new vehicle for scholarly communication and one of the first academic journals, the *Philosophical Transactions* of the Royal Society in London. In the intervening centuries since the establishment of the *Philosophical Transactions*, the form and content of the academic journal has been shaped by the various scholarly communities that have adopted it as well as by the contour of possibilities offered by the technology of print. We expect that similar evolutions will begin to take place with existing electronic journals.

Many scholars will no doubt be attracted to the network and to electronic journals because the technology offers an opportunity to participate, to a greater degree and in more useful ways, in the discourse of their community through scholarly forms that are somewhat familiar. Designers of electronic journals would do well to bear in mind that the network can be used in many ways to facilitate the routine discourse processes of their communities. But every new communication medium bears within it the seeds of change. Electronic journals are destined to change the way scholars read and write, the way they do research, and the very form taken by their research products. Printed academic journals have been at the heart of the development of the scholarly communities as we know them today. Electronic journals, and what they evolve into, will be at the heart of the scholarly communities that are created tomorrow.

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Virtual Transformations: The Evolution of Publication Media

KENNETH ARNOLD

ABSTRACT
This article examines the developing publication forms in the electronic environment in the light of recent critical perspectives on textuality, historical dimensions of technological change, and practical considerations of economic and political culture. The article suggests that the book will be significantly altered in the networked future—transformed into something new—but concludes that impediments to change are cultural—not economic or technological.

INTRODUCTION

In the 1977 film "Annie Hall," Woody Allen and Diane Keaton are standing in line for tickets to see the documentary movie "The Sorrow and the Pity" when a man behind them begins pontificating on movies and the media. When he incorrectly describes Marshall McLuhan's views on television as a "hot" medium, Allen can no longer take it. He turns to the viewer and says with exasperation, "Can you believe this?" The man demands equal time to express his opinions. When Allen dismisses him, saying he obviously knows nothing about McLuhan, the man responds that in fact he is an expert who teaches a course in "Television, Media, and Culture." Casually, Allen then says, "Well, I've got McLuhan right here," and produces him from behind a lobby billboard. McLuhan confirms Allen's opinion of the man. He says, "You don't know what you're talking about. How you got to teach anything is amazing." Allen says to the viewer: "If only life were like this."
“Annie Hall” is a movie that breaks the boundaries of convention. Combining isolated stand-up comedy routines with animation, cultural criticism, and a conventional love story, it exploits fully the visual medium, which is, in this case, also, in a sly way, the message. Looking back at the scene now, one might be tempted to describe it as an early example of “hypertext”—an electronic jump across the boundary of one medium to another, the source itself. Allen calls up McLuhan to annotate his “text.” McLuhan is a footnote but one that is more believable because the man himself is there—well, he is on the screen, a “virtual” authority. McLuhan must have relished doing the bit.

McLuhan’s (1962) book, *The Gutenberg Galaxy*, announced the end of print, which he characterized as a linear mode of communication emphasizing left-brain rationality. He described an emerging “electric” medium that “is not mechanical but organic and has little sympathy with the values achieved through typography, ‘this mechanical way of writing,’ as it was called at first” (p. 135). The impetus for McLuhan’s argument was television, which he described as “cool” because it “demands participation and involvement in depth of the whole being. It will not work as a background. It engages you” (p. 125). On the other hand, “hot” media, such as radio, fill in all the imaginative spaces. He saw in this new electric medium the potential to recapture the values of oral tribalized culture and to create a new global village based on intuitive right-brain behavior. Although *The Global Village*, his last book, was published posthumously in 1989, its argument is quintessentially of the 1960s, “the medium of the language itself as a public trust rather than of the reader as a private consumer” (McLuhan, 1962, p. 227).

A few years after *The Gutenberg Galaxy*, Jacques Derrida (1967) also declared emphatically, but more enigmatically (and to a much smaller audience), the death of the book. “The end of linear writing is indeed the end of the book,” even if “it is within the form of a book that the new writings literary or theoretical allow themselves to be, for better or for worse, encased” (p. 86). Although this sounds like a postmodern species of having it both ways, the futurist critic hedging his bets, all communication is certainly at some point encased for delivery. The question is whether a book is ever anything other than folded and bound pages filled with type.

Derrida and McLuhan were both insisting that multimedia culture requires new ways of thinking about text (and the meaning of text), and both were remarkably prescient in imagining the approaching communications revolution. Although Derrida was interested in text as an ontological category more culturally complex than McLuhan’s technology of print, his insights (as well as those of other cultural critics such as Roland Barthes) prepared the intellectual ground for questioning the sanctity of
the written word. The more widely read McLuhan captured a cultural restlessness that was about more than modes of communication. Although McLuhan was wrong about television (in itself) as the medium of the future—and his insights about television are not necessarily transferable to computer communications—he correctly identified the technological imperative as an important fact of Western cultural—not only economic—life. Television definitely changed the way people experience the world. On the other hand, the printed word and the book appear to be very much alive.

It was once thought that microfilm would revolutionize print media and lead to the end, or at least to the transformation, of the book. In 1935, Eugene Power, the founder of University Microfilms, saw the potential of the technology to revolutionize the preservation and reproduction of manuscript and printed materials. Microfilm remains, however, an important storage technology that has never seriously challenged the dominance of print (and the failure of microfilm to affect the shape of the book is often used now as an argument for moderation in making predictions about the fate of print in the computer era).

Vannevar Bush, a former scientific advisor to President Franklin D. Roosevelt, envisioned in a 1945 article in The Atlantic Monthly one use for microfilm that has led to a completely new way of thinking about information and manipulating text in electronic networks. What Bush described in "As We May Think" was a desktop apparatus he called the "Memex," comprising a "slanting translucent screen on which material can be projected for convenient reading" (p. 107). It was "a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory" (pp. 106-07). Operated by levers, buttons, and a keyboard, and based on microfilm storage technology, the contraption was a model in mechanical form of the desktop computer as a medium for retrieving and viewing information. More than that, it allowed a reader to "add marginal notes and comments, taking advantage of one possible type of dry photography, . . . just as though he had the physical page before him" (p. 107). The idea is that of a "virtual" text. Essential to Bush's conception was the ability of the Memex to facilitate associative links among texts. "When numerous items have been thus joined together to form a trail. . . it is exactly as though the physical items had been gathered together from widely separated sources and bound together to form a new book" (p. 107). He developed the concept as a way of dealing with an explosion of information but, more importantly, he saw the Memex as a system that
works as the human mind works. In talking about existing methods of storing and classifying knowledge, Bush complained that "the human mind does not work that way" (p. 106). Rather, he said, it works by association, snapping from one idea "to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain" (p. 106).

What Bush described is now known as "hypertext," a word first coined by Theodor Nelson in the 1960s. By that, Nelson explained in 1981, he meant "nonsequential writing—text that branches and allows choices to the reader, best read at an interactive screen. As popularly conceived, this is a series of text chunks connected by links which offer the reader different pathways" (as cited in Landow, 1994, p. 4). Although he based the concept on Vannevar Bush's work, he predicted its actualization in the new environment of electronic media. Nelson was frustrated by the inadequacy of books. In hypertext and hypermedia (a word he also coined), "he had the basis of a whole new type of publishing medium, one that would change the way books and other texts—indeed, all sorts of media—are produced and consumed. This new medium would become a text repository, even a vast database of the corpus of English literature, and it would be called Xanadu" (Woolley, 1992, p. 158).

Nelson confidently expected Xanadu to become operational in the early 1980s. This complete intellectual or knowledge environment embodied the New Left thought of the 1960s (as did McLuhan's vision of the new communications era). Nelson called on people to "imagine a new accessibility and excitement that can unseat the video narcosis that now sits on our land like a fog. Imagine a new libertarian literature with alternative explanations so that anyone can choose the pathway or approach that best suits him or her; with ideas accessible and interesting to everyone, so that a new richness and freedom can come to the human experience" (as cited in Landow, 1994, pp. 169-70).

Whether or not Nelson's vision of a new and freer society comes to pass simply because of a liberated literature, the concept of hypertext has radically altered the conceptual landscape, which now must be understood as fundamentally determined by the computer and electronic networks. As Bolter (1991) has written, the printed book "seems destined to move to the margin of our literate culture. . . . This shift from print to the computer does not mean the end of literacy. What will be lost is not literacy itself, but the literacy of print, for electronic technology offers us a new kind of book and new ways to read and write" (p. 2). The question addressed in this essay is whether computer technology will alter the traditional forms of communication dramatically enough to allow one to claim that something new has come into being. Does it suggest, in essence, a transformation so extensive that one might speak of the effective obsolescence of the book and other forms of print media?
Hypertext, many believe, is the essential characteristic of the new medium. Landow (1992), in his book *Hypertext: The Convergence of Contemporary Critical Theory and Technology*, argues that literary and cultural critics, as well as computer visionaries, agree that "we must abandon conceptual systems founded upon ideas of center, margin, hierarchy, and linearity and replace them with ones of multilinearity, nodes, links, and networks. Almost all parties to this paradigm shift, which marks a revolution in human thought, see electronic writing as a direct response to the strengths and weaknesses of the printed book" (p. 3). The essence of hypertext is its absence of center and hierarchy (which in the writings of Nelson, McLuhan, and others is also an attribute with political implications). In the hypertext landscape, all objects are of equal value and are equally accessible (as McLuhan himself was accessible to Woody Allen when he needed him). The only center is the actor/user/reader/voyager, a postmodern heroic figure who navigates independently and yet somehow according to the communal, even tribal, values of the World Wide Web of knowledge. In McLuhan's "Global Village," and in the land of hypertext, the specialist is no better than the amateur. In fact, the amateur is the only true inhabitant.

In *The Gutenberg Galaxy*, McLuhan (1962) traced the history of the shift from the hand-copied manuscript to the mass-produced printed book—two different modes of production—in light of television, which he saw as a medium as revolutionary as the printing press. He understood that wireless communication (the telegraph), the telephone, radio, and television had the potential to change fundamentally human modes of discourse. Print technology, he asserted, contains "a drive towards applied knowledge" (p. 214). The value of remote goals (the planning work of the specialist)

is inseparable from print culture and the perspective and vanishing point organization of space that is part of it. The fact that no such organization of space or culture is compatible with electronic simultaneity is what has involved Western man in new anxiety for a century. In addition to the solipsism and solitude and uniformity of print culture, there is now the immediate electric pressure for its dissolution (p. 214).

The medium of television did not require application or any particularly useful goal. In a letter to Buckminster Fuller, McLuhan wrote that "content is greatly transformed by the new technology. . . . today the environment itself becomes the artefact" (Molinaro et al., 1987, p. 309). Or, as he also said more quotably, "the medium is the message" (McLuhan, 1964, p. 13).

McLuhan was talking about a broadcast medium, which is centrally organized (and scheduled) but has no effective borders. Thus, he
conceived of a global village—one large tribe of people united by the one-way reach of broadcast technology. The computer, however, is a narrowcast medium that may well in some sense link everyone (everyone who has a computer, that is)—but interactively. It creates not one global village but an infinite number of small communities, the smallest of which is one person before the illuminated screen. The computer universe does not have to be centrally organized and is accessed according to individual, not mandated, schedules or external stimuli. Content in this universe is transformed by the medium, which includes the audience.

In the years since McLuhan and Nelson imagined the products of electronic culture, the printed book has retained its hold on information. Book production has not only not decreased, it has increased. The printed word still dominates learning and communication despite the extraordinarily rapid development of the personal computer and electronic networks. But there do seem to be signs that the book's form is evolving in new directions made possible by the computer. Whether the printed book itself ends may be a less relevant question than how it is being transformed by new technologies. (It should be noted here that there is no particular reason to distinguish between book and journal modes of publication. In the electronic environment, one speaks simply of information clusters or, as Roland Barthes termed them, *lexias.*)

The personal computer and advanced information storage media have permitted the development of desktop (or laptop) publications that are clearly extensions of the traditional book in various ways. ("Desktop publishing," as a technical term, has come to mean primarily the use of personal computers to produce designed text for the production of books. Used in this way, computers have done nothing to alter the book artifact itself, although they have made the work of the traditional publisher easier and even more economical.) The computer has generated book-like products—information in fixed media—that begin to take advantage of the capabilities of the technology, even though these are presented as “books” on electronic platforms. CD-ROM publications, notably, can incorporate in one deep-storage device, text, images, film, and even “live” interviews that can be accessed through hypertext links quickly and easily. These publications are in relatively wide use. Dictionaries, encyclopedias, and other reference items are particularly suited to the medium. The number of CD-ROM drives in existence runs into the millions. Not surprisingly, one of the main types of CD-ROM publication is the computer game, which in earlier television-based forms (such as Nintendo) taught an entire generation to think about interactive media in a new way.

One of the most admired computer games is *Myst,* which draws the “user” into a sort of alternative reality. The game begins with a figure falling eerily through space. The player of the game becomes this fallen figure, who searches the island on which he or she lands for the explorer
and creator from another time who destroyed the mythical book of Atrus. Unlike other computer games, the player is also the point of view: one sees but is not seen. The player can manipulate a pointing finger on the screen in order to move in one direction or another. The player traverses the landscape at will, entering buildings, climbing stairs. The graphics are excellent, the environment strange. The search is accompanied by appropriate environment sounds and weird music.

The game comes with no instructions (although there is a manual the faint-hearted can buy) and only three "hints," none of which tell the player what the object of the game is. The player has to record the clues found in a library, recovered pages of the lost book and, in other words, build up over time a mosaic of information that eventually leads to the solution. In this game there is no warfare. Players do not rely on weapons. They do not dodge evil creatures set on destruction. No one dies. Myst is a puzzle whose puzzle master is part of the puzzle itself. What it maps is a way of knowing that is distinctly different from that of the traditional world of learning. It creates a hypertext landscape in which links and process are as meaningful as the purpose of the search.

Games like Myst represent a distinctly new way of managing information in the electronic universe. Other CD-ROM publications present what some would call more useful content but in similarly random-access form. The Voyager publishing company has produced, with Robert Winter, a series of music guides that, when they first appeared, demonstrated powerfully the advantages of computer-based publications. The publications combine music with text, cultural context, history, and close readings in a flexible and interactive learning environment. The Way Things Work, a book originally written by David Macaulay and published a few years ago in traditional book form, has been remastered for CD-ROM by the publishing firm Dorling Kindersley in a publication that (as Garry Trudeau wrote in his New York Times Book Review notice) "with its whimsical interface, its crisp, refined animation and its highly accessible cross-referencing, . . . is about as operationally elegant as CD-ROM format publishing gets. . . . it's finally time to consider the gift of software" (Trudeau, 1994, p. 56).

In taking advantage of the visual and hypertext options of the medium, CD-ROM publications represent, without question, a new form of book. CD "jukeboxes," such as those marketed by University Microfilms, allow libraries to make a variety of electronic databases and reference works available easily and virtually immediately to researchers. The University of Nebraska Press is developing a CD-ROM-based "Library of the Frontier" that will make available in one place the company's extensive list of books on the American West, all of them connected by "pathways" that will link components across the boundaries of the previously separate publications. The Perseus Project, published by Yale University Press, was an early and impressive CD-ROM venture that explores the
world of classical Greece through linked texts and images. One can even "rotate" the image of a vase to see all sides of it on the computer screen. The National Gallery Collection on CD is a visual masterpiece that brings to the viewer's desk a virtual museum. Andre Malraux's "museum without walls"—and one might now include in that phrase "library without walls"—takes on an entirely new meaning in this electronic environment.

The CD-ROM technology represents in fixed form the direction in which computer-based publishing is going. It is a permanent addition to the publishing landscape. The reproductive technology itself is still evolving. The graphics are improving. The storage capacity of the CD is growing. The most interesting and exciting CDs have yet to be published. Although some have said that the CD-ROM is a transitional technology, that eventually it will give way to "online" network systems of information storage and retrieval, it seems likely that the desktop "on-demand" characteristics of the CD-ROM will encourage further development of the technology. Because it in so many ways mimics the portability and fixed qualities of the traditional book, and because it encourages private as well as library access, the CD-ROM promises to become a publishing medium of choice for the foreseeable future (limited for the present by relatively high development costs). It does more than a massive shelf of reference books can do, expanding and not simply replacing the information it holds. The multimedia potential of the technology is seemingly boundless.

The CD-ROM, in expanding the scope of the traditional book to include reader interaction, begins to look like something quite different. Taking this technology as the paradigm of electronic media, it is possible to imagine how other emerging communications systems will become equally compelling as computer and network platforms evolve. The sophistication of existing, albeit primitive, programs is already impressive (one must remember that personal computers have evolved to their present powerful state in less than fifteen years—and one writer has suggested that in a decade "we can start thinking of 1000 GB [gigabyte] storage devices for personal computers..." [Odlyzko, 1993, np]).

Some of the simplest publications are those that have transformed traditional books into diskette formats for storage on personal computer hard drives. The Voyager company's "Expanded Book" program reproduces mostly previously published texts with a variety of hypertext enhancements. These publications permit full-text searches, annotations, underlining, bookmarks, and pop-up notes that are relatively simple extensions of the "normal" reading process. The expanded book does not transform the printed object so much as translate it into a computer binding. A computer that contains several of the Voyager books facilitates access to them, allowing the reader to carry in one laptop several texts at once—a portable library for
research, reference, and pleasure. These are still like traditional books, however, each of them bound by the parameters of the author's intentions. The hard drive is a kind of shelf on which they sit awaiting retrieval. When they are no longer needed or wanted, they can be easily removed—and later reloaded.

Another system known as DynaText is more interesting in that it begins to transform the book into something more complex. George Landow's book, *Hypertext*, referred to earlier, is also available in a diskette version, *Hypertext in Hypertext* (1994), which contains not only the text of the print version but also a library of relevant resources. The reader is able to "look up" additional information on subjects the author refers to in the course of his argument that might be unfamiliar. The reader can jump from topic to topic, following a thread of discourse different from that imposed by the author. The electronic version of the book contains reviews of the print edition as well as papers written by the author's students on various aspects of the book's argument. *Hypertext in Hypertext* thus nests in a web of references not unlike that the author brought to the writing of the book in the first place. One may explore, in a sense, his frame of reference without closing the book simply by "clicking" on a subject of interest and following the hypertext link wherever it leads. The originally "closed" text explodes in all directions at the reader's will. The reader is also able to make notations, record verbal observations, or create new links for later reference, thereby adding to the hypertext structure of the publication.

More like a CD-ROM, but without graphics, DynaText (and other programs similar to it) creates a new kind of book, one that carries with it resources that the traditional printed book must, of necessity, omit or refer to only obliquely in footnotes. Diskette-based books that can be stored and read on laptop computers allow the reader to access a virtual library not serially but simultaneously, making associational jumps from topic to topic, in a way that is likely to revolutionize the publishing of textbooks. The laptop computer becomes in itself a kind of book, containing in its hard drive constantly changing clusters of information organized hypertextually according to the reader's present interests or needs. A student might well carry in one laptop computer all of the texts needed for an entire semester's courses, including peripheral reference materials such as dictionaries, mathematical tables, and specific course requirements and syllabi. More advanced students with more powerful computers will be able to create their own hypertext links among clusters, all within the confines of a five-pound machine. Such electronic books already exist—although there are not yet many of them—and today's computers provide the environment in which entire learning systems can be created and manipulated by most students.

In a sense, hypertext publications are no longer news, as CD-ROM and diskette-based texts are in fact well understood and accepted, if not widely used. There are not yet that many publications, nor are people
used to thinking of their computers as books or book platforms. Most
readers still say that computer screens are difficult or unpleasant to read.
They maintain that people will never read real books on them. These are
not problems intrinsic to the electronic book, however; they are prob-
lems of custom and the state of technology, both of which will undoubt-
edly be addressed in the near future. Certainly, the younger generation
has less trouble reading on screen than those over the age of forty. Impediments to the development of books on fixed media include uncer-
tainties about copyright, a subject beyond the scope of this article, and
 Corresponding uneasiness among publishers about the economic pros-
spects of electronic publications (one publisher suggested in a private
conversation that all electronic media lead the user back to print). No-
body has to purchase a computer in order to read a traditionally pub-
lished book nor must the publisher be concerned about system compat-
ibilities or software bugs. These are not trifling issues. But there seems to
be an inexorable movement toward more, not fewer, publications in elec-
 tronic media, even among the most traditional of book publishers.

The Internet and other electronic networks promise to encourage
forms of publication that will stretch even further the definition of “book.”
Moving beyond fixed media, network communications call into question
many of the basic assumptions of print culture. Even a hypertext publica-
tion resident on one’s personal computer is still an item fixed in place.
 There it is on the hard drive. Or there on the shelf is the envelope con-
taining the diskette. Networks have developed simultaneously with fixed
media, but there is no question that the potential for online publication
 is less well understood—and not only because of unresolved “revenue-
stream” issues. It is in network publishing and retrieval systems that the
most revolutionary new forms will emerge. In that environment, inform-
ation structures might well alter totally the present concepts of publica-
tion, research, and authorship. Once fixed media are eliminated, even
virtually, as they are online, the reader is adrift. Uneasiness and even panic
sets in. One is seemingly at the mercy of vast systems over which no one
has control. The telephone network is exactly like that, by the way, and
no one minds.

When boundaries are eliminated, as they are on the Internet, the
center truly is everywhere. On a fixed medium, such as a CD-ROM or an
online magazine, the reader understands that the universe is curved. One
will eventually come back to, for example, the table of contents. The
Internet, on the other hand, is constantly buzzing with information, linked
in often unexpected ways, mined with system crashes. A variety of easily
manageable search engines now exist for Internet users— Gophers, the
Mosaic interface for the World Wide Web, WAIS, and so forth. Bulletin
board systems abound. Discussion lists are relatively easy to access. There
is already a well-developed culture of the Internet, particularly in the aca-
demic community but increasingly in the commercial world as well. There are even online bookstores that supply electronic text as well as options for ordering printed objects.

What do people do on the Internet? They search for information in thousands of libraries and databases—and they talk. Electronic mail is probably as well accepted now as any other mode of communication (primarily in the West and especially in the United States). E-mail has made the Internet a friendly place for even the most inept computer user. It is a killer application, the one reason someone with a Royal manual typewriter might turn on the office computer. Chat is the commerce of the net. Bulletin boards and listservs are added daily, and many people think nothing of spending an hour or so every day surfing the chat lines. The Internet encourages a kind of Wild West atmosphere in which party lines cross, territories are unmarked, and anything (mostly) goes. These are only machines, and talk is cheap, if not free. The telephone encouraged a similar sense of the freedom to express oneself, but not (surprisingly) at first. In fact, in the beginning, back in 1876, “people thought [the telephone] was a device that would transmit news, drama, and music: the idea that the telephone was a way to talk to other people took about twenty years to sink in here, and about thirty years in Europe.” Seabrook (1994), the writer of a New Yorker article about Bill Gates, went on to say:

Similarly, today one hears about shopping, banking, and renting movies on the information highway. These are all possible ways of making money, of course, but the point of the information highway... is that it offers a new way of talking to other people. The trouble people have understanding this simple point is the same trouble people in the nineteenth century had understanding the telephone. (p. 49)

Seabrook is right about the talk potential of the Internet but wrong to say that people fail to understand and use it to chat. He is making a classic mistake about new media, one that McLuhan also identified. There is a tendency to think of new media as containers for old forms. People thought of telephones in the way they thought of newspapers. People think of the Internet in the way they think about telephones (and libraries).

McLuhan was right to identify the oral mode as one particularly congenial to the human animal. Most of the history of discourse has been oral, and the telephone certainly extended the capacity tremendously of people to talk to one another. The telephone, however, does what it does supremely well, and it is unlikely that typed conversations will replace speech, even though at the moment there is an enormous amount of keyboard chat on the wire. People like to talk. They like to be heard. The chat mode will undoubtedly be eclipsed by something else, for the
computer and its networks are not simply telephones attached to keyboards. When people first acquired desktop computers, they used them as typewriters and calculators. That is the normal course of technological development. The news in the Internet is this (quoting Stewart Brand quoting Marshall McLuhan in a book by Benjamin Woolley [1992] on virtual reality!):

Marshall McLuhan used to remark, "Gutenberg made everybody a reader. Xerox made everybody a publisher." Personal computers are making everybody an author. . . . If, as alleged, the only real freedom of the press is to own one, the fullest realization of the First Amendment is being accomplished by technology, not politics. In cyberspace, everyone is an author, which means that no one is an author: the distinction upon which it rests, the author distinct from the reader, disappears. Exit author. . . . (p. 165)

To put this observation in perspective, listen to McLuhan (1967) on the subject of authorship at the dawn of the age of print:

Authorship—in the sense we know it today, individual intellectual effort related to the book as an economic commodity—was practically unknown before the advent of print technology. . . . The invention of print did away with anonymity, fostering ideas of literary fame and the habit of considering intellectual effort as private property. Mechanical multiples of the same text created a public—a reading public. The rising consumer-oriented culture became concerned with labels of authenticity and protection against theft and piracy. The idea of copyright. . . was born. (p. 122)

Just as the notion of "author" changed—or was created—with the shift to print technology, so the notion is likely to be altered again in the electronic network environment, where the center is not the creator but the user who manages content.

It is in the networks that the true revolution in the book form will take place, but certainly over a relatively long period of time. Chat is not publication, but already there are systems in development that are beginning to incorporate talk as rudimentary forms of formal communication that mimic authorship. H-Net, a collection of discussion lists for historians, has been conceived by historian Richard Jensen as the basis of a history-publication network, although now it is merely a forum for academic chat. Eventually, in fact, the "H" in H-Net may be expanded to stand for "humanities." Organizing networks for the future is the job of the visionaries of today.

Information services are also important in networks, which allow fast and geographically unlimited searches of online library catalogs, full-text archives, and databases. Eventually, hypertext links in this virtual "library"
will further expand the concept of the book as, for example, DynaText already does on the personal computer or as Intermedia does at Brown. The World Wide Web already permits hypertext linkages and sophisticated interactive searching. In this environment, the reader or user is a navigator making brief visits to information sites and compiling, during the journey, a history that is uniquely personal. In a sense, one thereby compiles "books" that exist briefly in cyberspace and then disappear. (Some electronically published fictions literally disappear once they are read!)

Commercial networks supplying information are already relatively well established. PRODIGY, America Online, Delphi, and CompuServe provide extensive online services for subscribers. The CompuServe Information Service is the oldest of the major networks, and it contains a rich array of business, professional, and consumer information. The business of such services is supplying content in a user-friendly and attractive format. CompuServe can be accessed by a local phone call in more than 700 cities. It offers more than 1,000 different services to subscribers. One pays for this range of alternatives, of course. The commercial services are not the Internet, although increasingly they offer gateways to the net, which is characterized by its disorganized structure and cheap access. As contributors to the evolving form of publication, in the context of this article, such services are of no great importance. They are information access and, importantly, advertising systems (the Internet itself is increasingly of interest to commercial business). Information on networks is made available to the user who knows how to find it. Commercial systems make it easy but expensive; the Internet makes it more difficult but cheaper. Commercial services also de-emphasize the active role of the user/reader that is the essence of the Internet.

The World Wide Web embodies the first Internet framework for new publication form. Accessible through attractive graphical interfaces such as, notably, Mosaic, the Web is a hypertext-structured network that encourages users to jump from subject to subject across all boundaries linking texts and images that otherwise are simply holding in cyberspace (a word coined by the cyberpunk novelist William Gibson). It is the prototype of a future publication structure that will indeed make everyone simultaneously an author and a reader. The Web is, in effect, a gigantic CD-ROM accessible from any desktop computer anywhere in the world. The difference between the Web and a CD purchased from a publisher is that no one actually publishes the Web. It just is. One might add to it, but one cannot control or contain it. And the Web is not the last word on the subject; it is the beginning of the sentence. It is unlike commercial services in being unstructured and inexpensive to use; it is like them in opening the Internet to business exploitation. World Wide Web Home Pages have been described as storefronts in an information mall. PRODIGY has now added World Wide Web access to its system.
There are small webs in existence that suggest how publication media will change. The impact of these changes will be felt first in the academic environment, where electronic research systems are rapidly developing primarily, although not exclusively, in university libraries. At Brown University, the Intermedia system has been in place for several years (now supplanted by Storyspace). In this learning environment, texts are embedded in contextual networks that allow students to roam freely among linked *lexias*, independently creating, expanding, and adding to their instructional space. Created by George Landow and Paul Kahn, Intermedia was a true hypertext universe designed to teach students to think critically by making available to them the resources of an electronic library. One of the texts used in the system was Alfred Lord Tennyson's elegy, "In Memoriam," which because of its unusual form, lent itself especially to hypertext exploration. Landow describes this system in his book, *Hypertext*, and includes "screens" from the Intermedia program to illustrate the virtuosity of the system. The following is a description, accompanied in his book by a reproduction of the screen, of a snapshot from the *In Memoriam* Web:

The *In Memoriam* ROM. In this snapshot of a typical screen during a session on Intermedia, the active document, *In Memoriam*, section 7 ("In Mem 7"), appears at the lower left center of the screen with a darkened strip across its top to indicate its status. Using the capacities of hypertext to navigate the poem easily, a reader has juxtaposed sections 119 and 7, which echo and complete each other. The *In Memoriam* overview (IN MEMO OV), which appears at the upper left, is a graphic document that serves as a directory; it organizes linked materials under generalized headings, such as Cultural Context: Victorianism or "Images and Motifs." The *In Memoriam* imagery overview (IM IMAGERY OV), a second visual index document, overlies the right border of the overview for the entire poem. On the right appears the Web View, which the system automatically creates for each document as the document becomes active either by being opened or, if it is already open on the desktop, by being clicked upon. In contrast to the hierarchically organized overviews the author creates, the Web View shows titled icons representing all documents connected electronically to the active document, in this case section 7 of the poem. Touching any link marker with the arrow-shaped cursor darkens the icons representing the documents linked to it; in this case, the reader has activated the marker above the phrase "compared to 119" and thereby darkened icons representing both the text of section 7 and a student essay comparing it to section 119. (Landow, 1992, p. 39)

The Intermedia system is freely available to Brown University students taking the courses that require its use. There is no other program quite like it, but it represents a future in network publication
and learning that is revolutionary. It changes the concept of "book" irrevocably by launching it into space, setting it free from the constraints of authorship and boundaries (although there are boundaries introduced by the designers, the user can still expand those boundaries by adding to the Web).

How do students experience this learning environment? Quoting Landow (1992) again:

For students, hypertext promises new, increasingly reader-centered encounters with text. In the first place, experiencing a text as part of a network of navigable relations provides a means of gaining quick and easy access to a far wider range of background and contextual materials than has ever been possible with conventional educational technology. . . . Even more important than having a means of acquiring factual material is having a means of learning what to do with such material once one has it in hand. Critical thinking relies upon relating many things to one another. Since the essence of hypertext lies in its making connections, it provides an efficient means of accustoming students to making connections. . . . (p. 126)

There are other programs now being published that take advantage of similar hypertext structures. W.W. Norton has created a "networked writing environment" with Myron Tuman and Ann Arbor Software that places the computer program in the university and markets access software to students, a more conventionally conceived textbook program that nonetheless expands the student's options into a cyberspace-like environment. "Connect," as the program is called, is a word processing system that allows the writer to share documents over a computer network, communicating, if one wishes, with an instructor electronically. The system encourages computer conferencing and other forms of electronic collaboration. It is a new kind of textbook. Although it arrives with traditionally printed manuals, the computer diskettes that reside on the student's desktop or laptop computer are the essence of the book. They connect the user to the centralized program through which all of the users may communicate. The result is an interactive teaching and learning environment.

It seems clear that one of the major benefits of computer networks is the sharing of information across geographical boundaries. Designing systems that take advantage of options to share information is the job of universities, libraries, and publishers. What results will not look like books but will contain information as well structured as book-form publications. Many people worry that network publications will be undisciplined, subject to uncontrolled manipulation, and ultimately unreliable. Certainly,
the present state of Internet communications leads one to think those fears might be well founded. The chat mode of discourse allows junk to accumulate even in moderated listservs. But systems can be devised and are being devised that will manage information for learning. These systems are like books but are not books.

Research publication will also be affected by computer and network systems. The venerable monograph, which has been so long the measure of academic advancement in the humanities, will evolve in the electronic environment into more open-ended, less structured publications. The economic environment for the monograph is, to say the least, hostile. The form itself is the product of book and print culture, as this author has argued elsewhere (Arnold, 1993). The journal article is already undergoing transformation in the electronic environment. The Johns Hopkins University Press Project, Muse, by which print journals are being converted to online access, is a beginning that promises to open up the parameters of print dramatically. Articles can be published as they are written and accepted and can be downloaded by libraries for immediate local use. The project is still based on traditional publishing assumptions, but it will not be long before it begins to expand those assumptions into the capabilities of the medium. *Postmodern Culture* began life electronically and continues to evolve as an experimental publishing form, as does *Psycoloquy*, published by Stevan Harnad. Both journals are peer-reviewed online and allow for reader response on the network. These online journals replicate their print forebears but go beyond them in being interactive.

Digital libraries, which are coming into being at the University of Michigan, Columbia, Case Western Reserve, and elsewhere provide an environment for the development of university based "publications" that are in essence "live" research and learning environments without borders. These libraries, and the other evolving forms of academic publication mentioned earlier, open the realm of discourse to the nonspecialist in ways that scholars may find threatening. Certainly, it will be essential for universities in the not too distant future to begin to think of new ways to evaluate collaborative scholarly production in the humanities. The scientific community already works in a collaborative mode and, in many places, has already embraced the electronic networks as viable media for publication. The distinctions between academic discourse and chat may well begin to break down and the culture of literacy supported by the book may itself be altered in the network universe. This threat, if that is what it is, is felt most acutely by the humanists—scholars who, in the words of Lanham (1993), represent "the group still irrevocably committed to the printed word" (p. 755). Lanham goes on to say: "The academy cannot do business in a different expressive language, using a different definition of reason, than the world it serves. That expressive language is chang-
ing, and academic discourse must change with it" (p. 761). “The convergence of technology, democratization, and the return of rhetoric provides the dominant reality for the arts and letters of our time” (p. 775).

Lanham's argument in his book *The Electronic Word* is based on the notion that the ancient discipline of rhetoric is the appropriate mode of discourse in the electronic environment. In so saying, he echoes the argument McLuhan made for a return to oral tribal culture in the electronic age. He also suggests, as McLuhan and Nelson did, that the shift in technology promises a shift in political as well as expressive culture from the hierarchical modes of print to the more horizontally organized universe of the computer network. If that is the case, then the book is indeed threatened because it depends entirely on the specialist, the authoritative voice, the interpreter who stands between reader and information.

Do forms of communication alter consciousness? There is some evidence that those who are concerned about the transformation of media in the electronic environment are worried about just that—relationships of ownership and power will change with the advent of a new technology. When there are no books in print, who will be in charge? For some, rationality itself is at stake. Technology has always had an impact on humanistic and critical discourse—even though such thinkers are notoriously technophobic (as they are now). Writing “began as the hieratic possession of the politically powerful” and printing “provides one of the first instances of production-line interchangeable parts used in heavily capitalized production [as McLuhan also argued]. Scholars and theorists today can hardly be Luddites, though they can be suspicious of the latest form of information technology, one whose advent threatens, or which they believe threatens, their power and position” (Landow, 1992, p. 168).

The issue of the transformation of print culture may indeed be more about power than it is about forms of communication. Inevitably, the computer and electronic networks will alter those forms. That is already happening. The political questions will be answered only in retrospect.

REFERENCES


The World Wide Web and Emerging Internet Resource Discovery Standards for Scholarly Literature

STUART L. WEIBEL

ABSTRACT

The World Wide Web (WWW) has become an important medium for the dissemination of scholarly information. This article discusses the technology of the Web and why it is likely to have a lasting impact on the dissemination of scholarship. The role of the display and indexing of structured text is discussed, particularly the relationship of HyperText Markup Language (HTML) and Standard Generalized Markup Language (SGML), as well as problems associated with matching the needs of session-based document retrieval and the stateless architecture of the Web. The relationship of existing bibliographic description standards to emerging standards for the description of networked information resources is described.

INTRODUCTION

Access is the heart of the library. All other functions—selection, acquisition, cataloging, and preservation—derive from the basic objective of matching the information needs of users to the materials that will satisfy those needs.

The rapid development of networking and electronic dissemination of information forces upon us both opportunities and burdens. The opportunity is to provide the greater flexibility and convenience that networked information affords. The burden is to integrate these services with the existing library infrastructure such that users are not confronted with two disjoint information environments.
Technology is at the heart of all aspects of networked access to scholarly information: economics, protection of intellectual property rights, preserving the record of scholarship, and even the politics of publishing. The choices made—and those forced upon us—comprise the landscape in which the information ecology will evolve.

The present discussion focuses on the technological issues of electronic access to scholarly publishing, and, in particular, the World Wide Web (WWW) as a medium for the delivery of scholarly information. The role of structured text on the Internet is addressed (specifically the relationship between Standard Generalized Markup Language and HyperText Markup Language). Finally, the relationship of MARC standards to the evolving Uniform Resource Identifiers and related standards are discussed.

THE WORLD WIDE WEB: THE FRONT END OF THE INTERNET

World Wide Web browsers, such as NCSA's Mosaic, are the front end to the Internet; in a year's time they catapulted the Internet (and the WWW in particular) to the forefront of the public consciousness and garnered enormous attention in the national press. Will the WWW persist or is it simply the latest technology du jour? Is it a suitable vehicle for the delivery of scholarly information or simply a pretty (inter)face? The ability of Web protocols to embrace other Internet protocols (such as ftp and Gopher) augurs well for its extensibility over time. The WWW is likely to be an enduring part of the Internet landscape and should be considered a keystone for the delivery of scholarly information. What makes this technology important, and how will it affect access to scholarly information?

THE PRETTY, EASY ANSWER

WWW browsers provide users with an easy-to-use interface that introduces some of the virtues of print aesthetics to online interactions. Pretty is more than just attractive; good typography improves reading speed and comprehension and makes reading easier on the eyes (Gould et al., 1987). The ability to convey typographic emphasis—bold, italic, font size, and style changes—allows authors to provide visual inflection that is unavailable in the unembellished display of ASCII text.

The ease with which graphics are made available on the Web also accounts for much of its appeal. One can argue whether the information content of the net has been improved in proportion to the additional demands that graphics impose on network bandwidth and workstation performance, but there is no question that users are attracted to graph-
ics, and the old saw that a picture is worth a thousand words still applies (the problem is, it costs ten thousand words, but not to quibble); without graphics, scholarly (or any other) publishing will not prosper on the Internet.

The point and click idiom of hypertext makes it simple for even an inexperienced user to traverse links among documents and collections. The enormous popularity of NASA's Shoemaker-Levy comet images (JPL-a, 1994) illustrates the potential to afford rapid public access to the latest information in the sciences. Reports of this extraordinary event were not limited to grainy newspaper images or the glossy selection of news magazines a week later but were available to millions of Internet users on their desktops within hours of being available to the scientific community. Almost 2 million files were served to nearly 50,000 unique host computers in approximately three weeks in July 1994 from NASA's Jet Propulsion Lab (JPL-b, 1994). The Shoemaker-Levy home page was visited more than 3 million times in the next six months.

The same virtues that make the Web appealing to the neophyte net-maven will improve access to ideas by scholars. Every chemistry student learns the law of mass action in the first week of class: molecules are more likely to combine chemically if they bump into one another more frequently. So it is with ideas; make it easier to bump into them, and they will combine more often in the minds of users to form more complex ideas.

The ease of use of Web browsers is complemented by the ease of publishing information on the net. Any determined user can master the technology of mounting a Web server; never has the technology of mass distribution of information been so accessible. The technology of the Web is the modern equivalent of a printing press, except you could never get a printing press for free. Anyone with an Internet connection can download a Web server and browser for free from places like the National Center for Supercomputing Applications (NCSA) at the University of Illinois (where NCSA Mosaic was developed) (NCSA, 1994) or CERN, the European High Energy Physics Research organization where the Web began (Berners-Lee, 1994).

Early examples of scholarly publishing on the Web are already appearing. Johns Hopkins University Press, for example, has made some of its journals available on an experimental basis under Project Muse (MUSE, 1994). Prototypes of this nature foretell a future where universities and even departments will publish more of their scholars' efforts. Such publications are not likely to replace the peer-reviewed commercially published journal (the added-value of professional publication staffs is underrated), but the ease of network publishing will blur the distinctions between the formal scholarly journals and less
formal means of publishing, making the so-called gray literature more important.

Scholarly societies are establishing their presence on the Web in growing numbers, recognizing it as an important new means of maintaining contact with their members. The University of Waterloo Library maintains a master list of such resources that at this writing includes ninety-three scholarly societies (Scholarly Societies Project, 1994).

The Web lowers barriers to networked publishing, making it easier to encroach upon the traditional markets of publishers. But, at the same time, the idiom of hypertext affords publishers a means to protect their position by providing links among their products, thereby enhancing their value as part of a larger whole. Following links is the native idiom of World Wide Web navigation. The opportunity to weave a publication into the context of related scholarship (by embedding explicit links to related articles) will enhance the usefulness of the literature to the scholar and provide a competitive advantage for publishers whose scope of publications is large. Publishers will be driven to add value to their journals through enhanced features, and this competition will help drive the quality and capabilities of electronic publishing to higher levels.

OCLC's Electronic Journals Online supports such linkage today. For example, in the *Online Journal of Current Clinical Trials*, cited references are linked to their corresponding records in the MEDLINE database and can be retrieved by clicking on the highlighted reference. As more and more journals are delivered online, articles will be retrievable in the same manner, creating a web of scholarship that will be accessible with far less effort than with conventional paper literature.

Elsevier's TULIP project (Willis et al., 1994) suggests one model for promoting access to journals electronically without incurring the expense of full electronic markup. Essentially an electronic microfilm, scanned pages are delivered to the workstation to be read on the screen or printed. Although not as desirable as having structured full text, it is a practical and affordable means of making previously published journals accessible electronically, and it is a conceptually simple matter to link these page images to citations to them that will occur in fully electronic journals. But it is structured full text that is the key to the added value of electronically published journals, and these benefits will help to overcome the disadvantages of screen-based display and the less than ideal means we now have for managing online text.

**The Importance of Structured Text**

HyperText Markup Language, the lingua franca of Web documents, is basically a narrowly constrained subset of Standard Generalized Markup Language (SGML). HTML is a relatively simple (if lim-
ited) way of introducing the notion of structured data to users and would-be providers alike (for an eloquent discussion of the importance of structured text and SGML, see Coombs et al., 1987).

SGML is an international standard (ISO 8879) for the description of text in machine-readable form. An SGML document consists of text that is marked up with descriptive tags that specify the function of a given element within the document. As a formal language construct, an SGML document can be parsed against a Document Type Definition (DTD) that unambiguously defines what elements are allowed and where in the document they can (or must) occur.

**Procedural versus Descriptive Markup**

Conventional computerized typography defines the page layout of documents. Often referred to as procedural markup systems, they are oriented toward page description (that is, specification of where characters are placed on a page) rather than the description of document structure. While such systems are well suited to the production of paper-based journals, they are inadequate to the demands of electronic delivery.

SGML is the leading example of descriptive markup systems, so termed because a system uses a formally defined tag set to describe the role of a document component, rather than specifying the procedure to display it. The details of character placement on a screen (or piece of paper, for that matter) are left to the application software on the user's machine.

For example, in a procedural markup scheme, a title might be tagged to specify page centering, a type size four points larger than body text, and bold style. In a descriptive scheme such as SGML, it would simply be marked as a title. Final details of the display would be determined by the application responsible for its presentation (a Web browser, for example).

An added benefit of such a device-neutral encoding of the data is that the text is more readily reused by other applications. For example, it is a simple matter to extract subcomponents of a structured document (citation and abstract information, perhaps) that might be made available in a separate product or service.

The structure of text also provides the underpinnings for fielded searching. A user can search such a corpus for terms occurring only in the title or abstract, or perhaps for all papers that cite a particular paper, or papers written by a particular author. The ability to embed such structure (and use it as the basis for index searches) will be increasingly important as larger online full-text collections become common and users are confronted with the problems of managing ever-larger retrieval sets.
HTML: LESS IS LESS (BUT SIMPLICITY IS A VIRTUE)

HTML falls far short of the full power of SGML, and it suffers from the intermixing of structural markup (identifying the elements of a document) and display, or procedural markup (specification of how objects should be displayed on a page or screen). Nonetheless, it is a relatively straightforward idiom for imparting useful, if minimal, structure to networked information. While not up to the demands of formal publishing, its simplicity makes it ideal for less formal applications and occasional publishing tasks.

As HTML evolves (its enhancement is mediated by the activities of a Working Group of the Internet Engineering Task Force), it is likely to acquire greater expressive power, but it is not likely to be imbued with the full richness of SGML. If this were to happen, the Web browsers themselves would become far more complex to develop and maintain, and, more importantly, the simplicity of Web publishing as we know it today would be overwhelmed by the complexity of SGML.

A more likely scenario is the promulgation of SGML display applications that act in tandem with Web browsers much as external graphics viewers now support the display of image data without actually being part of the Web browser itself.

The first such SGML display engine has recently been announced by SoftQuad, a Toronto based vendor of SGML software and systems (SoftQuad, 1994). This product, named Panorama, is being made available in a public domain version and a commercial version (Panorama Pro, with somewhat enhanced capabilities).

Formal publishers will thus have a mechanism for distributing typographically complex, SGML-encoded, materials while occasional or less formal publishing will benefit from the simpler idiom that HTML affords.

AN INTERIM SOLUTION: THE TRANSLATION OF SGML TO HTML

When SGML viewers are commonly available and widely supported by information providers, many of the representational problems of HTML text will become moot. During the transitional period leading to that state, the delivery of complex scholarly text requires an interim solution involving the translation of more complex markup (such as SGML) to HTML. The translation facility developed in the OCLC Office of Research is being used to provide Web-based access to Electronic Journals Online (Weibel et al., 1994). The first journal to be supported thus is the American Institute of Physics journal, Applied Physics Letters Online.
The translator parses an SGML document and decomposes it into a grammar tree. Each SGML entity in the document is translated into either its HTML-specific counterpart or a bitmap of the appropriate font character. Each formula (i.e., equations or mathematical notation) is extracted and translated from 12083 SGML to TeX, a computer-based typography system, and subsequently rendered to generate a corresponding bitmap. The 12083 SGML standard is a recommended style of SGML for books and journal publishing (12083, 1994).

Figures and tables are handled similarly to equations. However, in these cases, a reduced size or thumbnail image is embedded in the running text. It in turn is linked to a corresponding full-size image that can be downloaded at the user's discretion. The thumbnail images reduce initial image-loading burdens and provide a better-proportioned page display (full-resolution figures in electronic documents are typically of awkward proportion when included inline in running text). The full-sized image is displayed by selecting the thumbnail image, thereby invoking the appropriate external viewer.

**Retaining SGML Structure for Indexing**

The original SGML versions of the documents are used to build an inverted-file database, which is used to search the collection and generate pointers to the HTML version of the document. It is important to note that the original SGML markup is retained in this database, and this markup supports searching in specific fields (for example, limiting the search term to occurrences in the title or abstract). Thus, although the delivery of scholarly journals into the WWW involves some display formatting compromises, it need not result in loss of structured document searching capabilities.

**Web Browsers as Remotely Programmable User Interfaces**

The World Wide Web is a prominent example of client-server computing. A client is a program that issues a request for service to another, largely independent, piece of software that may reside on the same machine or, more often, on another machine. The two are linked to the degree that they share a communications protocol—a formally specified language for communicating with each other. The protocol in the Web that supports this client-server communication is called the HyperText Transport Protocol (HTTP).

An HTTP server is a fairly simple piece of software that "listens" at an Internet port for requests issued by a Web browser. In its simplest terms, this request is a string of characters known as a Uniform Resource Locator (URL) that specifies a scheme (ftp, Gopher, or http,
for example), a host name (a machine on whose file system the resource resides), and finally, what is interpreted as a path to the location of a file on the host machine (this is not strictly the case but illustrates the basic workings of the protocol).

The server, having received a request for a document under its control, sends that file (typically HTML-encoded text) to the client that issued the request. Links may be embedded in the text, allowing users to jump to a different part of the document or another document entirely. In effect, these links become navigational controls embedded in the document, allowing the information provider to program the user interface to a limited degree.

**HTML Forms: Getting Information from the User**

A capability known as HTML Forms allows the document provider to interact with the user by putting up a template of text entry fields and several varieties of check boxes. The content and structure of the forms can be tailored to the specific task at hand, in effect a remote programming of the Web browser's capability that is as easily modified as any HTML file. Thus the user has what approaches a universal client application—familiar in its appearance and behavior but adaptable to a wide variety of search and retrieval situations.

From the provider's point of view, changes in search capabilities no longer require redistributing software to an entire customer base but rather a relatively straightforward change in a data file.

In the future, it is likely that the HTML standard will support a persistent toolbar capability (not unlike the toolbars currently found in Microsoft Windows and Apple Macintosh application software). When this is available, controls will not scroll away as the user moves through a document as they do now.

One can imagine a future in which scholarly documents contain dynamic data objects that, through the click of a button, will launch virtual experiments or demonstrations based on the published data and the models, all mediated through a universal browser that serves as a familiar entry point to all the user's information resources.

**Current Limitations of the World Wide Web**

The problems that currently exist with the Web as a document delivery medium fall out into two broad categories: (1) representation and rendering of complex text, and (2) the stateless model of Web transactions.

*Representation and Rendering Problems*

There are three major impediments to the representation of complex scholarly material in current Web browsers:
1. **Mathematical Representation:** Mathematical notation is among the most challenging aspects of any typographic system. HTML does not currently support mathematical notation at all; all such objects must be represented as rendered bit images (simple graphics).

2. **Formal Models for Tables:** Tables are notoriously complex as typographic objects. In an electronic delivery medium, the normal problems of expressing tabular material in a coherent notation are compounded by the need to express the underlying logical structure of tables in such a manner that they can be parsed by software that can read tables for the visually impaired (or convert them to braille). Currently, HTML supports neither objective, though work is underway to substantially improve the table model so that more complex information will be represented effectively, both logically and for display.

   The recent submission of the HTML 2.0 standard for formal standardization under the Internet Engineering Task Force includes markup that will support the International Committee for Accessible Document Design (ICADD) recommendations for marking up electronic text for the visually handicapped. ICADD includes representatives from standards bodies, disabilities organizations, governments, and vendors of software and hardware. The ICADD text transformation process description forms an informational annex to ISO 12083, the SGML application for books and journals (ICADD, 1994). This is a first and important step toward making the Web accessible to those with visual impairments.

3. **Character Sets:** Currently there are no generalizable methods for displaying alternative character sets in HTML documents, thereby severely limiting the expression of any but a standard character set. At this time, the only characters that implementers can be sure will be present on all platforms for all browsers is the lower 128 characters of standard ASCII. Characters not found in this basic set must be rendered as small bitmapped images. This state of affairs will be rectified in future versions of the HTML standard, but until then, implementors must resort to the contorted work-arounds such as those described earlier in OCLC's SGML to HTML conversion.

*Statelessness and Document Retrieval*

The Web is an example of a stateless protocol. Each time a browser requests a document from a server, it makes and breaks a network connection, incurring a certain amount of overhead. This keeps the HTTP protocol simple, but when a server and client carry on extended transactions, it is inefficient (imagine hanging up and redialing the phone each time you completed a sentence in a phone call, and the person on the other end forgetting what you said in the previous call!). This is particularly problematic for an information service that benefits from (or requires) a session-based interaction, as
is generally the case with reference databases and document retrieval systems. Users may modify a search strategy successively, reducing the size of a retrieval set until it is manageable. Such interactions require maintaining information about the state of a transaction.

Document search and retrieval works better in a session-based model—the server should retain session context for the user (reusable result sets, for example). OCLC has developed a hybrid HTTP-Z39.50 server to bridge the stateless world of HTTP and the session-based Z39.50 world (Weibel et al., 1994). The WebZ server provides Web access to Electronic Journals Online and soon will provide an entry point to the reference databases available under OCLC's FirstSearch system.

The WebZ hybrid server is acting as a Z39.50 client for the HTTP client, maintaining session information for any sequence of interactions from the same client. This is accomplished by putting a session ID in all URLs produced by the gateway and returned by the client. Authentication of the user is required only at the beginning of the session. Thereafter, the session ID in the URL is matched against active sessions maintained by the server, validating the request as legitimate. The sessions are aged by the server; if no subsequent requests are received within an arbitrary time interval, the session is closed and any subsequent request by the same client would require re-authentication.

**Finding What You Want**

No discussion of access to networked information can fail to note the major problem facing the net—i.e., finding something you want. Web browsers are just that—browsers. As browsers, they excel, and only the jaded (or perhaps a too-busy reference librarian) can resist the appeal of clicking from site to site around the world, stumbling upon gems and chestnuts that delight the inquisitive mind. But along with the gems are plenty of dead ends, and to find something from a dead start—either a known-item search or a keyword or fielded search—is quite another challenge, a challenge which the current information infrastructure does not adequately support.

The evolving information infrastructure that has served libraries for many decades has yet to be transferred to the digital world. Some aspects of the two worlds require different solutions, but the problems of networked resource discovery are more like those of the conventional library than they are different. The library community can contribute valuable experience to these solutions. The long-term investment of the library community in MARC records and the Anglo-American Cataloguing Rules (AACR2) (Gorman & Winkler, 1988) rep-
represents a working model of how object description can be formalized to support resource discovery and retrieval. Should MARC therefore be the basis for similar systems on the Internet?

**MARC AND THE INTERNET**

The MARC record must certainly be accorded a hallowed place in the history of library automation, and it is unlikely that it will be supplanted in the foreseeable future as the currency of bibliographic record exchange. It must be seen for what it is, however—a carrier syntax. MARC is a container with well specified capacities and a set of rules (AACR2) that have been developed over a long period of time to guide us in packing these containers.

MARC and AACR2 have been a success partly because the world of library technical services has enjoyed a hegemony over them that allows closely regulated control. The culture of the networked information environment is unsympathetic to this monopoly of form and structure, however, and it is unlikely that this world will stand quietly while the keepers of MARC and AACR2 adapt these standards to networked information. That is the bad news. The good news is that it need not matter. The library community need not force the MARC record onto the rest of the world, nor must it forsake this enduring and useful legacy (not to say, the enormous financial investment in MARC systems).

As a carrier syntax, MARC serves libraries well, but the needs of cataloging, retrieving, and managing electronic objects are sufficiently different that departure from existing MARC fields is inevitable. The critical issue for libraries is that the description standards for networked information objects and services not be made incompatible with existing standards.

The library community must assure that new standards map gracefully into and out of MARC. To the extent that they evolve to meet the new demands of networked objects, libraries will adapt and find ways to incorporate new structures and fields into MARC. The challenge is to assure that the systems that evolve in the electronic communities do not break existing practice.

**MARC 856 FIELDS**

Acknowledgment of the changes necessary to accommodate networked resources is already evident in the development of the 856 field in MARC—a field given to codification of the information salient to the description of (and retrieval of) electronic objects on the network (USMARC Proposal 94-9, 1994).

The evolution of such description will take place in parallel with other communities that are working to support access to electronic
resources. To the extent librarians involve themselves in these ongo-
ing discussions, it will be possible to influence these standards so that
they will work together. What are these other standards, and who is
developing them?

**SELF CATALOGING DOCUMENTS**

One of the dreams of library automation is the automation of the
cataloging process itself. This goal can be partially realized by the
encoding of descriptive information in the document. The Text En-
coding Initiative (TEI) represents an important step toward the real-
ization of this goal. The Text Encoding Initiative is a program aimed
at developing standards for the markup of scholarly information in
SGML; the recently published guidelines (Sperberg-McQueen &
Burnard, 1994) represent the culmination of this effort in a formal
model for marking up scholarly information. This standard includes
the specification of the TEI header, which includes descriptive infor-
mation normally considered part of conventional bibliographic de-
scription. TEI headers are a prime candidate for the expression of
cataloging information that will make a document self-cataloging. The
developers of this encoding scheme were mindful of this possibility,
and considerable attention was paid to the relationship of this encod-
ing standard to existing library standards. Thus, the TEI headers are
a prime candidate for the expression of cataloging data for electronic
resources. See Giordano (1994) for a discussion of the TEI headers
and Gaynor (1994) for a case study of their application for this
purpose.

**Uniform Resource Identifiers (URIs)**

URIs are the trinity of resource location on the net. Comprised
of three distinct, but closely related, standards (only one of which is
now in common practice), the codification of these identifiers is cen-
tral to the future workings of the networked information environ-
ment (see Duranceau et al., 1994, for an in-depth discussion of URIs).

Uniform Resource Locators (URLs) are the spine labels of net-
worked information objects. They encode the location of an object
or resource and, since the rules for specifying a URL are widely rec-
ognized and accepted as a standard, decoding the location specified
by a URL has become a trivial capability implemented in a wide array
of network applications. Decoding of such URLs is at the heart of
any Web browser.

Resource location should not, however, be tied to physical loca-
tion of an object; when an information object is moved, the URLs
that pointed to that object are no longer valid. What is needed is a
persistent unique identifier that does not change when the location of the object changes; this is the proposed function of Uniform Resource Names (URNs).

**Uniform Resource Names**

The notion of a Uniform Resource Name is closely related to an ISBN or LC card number. The two fundamental requirements of a URN are that it be unique and persistent into the foreseeable future. It involves a naming authority—an agency with the authority to assign these unique identifiers, and with the commitment to maintain a resolution service to map logical object names (the URN) to physical location pointers (the URL). Without this resolution service, the URN is useless. URNs do not now exist except in testbed applications built by those attempting to bring these standards to fruition. The technical and administrative details of their use are difficult and as yet unresolved. Readers of this journal are likely to recognize the similarity of this problem to one of the primary functions of a library catalog—i.e., resolving a title or cataloging number to a library (in the case of an interlibrary loan request) or a shelf location (in the case of a local transaction).

**Uniform Resource Characteristics (URCs)**

Catalogs do far more than provide for resolution of persistent names to item location. Bibliographic description is the basis for search in the library world, and so it will be in the electronic library. URCs are the least well understood component of the trinity and will evolve slowly and probably painfully as the ongoing dialogue between the computing community and librarians proceeds. The nature of resource description is more complex in a networked environment, but the problems are largely those that librarians have dealt with successfully for decades. The lessons learned in managing libraries must be brought to bear on networked libraries, lest we discover that the so-called libraries without walls are roofless as well.

**The Internet Engineering Task Force**

These protocols are developed and evolve under the auspices of the Internet Engineering Task Force (IETF). The IETF is a collegial anarchy open to participation by any willing to expose their ideas and proposals to the harsh spotlight of scrutiny (and egos) either at the meetings (held three times a year), or on the working group listservs. The principles of adoption of a standard are basically that a “rough consensus” be achieved, and that protocols be backed by two or more independent implementations. Once considered the realm of “Geek of the Week” types only, sightings of technically oriented
representatives of the library community are increasingly common. For an introduction to the culture and ethos of the IETF, see *The Tao of IETF—A Guide for New Attendees of the Internet Engineering Task Force* (Malkin, 1994).

**CONCLUSION**

The Internet is designing us as much as we are designing it; the requirements of providing distributed access to networked information are complex and challenge us economically, socially, politically, and technically. One astute observer at a recent IETF meeting invoked the well-known image of blind men describing the elephant, each describing only as much as he could touch. The problems of providing access are too large for any to fully grasp. We recognize the parts of the problem near and familiar, but the beast is larger than our experience. Bringing the elephant under service will require foresight as well as insight, and the problems are daunting. But the promise is great, and there are no alternatives. Electronic networks are here and their phenomenal growth will not admit inaction. If the library community fails to help describe the elephant, none of us should be terribly surprised to be stepped on by it.
APPENDIX

On-Line IETF Information

The Internet Engineering Task Force maintains up-to-date, on-line information on all of its activities.

FTP Access

The IETF information described above is available by anonymous FTP from several sites.

- Africa
  ftp.is.co.za (196.4.160.2)
  The Internet-Drafts on this machine are stored in GNU compressed form (i.e., the .gz file extension).

- Europe
  nic.nordu.net (192.36.148.17)

- Pacific Rim
  munnari.oz.au (128.250.1.21)
  The Internet-Drafts on this machine are stored in UNIX compressed form (i.e., the .Z file extension).

- US East Coast
  ds.internic.net (198.49.45.10)

- US West Coast
  ftp.isi.edu (128.9.0.32)

To retrieve this information, FTP to one of the above sites, log in with username anonymous and your e-mail address as the password. When logged in, change to the desired directory (using the cd command), and retrieve the desired files (using the get command).

E-mail Access

Internet-Drafts and other IETF material are available by mail server from ds.internic.net. To retrieve a file, mail a request to mailserv@ds.internic.net with a subject of anything you want. In the body, put one or more commands of the form:

- FILE /ietf/lwg-summary.txt
- FILE /internet-drafts/lid-abstracts.txt
- FILE /iesg/iesg.92-11-10
- PATH jdoe@somedomain.edu

where PATH lists the e-mail address where the response should be sent. If you have the mpack utility or a MIME-compliant mail reader, you may want to use the additional command:

- ENCODING mime

This command results in the information being returned in a MIME message.

Other Access Methods

IETF-related information is also available via the World Wide Web and Gopher. Both of these services are constantly evolving over time, so a description of their contents will not be given.

- Gopher: gopher.ietf.cnri.reston.va.us
- WorldWide Web: <http://www.ietf.cnri.reston.va.us/home.html>
Mailing Lists

Much of the daily work of the IETF is conducted on electronic mailing lists. There are mailing lists for each of the working groups, as well as an IETF general discussion list and an IETF announcement list. Mail on the working group mailing lists is expected to be technically relevant to the working groups supported by that list.

The IETF announcement list is a "moderated" mailing list that receives the following types of messages:

- meeting logistics,
- agendas for working group and BOF sessions at IETF meetings,
- working group actions,
- Internet-Draft announcements,
- IESG last calls,
- IESG protocol and document actions, and
- RFC announcements.

To join the announcement list, send a request to:

ietf-announce-request@cnri.reston.va.us

The IETF discussion list is open and therefore has a wide range of topics. To join the IETF general discussion list, send a request to:

ietf-request@cnri.reston.va.us

To join most other Internet mailing lists, send a request to the associated "-request" address (e.g., to join the list@listhost list, send a message to: list-request@listhost). Never send a subscription message to the list itself. General inquiries about the IETF should be sent to:

ietf-info@cnri.reston.va.us
REFERENCES


USMARC. (1994). Changes to the USMARC bibliographic format to accommodate online systems and services: Proposal 94-9 Network Development and MARC Standards Office Via e-mail:

send e-mail to <listproc@loc.gov>
text of message: get usmarc 94-9.doc
get usmarc 94-9.cov

via telnet:
telnet to marvel.loc.gov
login: marvel
select: Libraries and Publishers (Technical Services)
select: USMARC Standards
select: MARBI Proposals and Discussion Papers
(select appropriate proposal)

Academic Information Services: A Library Management Perspective

BRYCE ALLEN

ABSTRACT

Using networked information resources to communicate the results of scholarship has great potential value for academic libraries. This development, here called "academic information services," will require collaboration among libraries, scholars, computing centers, and university presses. Three barriers to collaboration are discussed: (1) clashes of organizational cultures, (2) personal incompatibilities, and (3) different approaches to change. In each case, library managers can take steps to overcome the barriers and help ensure successful collaboration. Developing appropriate organizational structures, selecting staff who work well in a collaborative environment, and showing leadership in organizational flexibility are all important management contributions to the development of academic information systems.

INTRODUCTION

Technological innovations have the potential to alter the nature of any industry. The information industry seems particularly subject to the effects of technology and currently is adapting to the introduction of a number of technological advances that are associated with the general availability of networked electronic information resources. The advent of systems that allow documents to be created electronically, stored and maintained in computers, and easily found and read using high-speed communications networks may produce dramatic

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changes in the information industry. It is certainly not clear whether documents prepared, distributed, and used through this new technology will replace or augment information resources published using more traditional media, but it seems likely that this new technology will bring about some changes in the structure of the information industry.

Technological innovation is frequently a key element in the evolution of an industry. Older firms with large investments in existing technology may find it necessary to retool to stay competitive with new entrants who can begin their operations with state-of-the-art means of production and distribution. This process can lead to a shake-out in which established firms lose market share to new entrants. In addition to shifting market demand from older to newer firms, new technology can also open up new markets. Changes in market demand, driven by technological innovation, can lead to changing patterns of ownership in an industry, particularly the restructuring and merger of existing operations. Abernethy and Clark (1988) described an innovation that simultaneously disrupts the market links between producers and consumers and the competence of the firms in means of production as tending to produce architectural change in the industry.

One example of technological change disrupting market links occurred with the introduction of commercial air traffic. Customers wanting long-distance transportation no longer went to railroad or steamship companies but to airlines. The traditional market relationship between travelers and transportation companies was disrupted.

An example of technological change affecting competence in means of production was the introduction of robotics into the automobile industry. Traditional assembly-line production methods were made obsolete, and the companies that could quickly become expert in the new technology were most competitive. If the technology affects both the market links and the means of production simultaneously, an industry can expect significant architectural change. This means that new firms will begin to compete with existing firms and may drive some of them out of business. Existing firms will have to adopt radical strategies for survival, including mergers, acquisitions, and the simultaneous restructuring of many aspects of their business.

The technology supporting networked electronic information resources seems likely to produce architectural change in the information industry and particularly in publishing. Readers will no longer depend on traditional publishers for information (thus disrupting the market link) and publishers will not necessarily be expert in the production of networked information services (thus disrupting their traditional expertise in the ways information gets produced). In an
industry experiencing architectural change, new businesses can emerge rapidly, taking over markets once dominated by traditional firms. Traditional firms may find it necessary to form new alliances to stay competitive. One view of the current round of mergers and acquisitions in the information industry is that it signals a period of rapid change in which the industry will be significantly transformed.

If this understanding of the current state of the information industry is correct, then possibilities exist for new production arrangements for different types of information. Scholarly information may provide a case in point. The advent of networked electronic information resources sets the scene for the development of what Atkinson (1993b) called "academic information services" (AIS). AIS would allow universities to gain control over the scholarly information transfer cycle by creating an electronic network for articles and books that are now published by commercial publishers or scholarly associations. In addition to being the primary producers and the main consumers of scholarly information, universities would become the principal publishers and distributors of the information. This AIS scenario can be seen in terms of the architectural change described earlier. Market links between scholars and publishers would be disrupted since scholars would be able to obtain information from the networked information resources. Similarly, the expertise required for AIS (information systems development, telecommunications, network tools) that is currently more likely to be found in universities than in publishing houses, would provoke a disruption of the means of production. In this situation, we would expect to see competition between publishers and universities as each tries to obtain control over the flow of scholarly communication. In this competition, the universities would have significant competitive advantages.

The vision of AIS presented by Okerson (1991) and Atkinson (1993b) is particularly attractive to academic librarians. The advantages of networked electronic information resources over the current system are primarily those of speed and cost containment. Speed is realized by shortening the production process. Although peer review and some amount of editing are built into most visions of AIS, it is generally maintained that review and editing would proceed more quickly in the electronic environment. And it seems undeniable that the delays associated with (for example) printing and physical distribution of journals would be eliminated. The cost containment offered by AIS is based on an assumption of on-demand distribution of information. Scholars would acquire only the information that they judge to be relevant rather than having to subscribe to journals containing some potentially relevant material along with articles that are not of interest. It also assumes that electronic production and
distribution is less costly than print publication and distribution, and Bryant (1994) gave some dimensions of this saving. His figures suggested that production costs would be 25 percent lower for electronic journals than for their paper counterparts, equivalent to a 10 percent subscription price decrease.

In the AIS environment, academic libraries would have the benefits of timeliness and cost containment. They would move from providing access through ownership to providing access through networks, and from acquiring materials in anticipation of potential patron need to providing information in response to expressed patron demand. Although there is no clear consensus on how the costs of AIS would be supported, it is argued that these costs would surely be less than those associated with journal acquisition. Metz and Gherman (1991) anticipated that serials pricing would drive the development of academic information systems, and that focusing on access rather than ownership would allow libraries to forego the costs of storage and concentrate on providing optimal delivery systems for their users.

There are also perils for libraries in this scenario. Some academic librarians are concerned that they will be left behind—as specialists in an obsolete information technology—unless they are active participants in the development of academic information systems. Arnold (1993), in an article that announced (perhaps prematurely) the death of the scholarly monograph, suggested that academic libraries and university presses share this danger. Bryant (1994) also spoke of direct electronic communication between author and reader as endangering the continued existence of university presses and libraries. Failure to participate in AIS, then, might leave libraries out of the mainstream of scholarly communication. Participating in AIS may have its own perils. The scenario outlined above suggests that universities (including academic libraries) will enter into direct competition with commercial publishers. Those who speak of this competition, such as Atkinson (1993a), cannot predict the outcome. It was noted earlier that universities have substantial competitive advantages. But it would not be wise to overlook the strengths of the academic publishers. They have large and loyal markets and have managed to maintain those markets despite technological change in the past. It is at least conceivable that the publishers might win out over the universities and retain their market. In that case, universities would have expended considerable sums in the development of unsuccessful AIS. Academic libraries, as partners in an expensive and unsuccessful enterprise, might find that they would be expected to share the costs of the failed AIS to the detriment of their budgets.

**Barriers to Collaboration**

Those who predict the development, and ultimate competitive success, of AIS agree that its development will require collabora-
tion among many sectors of the university. The symposium chaired by Bailey and Rooks (1991) identified academic libraries, computer centers, university presses, and professional associations as possible members of that collaboration. There are, however, concerns about how collaboration between the academic library and other parts of the academic community might be implemented. Despite many examples of successful cooperation in the past, there is an ongoing perception that collaboration between library and computer center, or between library and university press, might be difficult to achieve.

Stereotypes and perceptions in support of this idea are readily called to mind by academic librarians. For example, in one academic community working on a library automation project, contact between the library and the computer center was limited to one individual from each unit. All library input was channeled through one librarian and was directed to one member of the computer programming and development team. The stated reason for this arrangement was that more widespread communication between the two organizations working on the collaborative enterprise would have produced confusion. It was not just that the needs of the two agencies were felt to be different, but their ways of speaking about those needs were felt to be incompatible. Any wider channel of communication was expected to be less effective because the library community was thought to be so different from the computing community.

Anecdotes such as this are indicative of perceptions that reflect some element of truth. There are barriers in any academic community that can act to prevent or make more difficult the necessary collaboration between the academic library and other sectors of the community. This article will examine three barriers to collaboration: clashes of organizational culture, personal incompatibilities, and different approaches to change.

**Clashes of Organizational Culture**

There are organizational differences between libraries and other campus units. Probably the best documented organizational difference, because the two academic units have had broad experience of working together, is that between libraries and computer centers. It has been suggested that libraries have a service orientation while computer centers have a product orientation. Breaks (1991) spoke of a clash of cultures between libraries and computer centers that might imperil the management of an academic information service. While this may be an unfortunate stereotype, it is true that libraries are academic units while computing centers tend to be administrative units. Bebbington and Cronin (1989) discussed in more detail the different orientations of the cultures of computer centers and libraries.
The question of different organizational cultures or orientations becomes particularly crucial when ownership and control of information resources are at stake. Libraries share a service orientation that is built on the idea of free access to information. This is, of course, in complete opposition to any commercial orientation, in which control of the information resource, and marketing of the information resource as a commodity, may be a priority. As great an opposition exists between the managerial orientation, in which information is seen as a crucial organizational resource to be closely guarded, and the service orientation in which the only value of information is found in its wide distribution and use. Finally, libraries claim for themselves a user-centered orientation, and it is true that they try to consider the needs of all members of the user community in designing their services. This approach might be contrasted to that of other units on campus for whom the needs or wishes of powerful or influential user groups might be more likely to enter into information system design and access than those of less powerful constituencies. Indeed, much of the discussion of AIS has been couched in terms of meeting the needs of faculty and researchers, and we are left to wonder at times how such systems might be adapted to meet the needs of students.

**Personal Incompatibilities**

Another barrier to collaboration that has been suggested lies in the potentially incompatible personalities of librarians and other members of their academic communities. For example, Scanlon (1990) suggested that librarians and programmers are like oil and water: unable to mix or to work effectively together. Similarly, Lowry (1988) found that librarians are different from educational administrators in terms of their preferred mode of handling conflicts. There is no doubt that differences in personality, personal interests, backgrounds, and cognitive styles can lead to incompatibilities among workers. It is also true that individuals with certain personalities or abilities are likely to be attracted to, and retained in, one profession or occupation, while other occupations would be likely to attract people with different personal characteristics. It follows that personality differences between librarians and others on campus could set up a barrier to collaboration.

**Approaches to Change**

Different units that are important to the development of AIS may have different approaches to dealing with innovation. Some may move with greater speed than others in adopting new technology, and differences in rates of adoption can get in the way of productive collaborative relationships. This potential barrier to collaboration is particularly relevant in the context of AIS because some have suggested that
academic libraries appear to be passive in the face of this new technological possibility. They are perhaps impatient that libraries are not moving more quickly to generate AIS but rather are allowing other units (usually computer centers) to take the lead in information system development. Accordingly, it is appropriate to discuss how libraries can become more open to change and thus open to collaborative approaches to AIS.

MANAGING FOR COLLABORATION

Academic information systems can produce important service improvements and cost savings for libraries. It is crucial that academic libraries collaborate with other academic units if AIS are to be successful. The following discussion considers organizational structures that can be put in place to overcome the barriers associated with differences in organizational cultures, personnel strategies that can find (and create) personal compatibilities that will facilitate collaboration, and challenges to the library manager to provide leadership for organizational flexibility and openness to change.

Organizational Structures for Cooperation

Although there are undeniable organizational differences between libraries and other academic units that might impede collaboration, there are also ample precedents for ways around these differences. Probably the best recent examples of organizational solutions are centered upon library automation. Arms (1990) made the point that library automation is a logical precursor to networked information services. While there have been some negative experiences in library/computer center collaboration for library automation, there have also been a reasonable number of positive cooperative arrangements that have benefited both parties. Boss (1987) surveyed many cooperative arrangements between libraries and computer centers.

Those who have been engaged in cooperative efforts, and those who have observed them closely, note a variety of features that can lead to successful collaboration. For example, Lucker (1993) described the MIT Distributed Library Initiative and suggested that maintaining separate units, but making the boundaries permeable, is a viable organizational strategy. This arrangement would facilitate the sharing of organizational values and cultures while maintaining the organizational integrity of the two collaborating units. Woodsworth and Williams (1988) spoke of mutual interdependence and an administrative structure that would allow difficult issues, such as establishing priorities and schedules, to be settled. Since it is in these crucial areas that
clashes of organizational cultures and values are likely to occur, it seems logical to establish a separate administrative structure within which priorities and schedules can be negotiated. Dougherty (1993) suggested that technology itself, in the form of electronic mail and local networks, can break down organizational barriers to collaboration. One can see enhanced electronic communication between collaborating units as a means of negotiating and working through the problems that might be attributed to differences in cultures. Bebbington and Cronin (1989), while noting the potential for tension and turf clashes between academic units, suggested that collaboration might lead to a blurring of roles of the collaborating units and ultimately perhaps a loss of unit autonomy. In other words, the effect of working on an initiative such as AIS could be a reorganization or merger of the collaborating units. It is important in such an eventuality to ensure that the emergent administrative structure has a strong central guiding philosophy, and most librarians will concur that an emphasis on service quality and customer satisfaction provides an appropriate philosophy for an academic information service. If boundaries are permeable and communications are good, this philosophy can be communicated to other academic units to serve as a common approach to AIS.

In summary, the experience of libraries in cooperating with computing centers on library automation suggests that, although the organizational cultures of the two units are different, this barrier can be overcome by appropriate organizational structures. Permeable boundaries, special administrative forums to deal with crucial issues of schedules and priorities, and enhanced communications mechanisms can allow units on campus with different organizational cultures to work together productively. It is within the realm of possibility that working on AIS could lead to the development of an integrated information organization on some campuses.

Finding (and Making) Personal Compatibilities

This discussion will concentrate on personality differences between librarians and other professionals on campus as potential barriers to collaboration. However, the main points of this discussion are also true for all of the personal incompatibilities that can impede collaboration, and the management principles derived from looking at personality differences can be applied to all other personal incompatibilities as well. Although the idea of differences in personality as a barrier to collaboration seems plausible, it rests on an assumption that may not be supported by the evidence: that there is a personality that typifies librarians. There has been a great deal of research, much of it inconclusive, regarding the special personality type that identifies librarians. Early studies were analyzed by Fisher (1988), who found
no support for the idea of a distinct librarian personality type. More recent research into librarian personality types has used the Myers-Briggs Type Indicator (MBTI). Webreck (1985) collected data from fifty-five librarians, and identified tendencies toward introversion and judging in both public and technical services staff. Webb (1990), relying on data from 267 librarians collected by the Center for Application of Psychological Type, identified the librarian personality as typified by introversion, sensing, feeling, and judging (ISFJ), supporting Webreck's findings.

However, in what is apparently the largest research project into the personality of librarians completed to date, Brimsek and Leach (1990) obtained somewhat different results. Using data from more than 1,300 special librarians, they identified four personality types as most frequently found in librarians, none of which correspond to the stereotype accepted by Webb. Their findings were:

- Introversion, Sensing, Thinking, Judging (ISTJ) 17.50%
- Introversion, Intuition, Thinking, Judging (INTJ) 14.37%
- Extroversion, Intuition, Thinking, Judging (ENTJ) 8.85%
- Introversion, Intuition, Thinking, Perceiving (INTP) 8.49%

Tyson (1988) investigated seventy-two academic library directors in Virginia and found the following distribution of personality types:

- Introversion, Sensing, Thinking, Judging (ISTJ) 21%
- Introversion, Intuition, Thinking, Judging (INTJ) 15%
- Extroversion, Intuition, Thinking, Judging (ENTJ) 12%
- Extroversion, Sensing, Thinking, Judging (ESTJ) 12%

Once again, none of these personality types correspond to the stereotype offered in Webb's article and, although Tyson's findings correspond to those of Brimsek and Leach in the top three types, the similarity stops there. Finally, Hendrickson and Giesecke (1994) reported the personality types of twenty-nine managers at the University of Nebraska–Lincoln. They found 31 percent ISTJ, 10 percent INTJ, and 10 percent INFP, a distribution once again different from any other reported in the literature.

If we assemble the results presented by these researchers, it becomes clear that there is no consistent pattern. No one personality type accounts for more than one librarian in five. There is no consistent pattern in the findings that would suggest a single stereotypical librarian personality type. In short, we are left with a conclusion resembling that of Fisher (1988). We cannot state that librarians are personally incompatible with others in the academic community because we cannot generalize about librarian's personalities.
This does not mean that the MBTI is not a worthwhile instrument. In fact, productive uses of the MBTI, such as those suggested by Monty (1994), Moreland (1993), and Rome (1990), are based on the understanding that librarians represent different personality types, and that managers should be sensitive to these differences in creating work teams and dealing with other personnel issues.

Just as there is no single librarian personality, there is no single computer programmer personality. Pope (1988) studied the personality types of computer programmers and technicians and found a diversity that resembles in many ways the results quoted earlier for librarians. But it is interesting to note that the personality type most frequently found in computer programmers (INTP) was found in almost one librarian in ten by Brimsek and Leach (1990), and that the personality type most frequently found in computer technicians (ESTJ) was found in 12 percent of library directors by Tyson (1988). This suggests that some librarians will work quite well with computer personnel, and that one responsibility of management is to put in place personnel mechanisms to facilitate interaction among staff members in support of collaboration.

Further corroboration of this approach can be found in the research of Alberty (1987). He tested 294 undergraduate students to see which personality types (as tested by the MBTI) were associated with fast and successful learning of computer programming. Several of the personality types found frequently among librarians were in the top half of his students in both speed and successful learning. ISFJ students (corresponding to the librarian stereotype presented by Webb) did poorly, as did ENTJ students (corresponding to 8.85 percent of special librarians in Brimsek and Leach, and 12 percent of library directors in Tyson). However, students with personality types corresponding to 40.36 percent of special librarians and 57 percent of library directors did very well on learning computer programming. This suggests that many librarians are able to adapt well to a high-technology environment, and therefore will collaborate well with computer programmers and others on campus who work in that kind of environment.

The managerial challenge, then, is to recognize that in any professional staff there will be some librarians who will work well in a collaborative environment with computer center professionals, administrators, and academic press staff. Similarly, there will be some librarians for whom such a collaborative enterprise would pose problems. Managers can select those librarians who will become lead players in developing AIS, or support those who select themselves for leading responsibilities. No one benefits from stereotyping, either of librarians or of any other professionals. The trick is to make the best
use of staff so that their different personal characteristics can be matched with appropriate tasks. Similarly, the hiring process can be used to obtain not only expertise and experience, but also personal characteristics that will result in successful collaboration. Some libraries have experimented with personality tests of various kinds to aid in the task of selection. Whether this formal assessment, or the more informal assessment that takes place in the employment interview, is used, it is important that managers take the responsibility for selecting staff who will be able to contribute to collaborative efforts such as AIS.

Organizational Flexibility

Technological change has sometimes been regarded as determining organizational outcomes. Librarians might think of automation in this way: that the introduction of automated systems must inevitably bring about changes in library organization or in service provision. Management research shows, however, that the idea of technological determinism is inappropriate. Orlikowski (1992) emphasized the notion that technology is interpretively flexible. In any organization, managers and staff interpret technology according to their own understanding, derived from their background experience, and this interpretation influences the organizational response to technology.

Some specific aspects of the organization's interpretation of technology can be labeled conservatism and flexibility. Child, Ganter, and Kieser (1987) discussed the role of organizational conservatism in establishing constraints on the effects of technology on the organization. Personal and organizational attitudes can preserve organizational structures and services through the most pervasive and rapid technological change. Zammuto and O'Connor (1992) illustrated the importance of organizational flexibility in adopting new production technologies. If the organization is flexible, as opposed to conservative, then technological change can more readily influence the kinds of services that the organization offers and the structures that are put in place to produce services.

One important aspect of organizational flexibility is the capability to redeploy organizational resources into new services and structures. For example, in the case of academic information services and libraries, it would be important to be able to assign library staff to the tasks of designing access systems for networked information resources, soliciting and collecting electronic texts, and organizing the processes of reviewing and editing the texts. The charge of passivity leveled against academic libraries should be viewed in the context of organizational flexibility and the ability to redeploy resources. University libraries are hardly passive places. They are extremely busy, engaged
in meeting current information needs by building collections, providing access to electronic resources, teaching information literacy, and providing answers to many questions. It seems unlikely that libraries generally are in the position to redeploy resources away from these priorities to engage in AIS-related activities. This lack of organizational flexibility may be a serious factor in impeding the collaborative work necessary to develop AIS.

Kozlowski and Hults (1987) provide insight into the ways that libraries (or any element in the academic community) can develop the organizational flexibility that will ensure that innovation, creativity, and up-to-date competencies are representative features of the organization. Organizations like libraries that already employ complex technological systems tend to be able to adapt to additional technological change. One example will serve to illustrate this kind of flexibility. Twenty years ago, many academic libraries established positions, usually in their reference departments, with titles such as “online search specialists.” Librarians hired into these positions had expertise in a new technology called online searching, and they had the responsibility to provide services using this technology and to train the rest of the library staff in online searching. Eventually the responsibility for online searching became more general, and online search specialists were less likely to be needed in reference departments. In library schools, we educate future reference librarians to handle both print and online reference sources. Now an increasing number of academic libraries are advertising positions like “networked information services librarian.” It is possible to anticipate that librarians in these positions will have the same function as the online search librarians of a previous generation. They will, initially, have responsibility for expertise in a new service area. Ultimately, they will communicate that expertise to their colleagues, and all librarians will deal with networked information services. This strategy for dealing with organizational change could well be followed in establishing academic information services. A single librarian would have initial responsibility for dealing with the technology and leading the collaboration with other units on campus. Eventually, many staff members would become involved in AIS.

Kozlowski and Hults (1987) noted that organizations typified by high levels of standardization in their procedures and means of production are less likely to have the organizational flexibility that is associated with successful adoption of technological change. The insidious effect of standardization in stifling creativity is also highly relevant to the issues associated with academic information services. Libraries have achieved many benefits from having standardized ways of dealing with information. MARC communication standards and
A 2 rules have produced great efficiencies and have allowed the proliferation of systems that provide great enhancements in information retrieval that libraries can offer to their patrons. At the same time, these standards have acted to reduce the adoption of innovative and creative approaches to information retrieval. It seems clear, for example, that cataloging as it is standardized is not an effective way of providing access to networked information resources. Unless ways can be found to disassociate library information systems from long-standard methods, there is reason to be pessimistic about the ability of academic libraries to make a real contribution to AIS.

Kozlowski and Hults (1987) pointed out that internal rewards for innovation, built into the organizational structure of an organization, are particularly effective in encouraging the introduction of new technology into the organization. This idea could be fruitfully developed in academic libraries. The rewards structures associated with faculty or academic status are seldom directly tied to innovation. Some individual innovation in system development or service improvement may lead to publication, but rewards for publication are not available in all libraries. In those libraries where publication leads to tenure, the reward is not immediate nor directly associated with the innovation displayed. On the contrary, the bureaucratic management systems of academic libraries can stifle innovation. When financial management depends on line-item budgets, there is a strong incentive to carry on providing services in the same way as last year. When there are strong hierarchical communications structures, obtaining approval for any innovative approach to services or systems may have to undergo scrutiny at many levels as it ascends the hierarchy, then descends, perhaps changed beyond recognition. Where collegial structures are used for communication, innovation can get bogged down in committee meetings that examine every detail. The disincentives to innovation sometimes seem to outweigh the rewards for innovation.

What would seem to be called for is a system where librarians who wish to display initiative and new approaches to service, such as developing components of academic information services, should have available a reserved portion of the annual library budget, a thorough but speedy mechanism for reviewing and approving innovative projects, and a personnel system that acknowledges innovation along with competence and scholarship in making promotion, tenure, and salary decisions.

Library managers have significant leadership responsibilities in ensuring that the library as an organization is ready to change, and to participate in collaborative efforts such as academic information services. Encouraging organizational flexibility by supporting resource
redistribution, challenging the standardization of inappropriate approaches, and rewarding innovation are ways of ensuring that technology is interpreted positively by the library.

CONCLUSION

Examining the barriers to collaboration and the ways these barriers can be overcome has illuminated a number of general management problems and potential solutions to those problems. It seems arguable that these management solutions are of general application, regardless of the (somewhat problematic) future of academic information services. Collaboration with other academic departments on campus is essential to developing collections, instructional programs, and information services. Similarly, collaboration with administrative units is important to the survival of the library, not only because administrators are influential in making decisions about resources allocation on campus, but also because the administrative units they represent compete with the library for scarce resources.

In addition to this general case for the importance of on-campus collaboration for the future well-being of academic libraries, a special case can be made for the development of academic information services as a particularly crucial instance of collaboration. Information is the domain of the library. Library personnel have immense experience in dealing with acquiring, storing, and using information resources. It can be argued that librarians bring an important emphasis to the development of information systems—the user focus. Although there are enough examples of libraries that are not friendly or helpful to their users to keep librarians modest, there are also success stories that show how important a user orientation can be. Atkinson (1993a, 1993b) sees the role of librarians who will work on AIS as being able to personalize and humanize the relationship between the information systems and its users.

To meet this objective, librarians can bring to the academic information services collaboration their experience with user-based structures for retrieval. Part of this experience is negative in nature. Librarians have worked with, and in some cases developed, information systems that are based not on an understanding of user needs and information-seeking behavior but on the data structures apparent in artifacts such as books. Although frustrating enough for users and for the librarians who work with users, these systems do provide a valuable design base. In other words, librarians can help AIS developers avoid the design errors that are pandemic in bibliographic retrieval systems. There are, however, more positive experiences with
information systems that librarians can bring to the design task. Specialized academic libraries have created files tailored to the needs of their communities. For example, one engineering library has created a separately searchable file of records of conference proceedings so that users will not encounter the frustration of trying to locate these items in the online catalog. A library serving a specialized research institute has created a searchable file of all of the publications of scholars associated with that institute. A women's studies library has created a database that will bring together the widely scattered literature in this emerging field. These examples illustrate the experience in making information available to users that academic librarians can bring to the tasks of creating AIS.

Most of this experience relates, however, to designing systems that take existing information and retrieve it for users: in other words, designing systems for retrieval and output. Librarians have less experience in designing the information itself, typically choosing to purchase it "off the shelf." But the user-centered approach works equally well on information creation. For example, public librarians have frequently been involved in creating information systems that describe their communities—i.e., services offered by community agencies, special knowledge or expertise available from local individuals or organizations, and the functions of local government. Atkinson (1992) suggested that academic librarians should take increasing responsibility for the input side of information services. As a part of the academic community that is in regular and frequent contact with the information needs of all other segments of that community, academic librarians are in a position to bring that knowledge of information needs to the creation of information resources within the framework of AIS.

To ensure that collaboration between academic libraries and other academic units proceeds as effectively as possible requires a variety of managerial interventions. In considering the barriers that might prevent such collaboration, this article has identified several areas in which managers have a responsibility to act in support of collaboration. The first is in designing organizational structures that will encourage collaborative enterprises such as academic information services. It is important that library directors, as well as managers of other units in the academic community, work to create permeable boundaries between units so that the values and cultures of each unit can be shared. The many examples of structures that have been established to implement library automation provide examples that can guide future collaboration. At a minimum, facilities for electronic communication between academic librarians and other campus professionals can help to begin the process of cultural sharing that is so important in collaboration.
A second area of management responsibility is in the selection and appropriate deployment of personnel. The research into librarian personalities does not support a single stereotype. Rather, a variety of personality types are found among librarians and among other campus professionals. The task of academic library management is to ensure that those librarians who have personal characteristics and abilities that can enhance collaboration have an opportunity to engage in collaborative enterprises. In addition, selecting people with entrepreneurial attitudes and other characteristics that might be associated with successful collaboration and innovation makes good sense. Alexander, Boykin, and Meyer (1989), reflecting on a successful collaborative effort at Clemson, suggested that entrepreneurial attitudes in the librarians who were part of that effort led, in part, to its success. Building a library staff that can take an active role in the collaboration that will produce academic information systems, both through hiring new librarians and training existing personnel, is an important responsibility that Jennings (1992) considered the managerial priority for the future of university libraries.

Finally, establishing a climate that encourages innovation and collaboration is one of the important leadership roles challenging academic library directors. As the earlier discussion indicated, academic libraries have contradictory traditions in this area. In some ways, they have adequate precedent for building collaborative relationships and incorporating new technology into their services. In other ways, they are bound by standards, rules, and procedures that can inhibit innovation and collaboration. Emphasizing the one and helping to break the influence of the other is an important role for library leaders. Practical steps that can reward innovation in the library organization can also be taken to emphasize the value placed on new approaches to the provision of information services.

As academic libraries cope with the rapid changes in the information industry, they have an opportunity to move into a pivotal role in the generation, collection, distribution, and use of scholarly information through academic information systems. This role is not something they can accomplish alone, however. Expertise and experience in information transfer are found in other areas of the academic community, and so collaboration is essential. Academic library managers have important responsibilities to ensure that their organizations are ready to assume this pivotal role in the information industry of the future.

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Resource Sharing in the Electronic Era: Potentials and Paradoxes

GAY N. DANNELLY

ABSTRACT

Effective and efficient resource sharing, a long time goal of libraries, is at last becoming a reality in many current and planned projects. Access to OPACs and the development of rapid delivery systems are changing the way information can be delivered. At the same time, traditional interlibrary loan remains a strategic service. The social, economic, and technological complexities of both the new mechanisms and the traditional roles of libraries provide both opportunities for cooperation and paradoxes for the continuation of selection, archiving, and preservation of paper collections.

Today's libraries face myriad challenges: social, economic, technical, organizational, and functional. One of the biggest challenges, however, is the rapid rate at which all of these factors are changing, their interdependence, and the effects that we see in our attempt to maintain, much less increase, information services. In 1986, the ALA Commission on Freedom and Equality of Access to Information wrote that: "Libraries of all types today find themselves caught between the anvil of growing citizen demand for increased access to a broader range of information resources in a wider variety of formats and the hammer of declining financial support" (ALA, 1984, p. 99). They were reflecting the then rapid rate of change, but not even that august body could have imagined the rapidity and variety of developments in today's information society.
Technology and its applications to information are evolving so rapidly that cutting edge installations of today are old hat tomorrow. The digitizing of information is providing a cleaner and more restorable form of data collection, retention, and manipulation. The competition to provide supporting services for handling this digitized information influences not only the research community, but also the commercial and public sectors of the economy. The lack of standards has hampered this to some extent, but with the development of the Z39.50 standard, gopher space, World Wide Web servers, and Mosaic, the rate of change in system access and availability has increased dramatically.

Gorman (1991) has written that: “Resources sharing has two bases: the effectiveness of technology and the need to cooperate.” He continues: “I think that we are, like it or not, entering a Golden Age of Cooperation because (1) the technology to link libraries and to make the users of one library aware of the collections of others is available and getting better all the time, and (2) economics are forcing us to cooperate” (p. 7). These factors—technology and economics—impact library programs and practices more directly today than they have at any time in the past. These in turn produce a variety of paradoxes in the current art of library and information provision. (The Concise Oxford English Dictionary defines paradox as a “statement contrary to received opinion; [a] seemingly absurd though perhaps really well-founded statement; self-contradictory; person, [or] thing, conflicting with preconceived notions of what is reasonable or possible.”) They have indeed begun to force the issues of cooperation, collaboration, and a heightened need for resource sharing. The following discussion is general in nature, and there are always exceptions, but it is time to challenge certain assumptions about the way in which we provide information and the nature of the library environment.

Webster’s Ninth New Collegiate Dictionary defines ownership as “to have or hold as property; to have power over.” In this context, it is useful to consider several levels of ownership. The most convenient is, of course, the ownership that allows the patron to walk to a nearby shelf and take down the book or journal or videotape desired. The location of desired material that is owned at another branch of a library provides additional sources, but these are not immediately available. Another level is that of materials housed in remote storage. Most large universities are faced with this situation. Is it less convenient to wait for delivery from a branch library or from a storage facility that may be several miles or counties away? And the fourth level is the cooperative model, where access serves as surrogate ownership. The deciding factor in making a selection decision, aside from the cost and the availability of an item, is the opportunity costs to the patron. What does it cost the patron to wait for information for an hour, a week, or a month?
Webster's defines access as the "freedom or ability to obtain or make use of." Just as there are multiple levels of ownership, there are many levels of access, and these may influence the decision to own an item. First is the ability to identify desired materials. Do such resources—whether print, media, or electronic—actually exist? Next is the access level that provides knowledge of the item, that it is indeed available in a library or document depository in the required format. The third level is that of the ability to retrieve it. Can it be borrowed, purchased through document delivery systems, sent directly to the patron? And if the third is impossible, can the patron go to the item. For many scholars, the need to use original documents allows no other choice. The strategic issue in this situation is to know that something exists and where it is located.

As a profession, we began the deconstruction of ownership as the only option when interlibrary loan became an accepted and regular library activity. Upon the establishment of OCLC and other utilities, the issue of ownership versus access was no longer of major importance, except as a rather arcane construct around which we could structure library and information science class sessions. In fact, by the time the question became broadly recognized, the information environment in which we function had long superseded the question. And thus we have the primary paradox facing the profession: access is ownership. Access is analogous to paying rent on a short-term lease rather than paying a mortgage, while ownership is the mortgage and includes a condominium fee for the upkeep and continued housing of an item.

The second paradox is that ownership is not necessarily access. Consider the many large microform sets that libraries have acquired to provide primary source materials for their clients. How many of these are analyzed in the catalog, be it card based or automated? Particularly in an online environment, if the individual bibliographic record is not in the OPAC, the library might as well not own the set in which it resides. In the present computer-oriented information structure, the traditional printed citation and index apparatus is simply inadequate for information-hungry and impatient users.

This leads to the third paradox: cataloging is access, but cataloging priorities may not be, and often are not, established based on collection priorities. Cataloging priorities are primarily based on personnel availability and personnel classification requirements. Japanese may be a collection priority, but if you cannot hire a cataloger with the language skills, you may not be able to support this priority. In addition, materials for which there is copy are likely to receive cataloging whether or not they fit collection or service priorities. Again, this is often highly dependent on the staff resources available, and that is often an area where the collection manager has little
control. A library may be providing access to materials it owns, but its users may not care about records generated through the traditional cataloging backlog searching process.

Cataloging is access only when it happens. Minimal level cataloging of relatively rare or unusual items, in conjunction with collection level cataloging, provides less access to more information. Economics and organizational issues often govern our institutional priorities rather than the collection strengths and cooperative commitments established with such care and effort.

The fourth paradox is that acquisition and retention of a title is preservation. This is certainly not the traditional view of preservation, but if at least one library does not acquire, retain, and, preferably, catalog an item, it cannot become part of the shared resources of the library community. There is little reason to expect that any publisher, commercial or academic, will retain electronic information much longer than they retain paper copies. Again, it is a question of economics. Libraries and computer centers will continue to serve as the depositories of the intellectual and creative products of society. Our challenge will be to make these vast collections of materials accessible and available to those who need to use them.

The fifth paradox is that, while access assumes automation, automation does not necessarily mean access. There are many examples that support this contention. Interlibrary loan assumes that much of its transaction activity will be communicated via bibliographic utilities. If a library does not choose to participate, or if a utilities' requirements are such as to limit the library's participation, then automation may exist, but the data upon which the transaction should be based do not, and therefore access is limited at best. For example, many libraries add their data to OCLC via tape. However, due to the complexities of serial entry verification and the necessary de-duping activity that is required to maintain the database as a whole, serial holdings records may not (at present) be added via tape. They must be added online. Many major serial collections are therefore not yet reflected in a national bibliographic database.

The second issue in this scenario is that of retrospective conversion. Many libraries have not had the resources to carry out a retrospective conversion project, thus limiting the access to their collections. Automation may mean access if a library has carried out a project to support circulation on their local system. Brief records for every item in the circulating collection may exist in an OPAC yet may not be reflected in the utilities. However, with the access to catalogs through the Internet, access can be achieved when a library client is willing to invest the time to check many catalogs to locate one item.
A companion paradox is that acquisition is access if order and in-process records are included in the local OPAC as it is displayed on the Internet. In fact, with the inclusion of automated acquisitions systems in online catalogs, many of the concerns caused by the needs of the utilities and their huge databases can be bypassed by knowledgeable librarians and library patrons who are willing to invest the time and effort to access heretofore invisible materials.

The most disturbing result of this rapid high-tech environment in which many libraries are now living is the contrast between the "haves" and the "have nots." Flanders (1991) has noted that:

social, economic, and geographic barriers have combined to make it difficult for certain people to obtain information. Case in point: the telecommunications infrastructure in rural America is generally barely adequate for voice communications and cannot support touch-tone service, let alone the advanced data capacity required by NREN. (p. 574)

It is not only the technology that limits accessibility to information resources. We must be very conscious that there is no such thing as free information. Somebody somewhere pays for information. It may be the taxpayer, the patron, the sponsoring research agency, the businessperson, but it has to be supported economically. The issue libraries must face is who pays where? Does the library receive support from its governing body to provide information resources, in any format, to its patrons or does the library have to charge? Or does it consciously decide to charge based on the nature of the materials requested? For example, a university library might decide to charge for online searches of commercial databases but to provide free mediated searches of government produced CD-ROMs. Alternatively, a library might view the value-added nature of a CD-ROM as being an appropriate reason to institute charges, particularly when the library cannot acquire the title and the equipment any other way.

A puzzle in the development of electronic information is that librarians may, by their selection decisions, cause an economic chill in certain areas of traditional publishing by acquiring products only in machine-readable form. Paradoxically, the availability of relatively inexpensive "publication" through listservs or electronic journals could also make more works available than could ever be produced by decreasing publication cost dramatically.

To take the possibility of "chilling" publishing a little further, a major concern of collection managers is that, through the use of standard bibliographic sources, automated collection analysis mechanisms, and comparative collection evaluations, we are cloning our collections.
If libraries are not very careful, they will continue to lose the variety and health of the national collection in the desire to “keep up with” peer libraries. It is clear that every library has to have a certain “core” of materials to support ongoing programs, reference needs, and specific areas of research, and that these primary collections may be relatively constant across institutions of a particular size and type. However, the nation’s intellectual heritage is represented not only by these primary collections, but also, and in some cases, most importantly, in the more individual and perhaps fringe areas that seldom overlap but provide sources of great importance for present and future scholarship. And let us not forget that all scholarly work does not take place in the academic setting.

As libraries concern themselves with the retention of unique materials, they must also face the changing nature of communication and its affect on what Atkinson (1990) has called the “mutability of the historical record.” Librarians are all aware of the “recalled” published works in both monographs and serials. The electronic work is even more volatile. When and how does an electronic work become fixed for retention in the library’s “published” collection? How might it be changed and who can change it? Where does the historical and edited record reside? Again, there is no reason to assume that the producers of information, in any format, can be expected to be a permanent source of that information.

Another peculiarity of electronic publishing is the set of requirements that publishers are placing on titles; restrictions that would seldom, if ever, have been placed on printed materials. It is normal for a publisher to try to limit the access to an electronic product to the students, staff, and faculty of a college or university. This is a nearly unenforceable rule for tax-supported and depository libraries. Clearly, publishers must protect their profits in order to satisfy stockholders and continue publishing, but librarians and publishers must begin to work together to establish workable and realistic means to achieve this end.

Copyright is a paradox in itself. Fair use is continually reinterpreted through legal decisions, and the electronic environment only makes the situation more complex. Copyright statements now exclude any transfer of material to another format, including specific mention of any electronic medium. The role of fair use has not yet been clarified in this new environment and again forces librarians to evaluate the role of licensing, leasing, and copyright limitations impinging on the electronic scholarly record. Resources used to support distance education, a rapidly growing sector in continuing and adult education, will undoubtedly provide opportunities to test this in the near future. As Sabosik (1991) has stated, the changing technologies of
electronic transmission of information "are reducing the physical boundaries to information and are changing the role of the publisher and the library intermediaries in the chain of scholarly communication" (p. 60). These changes are not limited solely to the scholarly publication scene. As networking has become more common and less expensive, and as the information highway becomes a primary means of access to electronic information, the library and the publisher, not to mention the vendor, will take on new roles that are not yet defined and whose legal ramifications are as yet unknown and can only be anticipated in a most general way.

The excitement of providing greater resources and broader and more effective access to information in our local libraries and in libraries across the country (and with the Internet, the world) is tempered by the organizational cost borne by the library. Users are looking for vast arrays of information and then looking for ways to filter it in order to minimize information overload. The paradoxes in the library environment influence our ability to manage the local library as well as the ability to participate in effective resource sharing. Libraries need to establish methods of delivering information that are more effective for the individual library user and that take full advantage of the broader information environment. However, interlibrary loan is about to collapse under the incredible increases in demands and the lack of resources available to support that function. Thus the traditional process of ILL activity, on which resource sharing activities have been based, is ceasing to function effectively just as libraries become more dependent on its use.

The governing institutions of libraries have unrealistic expectations of resource sharing, particularly as they reduce financial support for library functions. Libraries will have to reevaluate their priorities and consider the implications of relying on ownership or access or the mix that is appropriate for a specific institution. This may well require the movement of cost centers, staff reallocation, rearrangement of space, and the hiring of personnel with a wider variety of skills or more specialized skills.

In an electronic environment that increasingly relies on resource sharing, new elements are central to the provision of library services, collection decisions, and staffing needs. Libraries have participated in formal interlibrary lending arrangements since the beginning of the century. "The library community has been struggling with how best to promote the acquisition, control and mobility of materials among libraries....This tri-partite framework for resource sharing has been developed in an attempt to enable people at every level of society to find the information they are seeking" (Dougherty & Hughes, 1990, p. 1). The recent developments in computer networks,
bibliographic utilities, and digitized transmission of images has enhanced the capability of interlibrary lending programs. However, the rapidly increasing load on these traditional mechanisms with their labor-intensive checking and verification and the increasing demands for materials not available at the local library have stretched the capability of the library community to the breaking point. The availability of electronic bibliographic databases has exacerbated an already troublesome situation. The costs of interlibrary lending and borrowing, as a library function, are now so high that it has become a serious drain on local services and personnel and, in many cases, libraries have been forced to decrease other library services in support of resource sharing services or to institute higher charges for borrowing of their materials.

Many examples of resource sharing, emphasizing particularly the movement of materials and, in some cases, people, have shown the importance of such agreements. The University of California system, with a shared catalog, Melvyl; a shared large purchase program; and shared regional storage facilities is one of the largest and most successful. The addition of bibliographic databases and commercial electronic journal archives to the university system also represents many of the programmatic directions taken by other more recent consortial arrangements.

One of the largest multitype library networks is ILLINET, linking public, academic, and some special libraries in a system that allows patrons to directly request specific monographic titles to be delivered to their home library from any other participating library in the system. One of the most interesting results of this program is the net borrower status of the University of Illinois at Urbana-Champaign. As expected, the university is also one of the major lenders, but the large amount of borrowing done by its students and faculty is clearly indicative of the need for multiple copies of specific titles, the usefulness of the most unexpected collections, and the verification that all libraries may contribute to the scholarly process no matter what their collections hold.

The more recent development of OhioLINK is another example of the growing state and regional developments of shared networks. OhioLINK includes all the state-supported universities, municipal colleges and technical institutions, the State Library of Ohio, and a growing number of private colleges. It provides for patron-initiated circulation of monographs, and serial article delivery is presently being tested. Early circulation statistics reflect the circulation pattern of Illinois: the largest lender is also the largest borrower. More than twenty-five licensed databases were available through the network at the end of 1994. The system is also designed to provide collection
management information not only by title and classification, but by types of users. Such information may provide some of the earliest analysis of use of materials by patrons in a decentralized system.

There are many other examples of state or regional networks that have been in place for many years or are in planning or implementation phases. It seems likely that such developments will increase and overlap leading to a variety of complications in commitments to various consortia and to local users who benefit from the shared environment, but who may also find it frustrating when materials they desire are in use elsewhere in the state or region.

As libraries are expanding their resource-sharing activities in response to academic needs, the role and nature of higher education is changing as the character of the national population shifts; as technology brings new requirements and opportunities to the educational, commercial, and social sectors of society; and as budgetary forces require "doing more with less." Rapid and efficient access to information has become an economic imperative, and technology is the driving force. Changes in the expectations of higher education, both within and outside of academia, are forcing rapid developments in both the content and form of the educational setting. Hayes (1986) has noted that a major development in the campus is that: "It's going to become a major communications center. That's where the real revolution is occurring—communications and information" (p. 71).

Increasing costs of information, rapid increases in publishing of interest to academia, and stagnating budgets of institutions of higher education have made it glaringly obvious that no library can provide all the resources required by its users (Graves & Wulff, 1990, p. 53). In 1979, Scholarly Communication: The Report of the National Inquiry reported, it is clear that research libraries can no longer function as autonomous entities, each striving for self-sufficiency. That goal, never realistic even in the years of rapidly expanding budgets, will slip further out of reach as each year passes. New forms of resource sharing, the development of national collections accessible to all research libraries, and the linking of libraries through computerized bibliographic networks into a national system are essential steps that must be taken if libraries are to meet their responsibilities to provide all users with reliable access to the research literature. (p. 151)

Performance expectations have increased at all levels of higher education: faculty are expected to publish, students are regularly expected to write papers or complete projects that rely on the scholarly record, and the purchasing power of library budgets has been drastically curtailed. The research library is not the only victim in this development. Libraries serving liberal arts and community colleges and technical institutions are caught in the same spirals of rising
expectations and decreasing resources. These conditions have forced an increased reliance on resource sharing through interlibrary loan, direct borrowing arrangements for faculty and students, and other delivery mechanisms. Interlibrary loan and resource sharing are no longer adjunct sources of information but have become integral components of primary library services.

The economic consequences of continuing to do business as usual are dire at best. Greatly increased costs of journals and monographs in all disciplines, proliferation of electronic formats that faculty and students demand, and disintegrating historical collections all contribute to the need to develop new methods and models of providing information. VonWalde and Schiller (1993) have suggested that: “In the networked environment, access will become the primary function of the library. We will need to spend more money to support access and delivery of information” (p. 32). White (1994) has noted that, as opportunities for access to previously unknown resources become available, demands for those resources will increase, and that costs will, solely on this basis, undoubtedly increase (p. 8). Combining such demands for new resources with the price escalation of traditional formats, and the linking of pricing between paper and electronic formats of the same title, libraries are clearly caught in an untenable situation both budgetarily and functionally. Libraries do not control costs, they simply respond to pricing and availability of resources produced by scholarly researchers and academic and commercial publishers (White, 1994, p. 7). The interactions of these external bodies govern the library’s ability to respond to local needs as well as consortial agreements. Although recent years have seen an increase in the dialogue among scholars, librarians, and publishers, the economic reward system of academia and the profit motive of publishers still control the information pipeline.

The economic pressures of materials costs and the decreasing resources available for staff and other support now threaten a basic tenet of American library service. As Battin (1990) has cautioned: “The financial pressures arising from a steadily expanding commercialization of the scholarly publishing process, swollen by the expanding production of knowledge and a proliferation of new storage and dissemination technologies, pose a persistent and disquieting threat to the distinctive sine qua non of the university—the commitment to broad and equitable access to information regardless of the ability to pay” (p. 2). In addition, the increasing costs of the lending and borrowing process itself has caused many institutions to increase their lending charges, thereby limiting access to the “shared scholarly record” and imposing more costs on the “have not” institutions and their constituencies. Miller (1992) has described the “warm fuzzy feel-
ing” of helping others and questioned how much it is worth when the “‘have’ library” has to “divert significant resources from local service to serving others” (p. 11). It seems clear that only those resource-sharing agreements from which all parties gain can be maintained in the future. In such arrangements, the independent scholar may become even more isolated as institutional bonds focus not only on the sharing of resources but their licensed acquisition and provision as well.

Complicating the situation is the role of technology. The costs of rapidly changing technology and the implications of network access to a variety of resources both enriches and costs the library and its university. While technology costs, per se, have dropped significantly, reliance on access implies the need for greater numbers of both staff and public workstations with increased capacities for both the access and manipulation of information. Technology and access to resources of many kinds implicitly governs the priorities of many libraries.

Technology, as Miller (1992) has noted, is an enabling factor but should not be the determining component in the identification and sharing of information resources. In fact, it often governs the process to the exclusion of other concerns (p. 14). Local networks and protocols, regional access to the network backbone, and institutional policies and priorities may govern not only the library's capabilities, but the local scholar's capability to access specific resources. The delivery of information via fax or other electronic means is also limited by local technological capabilities. Standards exist and continue to be developed, but the variation in local network infrastructure continues to be a limiting factor in providing broadbased access to, and delivery of, information.

Among the most interesting resource-sharing programs that technology has assisted are those that share subject expertise and sites for the collection and dispersal of information. The CRL project to digitize Brazilian documents and the Ohio State University Libraries East Asian Libraries Cooperative World Wide Web Text Server project, begun with a variety of funding assistance at Ohio State, are excellent examples of the sharing of information, technology, and subject expertise.

Technology also imposes limits on how resources may be accessed and delivered based on the format in which the information is provided, the hardware platform on which the resource is located, and the way in which the receiving workstation may acquire and display the information. Gopher has been the dominant mechanism used for the past few years, but it is being replaced by World Wide Web servers and Mosaic, which provide a graphic capability not previously available to many users. Mosaic, however, requires a workstation of considerable power to efficiently access and process the information.
acquired. Display capabilities, transmission rates, image resolution, and the ability of the local network to move the data efficiently are important in providing print equivalent clarity. Libraries, with commercial information providers, must be very aware of the need to provide useful and effective methods of access and delivery that can be available to the broadest array of users. Ideally, libraries should also cooperatively seek to develop expert systems that take on some of the qualities of the reference interview in aiding users to navigate not only the electronic resources available to them but also those tools that remain in traditional print or media format.

The administrators of many institutions have begun to view resource sharing as a means by which to provide access to information and save money on library expenses. While this may have some limited validity, it is imperative that administrators of both the university and the library understand the implications and costs of resource sharing. It is not free and it does not absolve the local institution from supporting its own programs from an appropriately developed collection. It does provide additional resources that could not normally be acquired, but it also requires that each participant give something to the consortia in terms of materials and expertise.

Traditional interlibrary loan has specific activities that, in an effort to save patron and library time, have become heavily labor intensive. Each step may involve countless iterations as circumstances and conditions change. However, with the proliferation of publishing, the limitations of local budgets, and the need for rapid delivery to meet user expectations, it is time to develop new methods using the new technology available and the movement of much of the current responsibility of ILL to the patron and to other segments of the library.

In order to make resource sharing work, it is necessary to create an environment that maximizes access to local collections to enhance local use and to provide efficient indexing for those remote users who identify needed resources via Internet catalogs. Such an environment provides full retrospective cataloging of print and media collections and brings the established indexing methods of libraries to the resources available through electronic gateways, servers, and commercial sources. It provides better communication within the library and between the library and both the local and the remote user.

In order to take advantage of the efficiencies of automation, it is important that institutions that have traditionally shared programs, research initiatives, and other activities expand those traditions to encompass cooperative or shared networks. These networks, based on common needs and specific protocols and agreements, should allow for unmediated borrowing by authorized users. This would allow the primary needs of the user to be subsumed under the circulation func-
tion of the participating libraries rather than through the labor-intensive interlibrary loan process. It places the burden of identification and selection in the hands of the user. By sharing a common borrower database or by allowing interlibrary access to such databases, much of the verification and location labor involved in the ILL process can be decreased.

The current Virtual Electronic Library project of the Committee for Institutional Cooperation libraries seeks to begin this process across the thirteen member institutions using a Z39.50 common interface that will act like the local interface for the user, but it will cross multiple catalog platforms. While unmediated borrowing is not yet part of the program, it is certainly one of the advantages that could develop out of this project. In addition, the member libraries have long-standing resource sharing agreements that are now being enhanced through specific cooperative collection development programs.

Electronic resources have a variety of complexities that far outstrip those of traditional printed materials. Servers are springing out of the woodwork in libraries far and wide. While they allow for specifically tailored resource development and direction, they also have a multiplicity of delivery problems. The first and most important is the nature of the electronic text. A printed work is fixed and, even though later printings may change, it is comparatively easy to identify the variant editions. In the electronic world, the changes made to a text can be essentially endless and untraceable. There are no established standards for noting modifications made to a text, and such changes are not limited to authorized editors, authors, or others who are usually responsible for the content of a work. Anyone who wishes to collect and mount texts on a server can do so, and the text can be infinitely varied. The role of the library in the fixing of electronic texts and the retention of their variations is only beginning to be considered in the new electronic world. This may be the single most important issue facing libraries in the acquisition, retention, and preservation of the scholarly record in all its variations and variable formats.

The contribution of commercial providers of information, particularly faxed or scanned images of journal articles with subsequent delivery to the scholar's workstation, is already having a major impact on both services and collections. As more materials become digitized and, in many cases, available only in electronic form, the nature of the historical data available for long-term access and use may be radically altered. It is imperative that libraries begin to address their role in future information retention and preservation. The massive cancellation projects carried out by libraries as journal prices have spiraled out of control during the past decade have led to reliance on
these commercial providers and have enabled libraries to make decisions based on use intensity rather than on the nature of the use of specific journal titles. The danger in relying on commercial providers, however, comes over time. To what extent can libraries and their users rely on the provision of images or digitized forms of information, and to what extent will these "backfiles" be maintained? Can we depend on them for twenty or thirty or more years of access? The same issue is true in CD-ROM bibliographic databases. To what extent can we be format dependent when the access to the information may shift radically every few years? Many of these sources are available only for lease, and the library thus retains no backfiles when the title is cancelled. This is a strategic limitation in providing access to the historical record.

As budgets become tighter still, libraries are again debating the issue of who bears the cost of access to information. Clearly, the local collection remains available at no cost to its users. But access to externally maintained resources becomes another matter. Does the library, and the institution, look to the efficiencies of electronic delivery as a means to increase productivity of students and faculty or as a way to support a cost recovery program? Does it use access fees to provide even more library services and materials or as a way to mitigate costs? And how does the scholarly process address the issue of equal access to information for all, no matter the income or economic resources of the user? To some extent, the academic library can limit its "free" access to its primary users; however, depository-, state-, or other government-supported libraries may not be able to limit access in such ways. If pricing becomes governed solely by time or frequency of use, then equal access may no longer be a viable approach to information. It is surely an issue of great importance in the democratic tradition of American librarianship.

Should all these developments in the provision of information directly to the user come to pass, then what happens to interlibrary loan? ILL needs to be able to concentrate on locating those resources that cannot be identified in any reasonable way through electronic networks; to acquiring those special and important items that may make or break a dissertation; and those items that lead to significant developments in scholarly insights. ILL is still an important function and will remain so as long as the object itself is required for scholarly study. It may become obsolete in a generation, as predicted by Ra (1990), but as long as printed works remain necessary to scholarly or personal study, then ILL will have a role in library services (p. 149). It would be nice to allow it to return to the function for which it was designed and get ILL out of the long-distance circulation business.
In order for this to happen, resource-sharing agreements must be developed in both broad and specific contexts and be accepted and supported by all those who participate in, or whose collections are affected by, them. Institutions and their libraries must see each other as partners and not as competitors. It is particularly difficult when institutions have similar or related programs and see themselves as competing for the same faculty, students, and grants, but such programs are not always the same, and cooperative efforts can begin to expand the resources available within the consortium for such programs.

For effective resource sharing, not just opportunistic title by title borrowing, the participants in such a cooperative program must be able to rely on each other for the stated aims of the program, have regular and effective communication methods, and have the support of the library administration and teaching faculty in each subject area. The institution and the library must maintain the primary collection for their local needs no matter what riches are available to them through resource sharing. The one flaw in all resource sharing assumptions by administrators is the expectation that they will save money. They won’t. If there is no collection, you cannot share it. And the aim of resource sharing is to enhance the wealth of the national collection and thereby support and expand the scholarly record for local users.

Technology has become an impetus to the cooperative process and certainly provides new and enhanced means of sharing information resources. The collection may be in a variety of formats and in fact may become almost entirely electronic. However, the collection is still the heart of the matter, and if there is no collection there is nothing to share. And while all these technological marvels are taking place, libraries will still be checking out best sellers and arcane tomes. We will still be giving directions to the drinking fountain and locating the latest information on epigraphical squeezes. Our responsibilities have not disappeared, and they have not decreased. Rather, the need to own and to access information requires selectors to consider the ever-narrowing boundary between immediate local ownership and needs that can be filled by remote “ownership.”

As means of access improve and broaden, library users will care less about where an item was obtained and more about the speed of delivery, whether from a remote storage facility or a library in the next state. Osborne (1990) has postulated “an evolving kind of collection management wherein the fundamental considerations are global accessibility, rather than local ownership, and the generic book, rather than the paper codex; wherein scholarly communication, rather than librarianship, is our business, and the distinctions between information and knowledge have a new importance” (p. 30).
As many library administrators have noted, libraries are what we can measure. In the new world of information communities and methodologies, it is imperative that we find new and creative ways to define and measure our “collections,” for they no longer live in our local buildings or on our local computers. Our new collections live across the state, the nation, and the world. The challenge is to develop organizational models that allow us to bring these far-flung collections to our users and to provide mechanisms that enhance their abilities to find the information resources they need, whether it is satellite weather data, a study of Cistercian monasteries, or the latest mystery by Sara Paretsky.

REFERENCES
Scholarly Publication and Copyright in Networked Electronic Publishing

LAURA N. GASAWAY

ABSTRACT

The publication of scholarly works in a networked electronic environment presents many opportunities for solving some of the problems that currently exist in the print world. At the same time, copyright law, a form of legal protection developed primarily for printed works, has been used to create stumbling blocks both for faculty authors and their institutions. This has occurred because publishers have required a transfer of copyright to the publisher as a quid pro quo for getting the work published. New models of copyright ownership and management can be developed for electronic publishing of scholarly works and research results that will provide greater control to the faculty author, ease the distribution and permissions process for the use of copyrighted works in teaching and research, and ultimately will reduce costs to universities which currently must repurchase faculty-produced works from commercial publishers.

INTRODUCTION

By circumventing traditional printed format, the publication of scholarly works only in electronic form presents unique opportunities for scholars and their institutions, but it also raises a number of important copyright law questions. The word "published" generally has meant to produce printed copies of works and to distribute them publicly through bookstores and libraries. The act of publication encompasses the rights of reproduction and distribution (Copyright Act,
1988), and authors have the right of first publication under U.S. copyright law (Harper & Row v. Nation Enterprises, 1985, p. 555). For years the only outlet for scholarly works was traditional book publishing, now increasingly centralized in the hands of a small number of publishers or, for shorter works, publication in a scholarly journal distributed through subscription sales to individuals and libraries. Such articles are produced primarily by university faculty members and by corporate researchers. The discussion and suggestions in this article relate to faculty authors and their universities.

Until approximately twenty years ago, scholarly journal publication was handled primarily by scholarly societies whose interests were coextensive with those of faculty authors. These societies provided peer reviewing for articles submitted, editorial services and the like, in addition to the publication and distribution of journals to society members. Members paid annual dues to the society, and a subscription to the journal was provided as a benefit of membership. Subscriptions were also marketed to academic research libraries, corporate and other special libraries, as well as to research facilities. Even so, for most journals many more copies were distributed to members than were sold to outside subscribers. The income from the sale of subscriptions often was used to underwrite other activities of the society.

Scholarly societies had little interest in taking the entire copyright from the author since their primary emphasis in publishing journals was the distribution of research data for and to their members. Thus, faculty authors were free to reuse their works later as book chapters, to update articles for republication, to reproduce them for distribution to the faculty member's own classes, and to make copies available to their colleagues upon request. In fact, faculty authors often gave permission to their academic peers to make multiple copies for classroom and other educational purposes. Neither the faculty members nor the scholarly society expected royalty or licensing income from the distribution of copies of articles, although some societies did anticipate income from the journal through subscription sales.

As the costs of producing, printing, and distributing journals increased, many scholarly societies recognized that sale or transfer of their journal publications to commercial publishers would be in the best interest of the society and its members. Thus, many such publications became commercial journals. Commercial publishers now manage the peer review, editorial, and other processes necessary to produce journals. The interests of the generator of the articles (authors) and the publisher are no longer the same. The commercial publisher focuses on maximizing profits and returns on investment and not on faculty authors' interests in broad free—or very low cost—
distribution of research results to members and the scholarly community. The change to commercial publishing has meant a tremendous increase in journal subscription rates, often bearing little relation to the cost of producing a journal (Association of American Universities, 1994). Further, commercial publishers have vigorously pursued licensing arrangements to secure additional income from photocopying and other reproductions of journal articles. Sadly, even many professional societies that continue to publish scholarly journals have begun to follow the commercial model (see American Geophysical Union v. Texaco, 1994) and may no longer support the best interests of the faculty author and the academic scholarly community they represent.

University faculty create copyrighted works and members of the university community use copyrighted materials to prepare for teaching and for research purposes; faculty assign copyrighted works to be read by students; and faculty-produced copyrighted works are reproduced for library reserves and in coursepacks. Additionally, universities also are engaged in the dissemination of research results and many publish copyrighted books and articles through their university presses. Clearly, life in an academic institution is intertwined with copyright (Association of American Universities, 1994, pp. 116-17).

Against this backdrop, it is natural to consider alternative publication and distribution methods, especially since academic authors currently receive little or no compensation for assigning their rights in an article to a publisher. In fact, in some disciplines, authors even must pay page charges in order to get a work published. University libraries are faced with repurchasing the scholarly articles of their own faculty authors, often at greatly inflated prices. The increase in the number of scholarly journals published, escalating prices, the declining value of the dollar on international markets, and static budgets in research libraries mean that few new journal titles are added to library collections, and many subscriptions have been cancelled in research libraries throughout the country. Thus, academic institutions are reexamining the current situation and considering whether universities themselves might become publishers by offering the scholarly contributions of their faculty authors electronically in a networked environment. In the alternative, there may be ways of enhancing the current publication situation better to facilitate the interests of the academic community and faculty authors even when articles are commercially published.

Regardless of whether a work is published in print by a commercial publisher or by a university press, or whether it is published electronically by a commercial publisher, university, or even directly by a scholarly author, a number of copyright issues must be considered.

Copyright Basics

In the United States, copyright is available only for original works of authorship (Copyright Act, 17 U.S.C., § 102(a) [1988]) which fall
into one of eight statutory classes: literary works; musical works; dramatic works; pantomimes and choreographic works; pictorial, sculptural, and graphic works; motion pictures and other audiovisual works; sound recordings; and architectural works (Copyright Act, 17 U.S.C., § 102(a) [1988]). Scholarly works today are almost all literary works; however, in the future, scholarship increasingly is likely to embrace other types of works and multimedia as well. The Copyright Act defines "literary work" as "works other than audiovisual works, expressed in words, numbers, or other verbal or numerical symbols or indicia, regardless of the nature of the material objects, such as books, periodicals, manuscripts, phonorecords, film, tapes, disks, or cards, in which they are embodied" (Copyright Act, 17 U.S.C., § 101 [1988]).

According to the copyright law's definition, a scholarly article stored in electronic format is a literary work. For purposes of this article, literary work is used as the prototype for all faculty-generated works, assuming that the primary type of material that might be distributed in a networked electronic environment is the article.

Rights Needed for Publication

One who authors a literary work receives a bundle of five rights: reproduction, distribution, adaptation, public performance, and the right to display the work publicly (Copyright Act, 17 U.S.C., § 106 [1988]). The rights of reproduction and distribution are the critical rights needed for publication regardless of how that publication occurs. The Copyright Act defines the term "publication" as:

[T]he distribution of copies or phonorecords of a work to the public by sale or other transfer of ownership, or by rental, lease or lending. The offering to distribute copies or phonorecords to a group of persons for purposes of further distribution, public performance, or public display, constitutes publication (Copyright Act, 17 U.S.C., § 101 [1988]).

Most librarians and other scholars have assumed that making works available in electronic format was a form of publication. The legislative history of the Copyright Act is not so clear on this point, however, and states that unless material objects change hands, there is no publication regardless of the number of people who are exposed to the work (U.S. H.R. Rep. No. 1476, [1976]). To deal with this problem, the Preliminary Draft of the Report of the Working Group on Intellectual Property Rights (known as the Green Paper) recommends that the definition of the term "publication" be rewritten to encompass the concept of distribution by transmission (Intellectual Property and the National Information Infrastructure, 1994, pp. 123-24). This would clarify the matter by amending the Act's definition of "publication" no longer to require that a material object change hands.
Neither the Green Paper's recommended statutory amendment nor the generally held view that distribution via an electronic network constitutes publication deals with the concept of unintended publication. An unscrupulous third party certainly could distribute a faculty author's article through transmission. Actually, this is no different from the current situation where such third party could publish a print version of another author's work without his or her permission. Just as in the print world, this could be handled by reserving to the author the right of first publication, a right recognized in the United States in Harper & Row v. Nation Enterprises (1985, p. 569). If the author accidentally distributed the work through an electronic network, he or she still owns the rights and can determine whether the work is thus published. If a third party distributes a faculty member's work without permission, not only does the faculty author have an infringement action against the illicit dissemination but, since the author has not given permission for the distribution, the work is not then published through the transmission.

In order to publish a work, the publisher—whether a scholarly society, a university press, or a commercial publisher must—at a minimum, have the reproduction and distribution rights assigned to it by the author. Authors are required to transfer these rights to the publisher as a condition precedent to getting the article published. Transfers must be in writing (Copyright Act, 17 U.S.C., § 204(a) [1988]), and the author may transfer the total reproduction and distribution rights in the work in whatever format (print, CD-ROM, or electronic), or the author may limit the transfer to a particular format. In other words, the author can transfer only the print rights and retain the rights for electronic publication. The transfer of the reproduction and distribution rights also might be limited by the number of copies reproduced and distributed or by the length of time the transfer endures (such as for ten years), after which time the rights revert to the author.

Oddly, most commercial publishers not only require a total transfer of the reproduction and distribution rights, but they frequently require the scholarly author to transfer the entire copyright, including rights that the publisher does not need in order to accomplish its publication goals. Consider a faculty-produced article that reports an anthropological study of a particular Indonesian people. By assigning the entire copyright to the publisher, the author has given the publisher the right to reproduce and distribute the work in print, on CD-ROM, or in an electronic database. Further, the faculty author has lost the rights to do the following without permission from the publisher:
1. incorporate the article as a chapter in a later book;
2. update the article and produce a new "edition" that reflects later research results;
3. license the movie rights (an unlikely development, but certainly possible especially in fields such as history, literature, ethnography, and the like);
4. reproduce copies for distribution to the author's own classes or incorporate the work into coursepacks;
5. grant permission to other faculty members to reproduce the article for distribution to classes or for incorporation into coursepacks at the author's own institution or throughout higher education;
6. reproduce copies for distribution to colleagues at conferences; and
7. supply copies to peers simply upon request.

If the author has transferred all rights to the publisher, then he or she must contact the publisher to seek permission even to reproduce and distribute the work to the faculty author's own classes or to adapt the work (such as through a new edition). Although most publishers have permissions departments, publishers' responses, even to their own authors, vary considerably both in the scope of permission they are likely to grant to the author and in how long it takes them to respond to the author's request. Some are quite responsive and answer almost immediately while others take weeks to reply to the author. As a general rule, publishers are more responsive to requests from their authors than they are to other faculty members who seek permission to reproduce and distribute an article to their classes.

Other Rights

Commercial publishers, many society publishers, and even some university presses have simply taken more rights from the authors than were needed in order to publish the work. While copyright certainly exists in order to promote learning as well as to reward authors (Fogerty v. Fantasy, Inc., 1994, pp. 1023, 1029), rewards to scholarly authors have not been economic but rather have been in the form of increasing the author's reputation and status such as by being awarded tenure. These rewards are not related to the transfer of the copyright, however, but rather accrue from the production and publication of the work itself. It is the university that awards tenure to scholarly authors based, in part, on their research and publication records. Reputational rewards come from the approval of one's peers. This is not to denigrate the role that publication in scholarly journals plays in the rewards system, however, the reward is not a quid pro quo for the transfer of the copyright. Currently, publishers reap the rewards that copyright and the U.S. Constitution envisioned as going to authors.
Notice of Copyright

Likewise, even though copyright notice is no longer required under U.S. law (Copyright Act, 17 U.S.C., § 401(a) [1988]), authors who choose to publish electronically should continue to include a notice with each article. The notice consists of: the ©, the word “copyright,” or the abbreviation “copr.”; the name of the copyright holder; and the year of first publication (Copyright Act, 17 U.S.C., § 401(a) [1988]). Inclusion of the copyright notice entitles the owner to certain benefits such as the right to bring suit against infringers in federal court (Copyright Act, 17 U.S.C., § 401(b) [1988]), recover statutory damages for infringement, and to recover attorneys’ fees (Copyright Act, 17 U.S.C., § 412 [1988]). Although these benefits are extremely important, there is another reason to include notice of copyright on works distributed in a networked electronic environment. The notice alerts good faith users that someone claims rights in the work. While a notice of copyright will not stop the unscrupulous, fortunately, most users of scholarly works use them in good faith. Thus, including the notice assists the user of the work as well as the copyright holder.

Along with the notice of copyright which the author should place on the work, the author may include any grant of rights to reproduce and distribute the article. For example, the author may grant blanket permission for reproduction for educational and research purposes which will avoid the necessity for such users to contact the author directly for permission. The author might elect to be more selective and permit reproduction and distribution only for nonprofit educational uses. On the other hand, he or she might choose to grant broad rights to all scholarly users whether in the for-profit sector or within academia. The breadth of the grant would depend on the author. Across-the-board permission relieves the faculty author from having to respond to so many individual requests to use a work. While not all potential uses are covered in the grant as described, the bulk of requests surely would be for the right to reproduce and distribute multiple copies for educational purposes, so the necessity for scholarly authors to respond to requests is greatly reduced.

Electronic Publishing and Copyright

Publication in electronic format rather than in print in no way changes the underlying copyright issues. Such publication may, however, present opportunities for avoiding some of the pitfalls to authors and thus to their universities or other employers. New models of copyright ownership are possible and may reduce the cost to university libraries for repurchasing scholarly works produced by their faculty and staff.
Electronic publication also presents possibilities for uncontrolled reproduction and distribution of works since users of articles from electronic sources can download and further distribute them. While greatly feared by commercial publishers, widespread distribution and use of faculty authors' scholarly works is exactly what they desire. So, traditional publishers and scholarly authors have different goals for electronic publication of faculty-created works.

Ownership of Copyright

The same questions of copyright ownership remain in the electronic environment as exist for print publications. If a university is the publisher, it cannot perform the necessary steps to publish the work electronically without some transfer of the reproduction and distribution rights from the author. These rights might be shared jointly by the university and the faculty member but, in order to publish, the publisher must have these rights assigned to it. Certainly, all other rights, such as the right to prepare derivative works, can and should be left with the author.

Authors may be tempted to make their works available electronically and dedicate them to the public. This is not a wise course of action, however. What most scholarly authors seek is wide (and perhaps even unlimited) distribution of their works. Most faculty authors probably would choose for this distribution to be free of charge since they currently receive virtually no income from their efforts in producing journal articles. By placing scholarly articles in the public domain, however, the opposite effect can occur. The author has relinquished all rights, and someone else can begin selling the work, charging whatever the market will bear, and the author has no right to control the work. A better course for the author is to publish the work and retain the copyright. He or she may include with the article a statement that the copyright holder grants to educational and research users the right to make single copies for research, scholarship, and other fair use purposes plus the right to make multiple copies for classroom use. This latter grant might be limited to nonprofit educational institutions, but it need not be so. An author may also want all of the greater research community, whether for-profit or not-for-profit, to have unfettered access to the work and the right to use it for educational and research purposes. However, it is and should be the author’s choice.

Fair Use

Regardless of who owns the copyright or what rights the author grants to users, fair use will continue to be a major concern. Fair use will exist in the electronic environment as it does for printed works.
The Green Paper states that "it is critical that researchers, students and other members of the public have on-line equivalent to their current opportunities off-line to browse through copyrighted works in their schools and public libraries" (Intellectual Property and the National Information Infrastructure, 1994, p. 133).

Fair use is both a defense to copyright infringement and a limitation on the exclusive rights of the copyright holder. It is a privilege in one other than the owner to exercise one of the exclusive rights in a manner which ordinarily would be copyright infringement but which is excused because of the existence of certain factors. Based on nearly 200 years of judicial doctrine, fair use now has been incorporated into the copyright statute. Section 107 of the Act states that "fair use of a copyrighted work...for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship or research, is not an infringement of copyright." The statute then states that, in any particular case, certain factors are to be considered in determining whether a use is fair. Although other factors also may be considered, the statute lists four considerations as illustrative, and frequently courts use only these four.

1. the purpose and character of the use,
2. the nature of the copyrighted work,
3. the amount and substantiality of the portion used in comparison to the work as a whole, and
4. market effect (Copyright Act, 17 U.S.C., § 107 [1988]).

The purpose and character of the use examines such issues as whether the use is for scholarship or for commercial gain. The commercial nature of a use, however, does not automatically mean that a use is not fair (Campbell v. Acuff-Rose Music, Inc., 114 S.Ct. 1164, 1177-79 [1994]). On the other hand, nonprofit educational uses are more likely to be found to be fair use than are commercial ones. The nature of the copyrighted work focuses on the work itself. The legislative history includes statements that indicate some works have no fair use rights such as standardized tests, workbooks, answer sheets, and the like (S. Rep. No. 473 [1975]. Reprinted in 13 Omnibus Copyright Revision Legislative History 117, 1977). Further, factual works, such as scientific and other scholarly articles, have greater fair use rights attached to them (Patterson & Lindberg, 1991, p. 210). The amount and substantiality factor looks at how much of the copyrighted work was copied. This is both a quantitative and a qualitative test, and courts measure percentages, and count words and bars of music. Reproducing even a small portion of a work can still be problematic if the "heart" of the work is taken (Harper & Row Publishers, Inc. v. Nation Enterprises, 1985, 569).
The final factor is the effect on the market for or value of the work. Thus, the economic interests of the copyright owner and any existing or potential markets for the work is critical. In fact, market effect has been held to be the most important test (Harper & Row Publishers, Inc. v. Nation Enterprises, 1985, 566). Courts also seem to focus on the existence of licensing agreements (such as through the Copyright Clearance Center) as a market (American Geophysical Union v. Texaco, Inc., 1994, pp. 897-99).

So, if a user of a copyrighted work on a network claimed fair use, courts would apply the above four factors to decide the issue. The metes and bounds of fair use in the electronic environment are less clear than in the existing print world. At the present time, under the auspices of the National Information Infrastructure (NII) Working Group on Intellectual Property, a series of conferences on fair use in the electronic environment are being held with representatives of library, media, and education associations; authors groups; publishers; and computer software groups to examine fair use. The ultimate goal is to develop guidelines similar to the guidelines for library and classroom use of printed works and music (chaired by C. A. Meyer, U.S. Patent and Trademark Office, the series of fair use conferences began in October 1993 and will continue for several months. The author is a participant representing the Association of American Universities).

Faculty authors who publish their works via university managed electronic networks can answer many of the fair use questions through a blanket grant of rights for all educational uses including multiple copies for classroom use, library reserves, and the like. Even with such a blanket grant, however, there will still be fair use questions from users in the for-profit sector but whose purposes are education and research. Likewise, users in nonprofit institutions might seek to make a commercial use of an author’s work and will need to contact him or her for permission. Thus, fair use will continue to be an issue of importance even with electronic publication.

First Sale Doctrine

Another important limitation on the exclusive rights of the copyright owner is the first sale doctrine. The doctrine, embodied in the statute, says that after the first sale of a copy of the copyrighted work, no more royalties are due to the copyright owner (Copyright Act, 17 U.S.C., § 109(a) [1988]). The doctrine limits the control a copyright holder can have on subsequent sales of a work. It also means that the lawful owner of a copy of a work may dispose of that copy in any way, such as through sale, gift, loan, etc. Until 1984, the first sale doctrine was absolute, but it was amended in that year for phonorecords of sound recordings (Copyright Act, 17 U.S.C., § 109[b][1][A] [1988])
and now has been amended for computer software (Copyright Act, 17 U.S.C., § 109[b][2][A] [Supp. 3] [1991]). These changes were made because of the ease with which the works can be reproduced far more inexpensively than an original copy can be purchased. Moreover, such copies suffer little denigration of quality (Corsello, 1991, p. 192).

The Green Paper posits that the first sale model, in which the owner of that copy transfers the copy to someone else, should not apply to distribution of works via transmission. The reason for this position is that with the current technology, in the electronic environment, both a reproduction of the work and a distribution of the reproduction occurs. The problem, according to the Working Group, is that, with a transmission, the owner of a copy does not dispose of the possession of that copy. Thus, the Working Group recommends an amendment to the statute which would make it clear that the first sale doctrine does not apply to the transmission (Intellectual Property and the National Information Infrastructure, 1994, pp. 124-25). This recommendation has been particularly controversial among members of the library community who have responded that there are instances when the owner of an electronic copy of a work may transfer possession entirely without retaining a copy (Letter of the American Association of Law Libraries, September 7, 1994).

Publication in electronic format also presents opportunities to address the problems that exist in the current scholarly communications system and creates a new environment that supports not only the creator of scholarly works but also the users of those works. Two important recent projects have dealt with these issues over the past few years.

**Projects Concerning University Authors and Copyright**

The Triangle Research Libraries Network (TRLN) project, under a grant from the Council on Library Resources, began work on a model for faculty ownership of copyright beginning in 1991 (Triangle Research Libraries Network, 1994, p. v). The following year, discussions between the Association of American Universities (AAU) and the Association of Research Libraries (ARL) ensued, and the second project was initiated to examine the intellectual property rights in the electronic age. The result was the development of four models and a recommendation for further exploration by universities (Association of American Universities, 1994, p. 113).

**TRLN Model Copyright Policy**

The Triangle Research Libraries Network, a long existent library consortium of the academic research libraries at Duke University, North Carolina State University, and the University of North Carolina-Chapel Hill (in 1994, a fourth institution became a member of
TRLN, North Carolina Central University in Durham), received a $100,000 planning and policy analysis grant from the Council on Library Resources in 1990. The primary purpose of the grant was to examine policy and service issues related to the development of cooperative information resources in the sciences and to analyze criteria for selecting shared resources. Other purposes were to recommend organizational means for ensuring that TRLN constituencies could have effective input into the operation of cooperative information programs; to investigate funding strategies for shared resources; and to recommend a general planning and policy framework for the pursuit of collaborative information resource development. The first major initiative under the grant was a symposium and planning retreat held in Chapel Hill in mid-1991 for 100 faculty members, librarians, and administrators (Triangle Research Libraries Network, 1994, p. 1). In the course of the symposium, quite unexpectedly, concerns about copyright and publisher impediments to the wide sharing of scholarly articles and research results in the sciences were identified as the single most important issue (Triangle Research Libraries Network, 1994, p. 23).

The TRLN model copyright policy recognizes the centralization of the publishing of scholarly scientific and technical articles into a few European-based commercial publishing conglomerates. The problem with the current system is "incompatibility between the noneconomic goals of academic researchers and the largely economic goals of commercial and even some not-for-profit publishers" (Triangle Research Libraries Network, 1994, Appendix L, p. iii). Moreover, copyright practices in scholarly publishing exacerbate the problem. By assigning the entire copyright to commercial publishers, authors give away the ability to control any of the conditions under which their scholarly articles are disseminated. An important initial step toward controlling spiraling scientific and technical journal costs is to return control to scholarly authors and their universities (Triangle Research Libraries Network, 1994, Appendix L, p. iv). As stated by Bennett and Matheson (1992), only the copyright owner can decide whether scholarly journal articles are to be treated as knowledge to be shared among members of the research community or to be sold for a profit (pp. B1-B2).

Beginning in November 1991, a ten-member task force was appointed to examine copyright as it affects the dissemination of scholarly information and to develop a model copyright policy which outlines the conditions under which faculty authors would or would not transfer copyright to publishers. The Task Force was comprised of faculty, librarians, and university press administrators. As the group proceeded with its task, it became clear that the most effective action
would be to educate faculty, administrators, and scholarly publishers about the problems with the current system of scholarly communications and about copyright law. The consequences that transfer of the copyright has on universities and their libraries also should be included in any educational effort (Triangle Research Libraries Network, 1994, p. 23).

Upon adoption of the model policy, universities commit to work to strengthen existing "publishing enterprises (of scholarly societies) whose journal subscription prices are rationally related to the actual costs of journal publication" (Triangle Research Libraries Network, 1994, Appendix L, p. 1). The policy asks university faculty to publish scientific and technical articles in journals supported by universities, scholarly organizations, and other associations that support the idea of distribution of research results at reasonable costs. Where it is not possible for authors to publish their articles with such publishers, faculty are asked to use a model "Authorization to Publish" form which ensures that control of the copyright in the work remains in the academic community rather than with a commercial publisher. The "Authorization to Publish" requires that the first page of the article (whether published in print or electronically) contains a statement that copyright remains with the author. All the author transfers to the publisher is the right to reproduce the article and distribute it in the journal. Further, the statement must give permission for the "non-commercial reproduction of the article for educational or research purposes" (Triangle Research Libraries Network, 1994, Appendix L, pp. 1-2). This relieves the faculty author from dealing with requests for permission to reproduce the work for distribution to classes and for retention of copies on library reserves without regard to the number of class terms the work remains on reserve. The faculty author also could give blanket permission for inclusion of the work in coursepacks or license the publisher to handle coursepack permissions for an agreed-upon reasonable rate (Triangle Research Libraries Network, 1994, Appendix L, p. 2).

The policy also contains guidelines which provide guidance to authors to assist them in selecting an appropriate publisher and in negotiating copyright and license agreements. The purpose of the advice is to ensure the widest possible dissemination of scholarship and research results at reasonable costs, something most scholarly authors favor. One guideline states: "Publication via national or international public online computer networks is encouraged when this alternative is available" (Triangle Research Libraries Network, 1994, Appendix L, p. 4). At the same time, faculty authors and their universities assume certain responsibilities by refusing to assign the entire copyright to publishers such as:
1. to seek not only the most prestigious journals for publication of faculty-produced scholarly articles, but also to consider journal publishers that will assure wide availability of the article at reasonable cost;

2. to learn more about U.S. copyright law, the current system of scholarly communication and the role copyright plays in this system;

3. to participate actively in debate at all levels on changes needed in the scholarly communications system;

4. to support the efforts of university presses and other campus agencies to create new outlets for the dissemination of scholarly articles and research results; and

5. to respond in a timely fashion to permission requests to resell articles commercially (noncommercial reproduction would be permitted automatically via the statement required on the first page of the article) (Triangle Research Libraries Network, 1994, Appendix L, pp. 45).

The TRLN Copyright Policy Task Force continues to promote debate on the problems it identified and the model policy as a solution. A number of efforts to distribute and discuss the policy have included presentations to regional and national meetings of scholarly and professional associations (Triangle Research Libraries Network, 1994, pp. 25-26). The task force further agreed to seek funding through the AAU and ARL to test the model (Triangle Research Libraries Network, 1994, p. 23).

**AAU/ARL Project**


The task force was charged to examine, from a university perspective, the emerging possibilities for creation and dissemination of electronically based information. From this examination, it was anticipated that proposals for new methods to collect and disseminate research and scholarship would be developed and opportunities available through a collective university response would be identified (Association of American Universities, 1994, p. 107).

Some attention was given to the problems posed for faculty-created works by the current copyright ownership scheme and publishers' practices. At the same time, the concept of fair use is being eroded by university responses to litigation or the threats of litigation from
publishers and by limitations imposed by academic institutions due to fear of exposure to liability (AAU Task Force early discussions. See Association of American Universities, 1994 for the final report). Although the focus was on the electronic environment, the task force recognized that the current electronic world is paradoxical; many publications still are produced in print form, some exist both in print and in electronic formats, while others are available only electronically (Association of American Universities, 1994).

The task force considered whether a change in the Copyright Act might be the ideal solution. After considerable debate, it was determined that proposing amendments to the law was not the best or perhaps even a desirable solution given the nature of the political process and the strength of lobbying groups that represent copyright owners. Thus, the task force turned to the academy itself to see what changes it could propose in the current system of scholarly publications which require that copyrights be transferred from the author to the publisher.

After initial discussions, the group identified various models or scenarios for changing copyright ownership and management. The six models include an enhancement of current practices, faculty ownership, joint faculty/university ownership, university ownership, ownership by a consortia, and joint faculty/consortia ownership. The following issues were examined for each model:

1. What works should be covered?
2. Who is entitled to decide whether to transfer ownership?
3. What rights should be assigned to publishers, should there be date limitations on rights granted to publishers, and the like?
4. Whether the university would be entitled to recover production costs for extraordinary expenses incurred to produce the work (such as for the use of research equipment, video production staff and equipment, and computer programming)?
5. Would the model best be facilitated by revenue sharing for royalties received?
6. What access to the copyrighted work within the university would be guaranteed (for use in coursepacks, library reserves, and for class handouts)?
7. Should access to other universities and educational users be ensured?
8. Would access to industry and other researchers be provided?
9. Who will have reuse rights to permit incorporation of the work into later works, preparation of new editions, and other updates, etc.?
10. Would there be any alteration of tenure and promotion policies needed to encompass nontraditional publishing and service on association editorial boards?
11. Would the university need to provide copyright-related support services to faculty authors?

Figure 1 highlights the issues and problems with the various models.

After considering the pros and cons of these six models, the task force produced written scenarios for the four models for change deemed to hold the most promise. These four models are not mutually exclusive. For example, the first two differ only in degree but not in philosophy; the third and fourth embrace the idea of sharing the ownership with another entity, either with the university itself or a consortium. The ultimate purpose of that sharing is to establish the institutional owner as guarantor of wide electronic access, archiving, and use of the materials. In the majority of university copyright policies, faculty members own the works they create. None of the scenarios pursues the possibility of faculty-created works being considered works-for-hire. Not only were members of the task force divided over whether sole university ownership was desirable, but it was viewed as so contentious as to be unworthy of further consideration.

1. **The Current Enhanced Model** does not tamper with present copyright ownership arrangements. Instead, it advocates that all university employees be educated about copyright law and the consequences of copyright assignment or transfer to both the creator and to the university. Individual university members of the AAU would mount strong education programs for campus information, discussion, involvement and support.

   Representatives of university presses and society publishers whose officers are employed at AAU universities would enter into discussions with faculty to consider language acceptable for copyright transfers, licenses, and other contracts. The negotiated outcomes would attempt to balance the needs of authors, members of the university community, and publishers. Universities and their faculty also would consider what incentives could be offered to persuade researchers and scholars to publish in lower-priced journals and to develop alternative publishing vehicles (Association of American Universities, 1994, pp. 135-36).

2. **The Faculty Ownership Model** also does not change copyright ownership; faculty members continue to own copyright in the works they create. The major difference is that faculty retain the rights to the work and do not assign the copyright to the publisher as is currently required by many commercial and association publishers. By retaining the copyright, it is the individual faculty member who determines whether to grant blanket permission for educational uses, inclusion in coursepacks, and the like. Faculty authors transfer to the publisher only the rights necessary for reproduction and distribution of the work in that particular publication. All other rights are retained by the faculty member.
For this model, the task force used the TRLN Model Copyright Policy and was grateful for the work done by TRLN in this area. This model assumes that faculty members will be encouraged both by their universities and by their own self interest to place their works for publication with quality publishers whose prices are not the highest in the discipline. To make this model function effectively, some central medium for registering works, managing faculty copyrights, and granting permissions for use to others must be developed and maintained by the university (Association of American Universities, 1994, pp. 137-38).

3. The Joint Faculty/University Ownership Model envisions shared ownership between the faculty member and the university. The model excludes royalty-producing works such as textbooks and creative works, including plays, novels, paintings, musical compositions, etc. The university and/or faculty author would determine what rights to transfer to the publisher and whether to license certain uses. Thus, control is not transferred automatically to publishers. The work then is available for in-university use and the co-owners determine whether to make the work available with or without charge to other universities. In order to implement this model, however, new employment contracts likely would be required to specify this new joint ownership arrangement.

As a co-owner of the work, the university absorbs all costs of production of the copyrighted work. The university then has an interest in determining where articles are submitted for publication in order to achieve the goals of cost reduction to the university and increased availability in alternate formats.

4. The Joint Faculty/Consortium Ownership Model focuses on an information network maintained by the academic community that encourages the widest possible dissemination of scholarly works at the lowest possible cost to the university, which is a member of an established consortium. This model requires experimentation with electronic publishing and new models for cost recovery. There are natural vehicles for this move such as the CIC (the Big Ten plus Chicago) which already has an electronic infrastructure. Such networks are well positioned to work cooperatively with university presses and professional societies in establishing and encouraging electronic journals.

This scenario establishes the principle that universities have a long-term interest in the ownership of scholarly works produced by their faculty and encourages faculty authors to publish electronically through their consortium. The joint faculty/consortium model likely has the highest start-up cost of any of the models, but it may encourage the most innovation and experimentation in alternative methods of publication and management of copyrights (Association of American Universities, 1994, pp. 141-42).

The task force report was submitted to the AAU presidents in April 1994. The report recommends further study in several areas.
**Figure 1: Comparison of Models**

<table>
<thead>
<tr>
<th></th>
<th>Enlightened Status Quo</th>
<th>Faculty</th>
<th>Joint Ownership</th>
<th>University</th>
<th>Consortia</th>
<th>Joint Faculty/Consortia Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Works covered</strong></td>
<td>All produced</td>
<td>All produced</td>
<td>All produced within scope of employment</td>
<td>All produced within scope of employment</td>
<td>All produced within scope of employment</td>
<td>All produced within scope of employment</td>
</tr>
<tr>
<td><strong>Transfer of ownership</strong></td>
<td>None</td>
<td>None</td>
<td>Faculty transfers predetermined percentage to university worked out by prior agreement</td>
<td>Faculty automatically assigns all rights</td>
<td>Faculty automatically transfers all or some rights</td>
<td>Faculty transfers predetermined percentage to consortia</td>
</tr>
<tr>
<td><strong>Licensing rights to publishers/date limitations</strong></td>
<td>Faculty determines where to publish; publisher owns copyright &amp; makes all other decisions about licensing, etc.</td>
<td>Faculty determines whether to license, where to publish joint decision</td>
<td>Standard agreement needed about who decides or if publish/license/ terms to seek</td>
<td>University determines whether to publish/license/ terms to seek</td>
<td>Consortia determines whether to publish/license/ terms to seek</td>
<td>Standard agreement about who decides or if joint decision</td>
</tr>
<tr>
<td><strong>Cost for production of work (use of research equipment, manuscript preparation, etc.)</strong></td>
<td>May include reimbursement agreement for extraordinary expenses incurred by university if royalties received</td>
<td>May include reimbursement agreement for extraordinary expenses incurred by university if royalties received</td>
<td>University bears costs in exchange for part ownership</td>
<td>University bears costs</td>
<td>University or consortia bears costs</td>
<td>University or consortia bears costs</td>
</tr>
<tr>
<td><strong>Revenue sharing</strong></td>
<td>None</td>
<td>None</td>
<td>Shared percentage to be determined by standard agreement when work produced</td>
<td>University receives all revenue as management fee</td>
<td>Consortia receives all revenue as management fee</td>
<td>Shared percentage to be determined by standard agreement when work produced</td>
</tr>
<tr>
<td>Access within university</td>
<td>Publisher determines</td>
<td>Guaranteed to university by faculty author plus other faculty members &amp; students</td>
<td>Guaranteed to faculty author plus other faculty members &amp; students</td>
<td>Guaranteed to faculty author plus other faculty members &amp; students</td>
<td>Guaranteed to faculty author plus other faculty members &amp; students</td>
<td></td>
</tr>
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<td>--------------------------</td>
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<td>--------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Access to other universities &amp; educational users</td>
<td>Publisher's choice</td>
<td>University can encourage but faculty choice</td>
<td>Joint choice but strongly encouraged</td>
<td>University choice</td>
<td>Guaranteed to consortia members</td>
<td></td>
</tr>
<tr>
<td>Access to industry &amp; other research users</td>
<td>Publisher's choice</td>
<td>Faculty member choice</td>
<td>Joint choice</td>
<td>University choice</td>
<td>Consortia choice</td>
<td></td>
</tr>
<tr>
<td>Faculty retention of reuse rights</td>
<td>Publisher's choice, but faculty member should insist on right to reuse</td>
<td>Yes</td>
<td>Granted back to faculty</td>
<td>Granted back to faculty</td>
<td>Granted back to faculty</td>
<td></td>
</tr>
<tr>
<td>Alteration of tenure &amp; promotion policies to encompass nontraditional publishing, service on association editorial boards</td>
<td>Desirable</td>
<td>Desirable</td>
<td>Yes, in exchange for part ownership</td>
<td>Yes, in exchange for ownership</td>
<td>Desirable</td>
<td></td>
</tr>
<tr>
<td>University support services</td>
<td>Desirable</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Provided by consortia, not individual universities</td>
<td>Provided by consortia, not individual universities</td>
</tr>
</tbody>
</table>
and encourages universities to experiment with the various models. All models will require significant educational efforts. The report envisions a greater role for university presses, including an active role in scientific journal publishing—especially in electronic form. Further, universities will need to provide an officer to assist faculty and other university authors with assignment of copyrights, publishing contracts, licenses, and related matters. This officer easily could be someone within the university press. These new roles for the press will require treating presses as programmatic partners with libraries and academic computing centers. Also, it likely will demand a reversal of the trend that requires university presses to function as stand-alone cost-recovery centers (Association of American Universities, 1994, p. 143).

Issues relating to the pressure on faculty to publish, tenure, and rewards must be addressed in light of the move to electronic publishing and the proposed changes in copyright ownership and management. The task force did not see any inherent conflict with the principles of academic freedom but rather greater university involvement in the management of copyright to the benefit of the university and its faculty scholars. The American Association of University Professors is poised to deal with problems should a research university overstep its bounds and try to suppress publication of a faculty member's work because of disagreement with its conclusions, tone, or methodology (Association of American Universities, 1994, p. 147).

The AAU presidents plan to continue the project in order to build campus consensus and involve other academic organizations. More study is needed to develop consensus on what constitutes fair use in the electronic environment. Feasibility studies are needed for creating and maintaining competitive electronic publishing outlets such as through strengthening university presses (Association of American Universities, 1994, pp. 152-53). Further, individual universities are volunteering to work on copyright policies that test one of the models; the policies might then serve as a guide to other universities.

CONCLUSION

Copyright issues should not stifle creativity and experimentation with scholarly publishing in an electronic networked environment. Nor should the economic interests of publishers be escalated through licensing and pay-for-access systems to the point of excluding fair use. Publication of scholarly works through university-managed networks promises to offer innovative solutions and restore the balance between the rights of authors and publishers and to emphasize the noneconomic goals of faculty authors. The proposed solutions attack the primary problem of a scholar's lack of control over his or her scholarly works, but none of the models has been tested.
As such experimentation occurs, many questions remain and must be addressed.

1. Will faculty retention of copyright mean that they are unable to publish their scholarly works other than with a university?
2. If this is the case, will this be detrimental to the individual faculty author or can universities offer sufficient incentives to encourage such publication?
3. Will the loss of prestige currently enjoyed by scholarly journals be transferrable to electronic databases? If not, will it be possible to convince faculty authors that it is in their best interest to publish through such outlets?
4. If the copyright is held jointly by the faculty and the university or a consortium, what happens when the scholarly author leaves the university and wants to exercise copyright termination rights?
5. For works published electronically and made available in a networked environment, how will universities ensure the integrity of the work? How can authors be protected against unauthorized adaptation of a work?
6. Will universities be able to make available the technical staff to assist authors who are unfamiliar with computer technology if their work is to be published in this format?
7. How will universities be able to support and manage databases they create to distribute faculty-produced works?
8. How can universities fund the necessary copyright management staff that will be needed? Will funds be freed by cancellation of expensive and no longer needed journal subscriptions, or can other sources of funding be found?
9. Can universities orchestrate needed changes in their tenure and promotion standards to embrace electronic publishing for their faculty scholars?
10. Assuming that the integrity of the article can be ensured by the university, will faculty authors be concerned about misuse of the work? If so, what mechanisms can be developed to alleviate any potential problems?

These issues must be addressed in addition to those copyright problems raised by this article. This article merely scratches the surface of the scope of issues regarding copyright that must be addressed if scholarly publication in electronic format and distribution through networks is to become a standard means for the distribution of scholarly articles. Such publication already is occurring and answers must be found if faculty authors are to be encouraged to publish their scholarly works electronically.

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American Geophysical Union v. Texaco, Inc., 37 F.3d 881 (2d Cir. 1994).


Archival Issues in Network Electronic Publications

Maynard Brichford and William Maher

Abstract
Archives are retained information systems that are developed according to professional principles to meet anticipated demands of user clienteles in the context of the changing conditions created by legal environments and electronic or digital technologies. This article addresses issues in electronic publishing, including authentication, mutability, reformatting, preservation, and standards from an archival perspective. To ensure continuing access to electronically published texts, a special emphasis is placed on policy planning in the development and implementation of electronic systems.

Introduction
Archives are information systems retained for their long-term value—or, if one is an optimist, their permanent value. Archival theory and practice are based on seven areas of professional responsibility. Archives are established, administered, and evaluated by institutions, organizations, and individuals to ensure the retention, preservation, and utilization of archival holdings. They are authenticated by analyzing their content and obtaining evidence of their source during the process of their accession. They are appraised or evaluated on the basis of their anticipated use in relation to the costs of description and long-term retention. They are arranged according to source in the original order or structure in which they were kept while in active use. They are described in inventories, finding aids, and guides.
to facilitate long-term access to their informational content. They are preserved to assure their future availability in a safe environment and on media that will remain accessible or renewable for the period of anticipated use. They are used to explain the past, provide guidance in the present, and accountability to the future.

Archival programs are the repositories of information systems from all types of persons and organizations. They must cope with vast accumulations of recorded data, as well as languages and formats representative of all past and present recording technologies. The three principal categories of archival materials are official files of institutions and organizations, publications issued by such bodies, and personal papers of individuals. Archival holdings in each of these areas are unique in the sense that they are treated as aggregates accumulated by a specific person or corporate body. Electronic information technologies have had profound effects on aspects of all of these categories.

Large quantities of information have been generated, transmitted, received, and stored on electronic disks, tapes, and other formats. The primary archival concern with regard to electronic publishing is that the published material should be transferred to archival custody. When the transfer occurs, the archivist must address the issues of authentication, appraisal, arrangement, description, and preservation or physical protection. These responsibilities are closely interrelated. Most archival holdings are not identical copies of information obtainable in other repositories, so they are appraised, accessioned, and retained according to their potential value and the anticipated costs of processing, preservation, and retention. Authentication and anticipated use have a direct effect on appraisal. Description and preservation of the information affect both its future availability and value.

As custodians of aging information systems, archivists are aware that they maintain information, not artifacts, and that reformatting is an essential tool of their practice. Few archives have sufficient intrinsic value to justify expensive efforts to ensure the long-term retention of original formats (Mitchell, 1956, pp. 139-42; National Archives, 1978, pp. 1-6). The most effective way to satisfy archival requirements for handling electronic information is the establishment of procedures and standards to ensure that valuable material is promptly transferred to archival custody in a format which will permit access on equipment that will be readily available in the future. Few archives will have the resources to copy data from obsolete formats for use on each future generation of software and hardware. Textual, quantitative, and graphic information on paper has been the standard format for the issuance of official or formal information. Archival copies are often
published or printed out with a date and an indication that the information is a record copy. Given the markets for competing standards and revisions, scanners may provide an acceptable option for converting information on paper to future electronic formats of choice. Long-term costs and access requirements are the crucial factors in determining how much information should be retained in electronic formats.

Electronic publications include journals and periodicals, books and monographs, newsletters, bulletin boards, and open interest-based listserv communications. It excludes e-mail and personal communications between individuals. All recorded, published, or disseminated information in electronic devices has a physical existence, including:

1. a location (hard drive, diskette, or tape);
2. a structure or organizational framework (program) for data entry, storage, and retrieval;
3. variable data entered by humans or systems designed by humans;
4. telecommunications or a means of communication or distribution of the information to an extended group; and
5. transmission standards.

As information ages, the user clientele shifts from subscribers to commercially viable or subsidized networks to researchers whose primary interests are in searching older information for “leads” and in understanding the developmental processes represented by information systems. The results of scholarly research are published to meet current user interests. Many current scholarly publications are a means of mass communication and represent both the product of research activity and a source for future investigations. Noncirculating record copies of such publications are transferred to archives as evidence of the functions of the agency disseminating the information. The principal archival interest is in the long-term or secondary use of information. Such uses are more likely to relate to process or the context of events rather than specific transactions. With the passage of time, scholarly studies of archival information systems can benefit from increased detachment and perspective and the loss of substantial portions of detailed information, which is destroyed after a few years.

AUTHENTICATION

Authentication involves a determination of the validity or integrity of information. Integrity requires the unbroken custody of a body of information by a responsible authority or individual. Continuous custody is assured by providing policies and rules for changes and by
the arrangement of information so that the creating agency is identified and the dates and parties responsible for additions, modifications, and deletions of records are recorded. Publication or distribution of multiple copies by providing multiple access points for copying should also be documented to establish the authenticity of the information. Authenticity is a condition precedent to the appraisal of information systems because what will be kept depends on the credibility of information (Graham, 1994; Brichford, 1977).

Cost, mutability, and miniaturization of information affect the choice of an electronic format and often result in a medium that has a relatively short life. The original is the first recorded version of information. In the case of electronic media, it may be revised, copied, or deleted with ease. Information in such formats may be suspect due to the ease with which it may be altered. From an archival perspective, the value of information is dependent on its content and the custodial responsibility of the agency that maintains it—e.g., the source determines authenticity. The authentication of archival information requires that it be verified as to source, date, and content. The mutability of electronic network data is a common characteristic of aging information systems. Chronicles or reference data have been updated at regular intervals by adding new information. Electronic publications may be supplemented at any time provided the circumstances of the additions are stated and provided that existing data are not altered. Information that is mutable, modifiable, or changeable loses its validity if the persons adding, altering, or deleting information cannot be identified and the time, place, and nature of the changes is unknown. The long-term retention of electronic publications is also a problem because of the lack of archival standards of permanence for digital storage media.

**Preservation is Access**

The proper consideration of the preservation of electronic texts must start by reexamining the very purpose and meaning of archival preservation because the requirements of electronic texts are fundamentally different from traditional library and archival materials. To date, most literature and professional association offerings on preservation consist of detailed descriptions of techniques and technical standards employed to increase the longevity of physical media. Without discounting the importance of these technical issues, the archivist's and librarian's preservation responsibility is better understood as a matter of ensuring the future availability and intelligibility of the informational content of documents.

In this sense, preservation is more a matter of access to information than it is a question of survival of any physical information storage media. In fact, by looking at electronic information systems and
technologies, one can see clearly that what matters most to the user is the survival of the information itself and the access points provided by the system and not the specific hardware, or even software, on which information is stored.

**Traditional Preservation Considerations**

Protection of the physical media or information carrier is not entirely irrelevant, and a brief review of the threats to the physical survival of library and archival materials is a useful starting point because many of these same issues pertain to the physical longevity of electronic storage media. The conditions which influence the longevity of materials and the nature of preservation work can be categorized as internal and external. Internal conditions arise from the nature of the material on which information is recorded. For example, the longevity of paper documents is heavily dependent on papermaking processes, especially since the 1860s when lignin in wood fibers and chemicals used to process wood into paper resulted in the development of acid compounds that have caused paper to become brittle, stained, and fragile. Other media, such as photographic prints and negatives, sound recordings, videotapes and computer tapes, disks, cards, and perforated tape, present comparable problems because of the chemical instability or fragility of materials ranging from glass plates and nitrate films to acetate tapes and oxide coatings on tapes. Generally there is little that can be done about internal or inherent characteristics of the documents other than replacing the media through expensive and often imperfect methods of recopying or performing major chemical and physical treatments such as deacidification and encapsulation.

Regardless of media type, external threats are considerable. Light, especially ultraviolet, fades inks and photographic images. Heat accelerates the acidification of paper and the chemical and physical breakdown of nonpaper media. For example, excessive heat can cause the oxide coatings on which magnetic signals are recorded to separate from the backing of audio and videotapes. Excessive moisture, whether atmospheric or liquid, causes considerable damage—inks run, papers and photographs fuse together, molds and mildews grow. Atmospheric moisture also acts as a catalyst for the acidification of paper. Air pollution causes damage both through particulate matter and gaseous fumes such as sulphur dioxide and nitrogen dioxide, which are especially harmful to plastic-based materials. Insects and rodents damage documents both through their chewing and droppings. Adjacent materials pose a serious threat. Particularly harmful are newsprint clippings, paper clips, pressure-sensitive tape, rubber bands, inadequately sealed wood cabinets or shelving, and magnetic
fields, which can weaken and destroy information on tape recordings or computer diskettes. Perhaps the greatest external danger to documents is posed by humans who expose records to all of the hazards listed above during their creation, archival processing, and research use. Through carelessness, and occasionally maliciousness, humans erase, destroy, and steal documents.

To address the diversity of threats to the longevity of documentary material, archival preservation traditionally has focused on techniques to extend the longevity of the information carrier. Common preservation work has included: controlling temperature, humidity, and light in stacks; physically protecting materials in boxes, containers, or encapsulations; cleaning and removing harmful materials; neutralizing acid in paper; and educating records creators, staff, and users in safe handling techniques. For modern documentation, recopying documents onto archival-quality materials—e.g., silver halide microfilm or acid-neutral paper—has become an important aspect of preservation.

**Preservation of Electronic Media**

In the threats to traditional documentary materials, one can see several hazards to electronic media, whether "floppy" diskettes from an author's personal computer or a mainframe's mass-storage disk packs and tapes. Applying the paradigm used for conventional archival materials, one would examine the chemical and physical composition of computer disks and tapes, the volatility of the plastics, the stability of the recording strata, and then employ accelerated aging tests to assess the effect of environmental factors such as humidity and airborne gases (see Cuddihy, 1980, pp. 558-68). After all this research, one could outline standards for "archival quality" storage media and environments. These are important activities about which archivists should be well informed, but to approach the preservation of electronic texts by focusing on physical threats will miss the far more pressing matter of ensuring continued accessibility to the information on such storage media.

A different approach to electronic texts is needed for three reasons. First, unlike conventional paper and photographic materials which remain eye-legible even in advanced states of deterioration, electronically-recorded information can only be examined and used if the hardware and software on which it was created remains available and operative. A twenty-year life for the plastic backing material used for computer tapes and disks is irrelevant if the tape or disk drives on which they were recorded become obsolete and unavailable after ten years. What remains is not the information but a long-life physical artifact that rather ironically might find its best use as a paperweight.
(Stielow [1992, p. 339] cites one such example in which even the manufacturer was unable to provide the software necessary to read a five-year-old CD-ROM).

Second, the usable life of physical media for electronic information storage has progressed to the point where, with reasonable operating precautions, it is now greater than the life cycle of most software and hardware used to access the media. Certainly disks and tapes can be damaged through accident and carelessness, but the actual media are stable enough to survive until the information can be recopied and verified onto new media (for a bibliographic introduction to literature on the preservation of magnetic recordings media see Child, 1993). In addition, recopying is an option for digital information which can be copied faithfully multiple times without image degradation, unlike conventional materials, including audio and videotapes. Thus, preservation actions can and must be taken at regular intervals, far closer to the original creation and use of the electronic information.

Third, a different approach to the preservation of electronic texts is needed because of the increasing complexity of information on such systems. Merely ensuring the longevity of a computer tape and providing a means to read the files it contains will not necessarily preserve the complex nature of information linkages that are at the core of the most interesting electronic publishing ventures. Simple "dumps" of files or printouts of data, as one might do in adherence to the traditional preservation practice of reformatting, will not preserve the dynamic nature of access systems or the hypertext links in electronic publications. In such cases, the access points and linkages can be a key part of the original publication and thus must be maintained if one is to truly "preserve" the document.

By examining the relation of traditional archival preservation to electronic publications, it becomes clear that there are only three options for ensuring ongoing accessibility:

1. The texts can be off-loaded by printing onto hard copy once sufficient time has elapsed that electronic and interactive access is no longer critical.
2. The original storage media, software, and hardware can be retained to allow continued access to the system. Under this option, the publisher, library, or archives must become a hybrid of a museum and a specialized electronics laboratory.
3. The data, access systems, and hypertext linkages can be continually converted and verified as each generation of hardware and software is replaced or upgraded.

All factors being equal, the third option is preferable. However, it may be viable or appropriate only in circumstances where electronic
publishers have the incentive to provide the considerable resources required, and where there is a substantial ongoing user community interest in the information.

EDITORIAL AND ADMINISTRATIVE POLICY ISSUES

Implementation of any of these options illustrates the fundamental difference and challenge of electronic information systems. If the information is to remain accessible as long as paper, preservation must be a front-end, rather than an ex post facto, action. With paper-based information, publishers, librarians, and archivists can simply warehouse texts, preferably in research repositories and under environmental controls, and then wait to see if research demands develop over the years sufficient to justify the cost of reformatting or other preservation steps. With electronic data, if one simply waits for user communities to emerge, the means to convert data are likely to be long since unavailable by the time that the next cycle of users emerges and new questions for old texts are posed.

Consequently, the preservation of electronic texts is first and foremost a matter of editorial and administrative policy rather than of techniques or materials. Those who create texts, both authors and their publishers, must take a central role in considering long-term accessibility. Among the most important editorial questions to be faced at the establishment of an electronic publication is an existential one: Are the publication and the texts that it contains worthy of long-term accessibility, or is the information only of transient, even if critical, value? As a practical matter, unless the electronic publication has in place a mechanism to ensure ongoing access at least as long as what would be available through printing on acid-neutral paper, the publisher is de facto saying that the author's work does not have long-term value even if it merits rapid electronic dissemination. By placing his or her work in an electronic publication without plans for long-term accessibility, the author is saying that the work does not have permanent value.

Not all electronically published products of scholarly research merit long-term accessibility. For example, an electronic bulletin board posting summaries of recently completed research may have little long-term value if its function is to be a prepublication notice of items to appear later in paper or electronic texts or journals of record. What is needed in all cases is a difficult editorial decision on the continuing value of information. Nevertheless, with electronic information, archivists and librarians have to face the difficult collection development or appraisal issue of assessing value without the benefit of time to see the evolution of scholarly writing and research.
Because of the considerable costs involved in creating and maintaining the infrastructure that permits ongoing access to electronic publications, and because of the extent to which commercial and market considerations have so dominated publisher and library relations, action on these items will require a fundamental reconsideration of the relations among authors, publishers, librarians, and archivists. Authors will need to consider future accessibility of their work when they choose a publisher. Publishers’ responsibilities will have to go beyond the traditional role of simply distributing texts and instead extend into providing for the disposition of texts. Otherwise they will be delivering products of increasingly dubious utility because of their rapid obsolescence.

Librarians and archivists can play an important role in new relationships with publishers and information providers. Both are aware of the ways people use information especially for purposes well beyond those envisaged as the audience by the author or publisher. In a more structured relationship with publishers and authors, archives and libraries might serve as depositories for either hard copy “dumps” of electronic texts or as predesignated repositories for access systems that will enable long-term research access to electronic texts. With careful up-front planning involving publishers, their boards, librarians, and archivists, the mechanisms to allow long-term research access can be established. However, a continuance of the laissez-faire system that has evolved for traditional paper and commercial publication will ensure the loss of authors’ texts and extraordinary costs for libraries and archives as they strain to meet users’ inquiries.

Ultimately, the preservation of electronic publications cannot be solely an archival issue but an administrative one that can be addressed only if the creators and publishers take an active role in providing resources necessary to ensure that ongoing accessibility is part of initial system and product design. Although substantial costs might be involved, there are important administrative incentives to incorporating preservation/continued accessibility into initial production. Furthermore, scholarly publishers and text-based vendors will be able to improve the attractiveness of their product when they can offer assurances of indefinite future access. Certainly some commercially oriented electronic publishers who make no provision for maintaining texts may be able to offer cheaper products, but they will in effect be offering nothing better than the electronic equivalent of newsprint for works that both authors and users believe have an enduring, if not timeless, value.

Electronic publishing has an undisputed advantage in providing rapid and broad distribution, but unless it provides assurances for ongoing accessibility, it will not be able to fulfill key substantive and
"political" roles of scholarly publishing. At its most basic, the purpose of scholarly publishing, whether electronic or paper, is to disseminate an authentic account of research findings for use by the present and for examination and re-interpretation by the future. The very terminology used for key publications as "journals of record" or "archival proceedings" reflects this critical need for scholarly publications to provide a permanent record of the development of knowledge in each discipline. In practical terms, "publications of record" also play a central role in the academic process, especially in the evaluation of scholars for appointment, tenure, and promotion. Even after the issue of peer review for electronic publications is resolved, enduring accessibility of a scholar's publications will be an important factor if authors and publishers expect electronic publications to be credible elements in promotion reviews. Without publications and journals of record, colleges and universities will be hard pressed to ensure the quality and integrity of their faculties. This is not to suggest that merely ensuring indefinite future access to electronic texts will improve the academic evaluation process, but unless ongoing access is considered, it seems unlikely that electronic publication can be a significant means to disseminate key scholarly texts.

**Technical Steps**

When preservation issues are pushed to the fore during the planning and development of electronic publications and when they are appreciated as matters of administrative and editorial policy, the resolution of technical questions actually becomes simplified. If publishers start with the understanding that they have to provide for long-term accessibility of texts, they will resolve access questions long before current hardware and software become obsolete. Preservation needs can then be met through standard management practices such as daily system backups, off-site storage of backup tapes, thorough system documentation, and quality control over purchases of hardware and storage media. In all those cases where the published text is deemed to be of such ongoing interest that it will be continually provided online, preservation should be indistinguishable from daily system maintenance.

In those cases where the published text may not merit the costs of continuous live and broad access, additional work will be needed. First, through an editorial and management process, involving authors as well as librarians/archivists, the long-term value of the text will have to be assessed, and the best mechanisms to permit continuing accessibility will have to be identified. The archival model of records disposition scheduling can be of enormous utility here because it lays out a mechanism for systematic review and scheduling of the disposition of information.
Technologically, the most critical element for the preservation of, and ongoing accessibility to, electronic texts is the adherence to standards in designing the structure and content of the texts. Since ongoing access will necessitate the movement of text from one system to another to maintain currency of hardware and software, information will have to be encoded in a readily transferable format. The most promising way to achieve this transportability is through use of the Standard Generalized Markup Language (SGML) which was accepted as a standard by the International Standards Organization in 1986. Although seemingly clumsy on first examination, SGML is actually quite flexible and has the enormous advantage of supporting not just the encoding of text but also formatting information and data linkages (e.g., hypertext). Because it is a standard, it allows transportability across hardware and software platforms (Bradley, 1992, pp. 271-74; 1994, p. 10).

An encouraging development is that SGML has been considered to be a critical element for electronic publishing because of its transportability and because it supports multiple representations of a single text (e.g., the Association of American Publishers [1987 has produced a guide for the mark-up of documents for typesetting and printing). This illustrates the convergence of production and archival issues as both publishers and librarians consider the fundamental changes brought about by electronic information systems. In the process, both the nature of preservation and publication are being reconsidered. The principles and mechanisms are already available to resolve these issues to the mutual benefit of authors, publishers, and librarians. Still critically needed are the plans and resources to ensure that the future accessibility of information is secured before products are marketed. This is no small challenge since the momentum of market-driven publishing and feature-laden technology continues to be so overwhelming that the greatest emphasis appears to be on rapid issuance and marketing of products.

Access and User Services

User access to archival material may involve a conflict between the rights of privacy and confidentiality and the public rights of freedom of information. Underlying all questions of access is the fundamental consideration of cost. The concept of free access to all published information in the public domain is in opposition to the constitutional protection extended to corporate or individual rights to compensation for the use of intellectual property. Examples of the complexity of such conflicts are afforded by public subsidies of for-profit information services and the private marketing of public information. The marketability and rapid dissemination of electronic publications also provides new and fertile ground for litigants.
CONCLUSION

The publication of electronic information for network access represents a contemporary information delivery system. Archivists must be aware of the process and consider authenticity in the appraisal of information. They must also preserve the content of contemporary information systems and provide access for current and future users. In these activities, they will have to confront and employ rapidly changing technologies, face legal issues surrounding authenticity and property rights, recognize the necessity for the early incorporation of preservation measures into information systems, and serve user clienteles that expect rapid access to archival holdings.

REFERENCES

Economic Issues Concerning Electronic Publishing and Distribution of Scholarly Articles

DONALD W. KING and JOSÉ-MARIE GRIFFITHS

ABSTRACT

While there have been literally hundreds of articles and other publications dealing with electronic publishing, few go beyond expressions of opinion or speculation. Very few recent publications, even those having the term "economics" in their titles, provide any empirical evidence concerning these speculations. This article presents some economic issues, provides some quantitative evidence concerning the economics of scholarly journal publishing, and extends these data to examine the economics of electronic publishing. It is believed that publishers and librarians alike tend to apply traditional economic approaches to journal publishing in which economic competition is among journals. However, evidence shows that consumer choices are in fact among alternative ways of obtaining needed information and the attributes of the alternative sources of information rather than choices among journals. Readers of scholarly articles appear to apply a valid economic rationale to deciding from which source to obtain needed information. These economic choices appear to drive the current journal market demand and may do so for electronic alternatives in the future.

INTRODUCTION

This article deals with the economics of four types of electronic distribution of scholarly articles. The first type of electronic distribution is what Elder (1994) calls "full-text journals online." These are
full texts of journals made available online by commercial database vendors such as DIALOG, BRS, STN, and Lexis/Nexis. In a sense, this distribution is like electronic delivery of interlibrary loans (or articles obtained through document delivery services). Schauder (1994) calls this type "publishing via commercial database hosts." Elder states that, among the various vendors, several hundred titles are available, most of which are in business and law. A second type of electronic distribution is what Elder calls "image files on CD-ROM" and Schauder describes as "publishing via portable electronic media" which are journals found on CD-ROM. ADONIS and University Microfilms are the principal sources of such journals. Some of the articles are found in CD-ROM only, but most articles on CD-ROM are also available in print. Elder reports that Ulrich's (1992-93) lists 559 serials available on CD-ROM of which only 107 are journals or newsletters. A third type of electronic distribution is called "true electronic journals" by Elder and "publishing via the Internet and related academic networks" by Schauder. These are journals made available only by electronic distribution using the Internet or other networks (at minimal or net cost). Elder indicates that few journals are accessible in this manner. A fourth type of electronic publishing, discussed here because of extensive interest at the current time, deals with the idea that academically written scholarly articles be published by university presses and libraries. Patricia Battin (quoted by Franks, 1993) succinctly captured the widespread sentiments of the academic community by pointing out that:

The advent of electronic capabilities provides the university with the potential for becoming the primary publisher in the scholarly communication process. At the present time, we are in the untenable position of generating knowledge, giving it away to the commercial publisher, and then buying it back for our scholars at increasingly prohibitive prices. The electronic revolution provides the potential for developing university controlled publishing enterprises through scholarly networks supported either by individual institutions or consortia.

Some, such as Okerson (1992), have suggested that such arrangements can avoid many out-of-pocket costs by simply providing free access to these academically produced articles, presumably like interlibrary lending (at least until recently).

There are four basic economic topics that this article will address:

1. the nature and size of the scholarly journal system (at least in the United States),
2. scholarly journal system costs,
3. economics related to the demand for sources of scholarly articles, and
4. economics related to the supply/publishing of scholarly articles.

The next four sections deal with these topics. Following them is a section that discusses the relative importance of these economic issues and how they might affect the four electronic publishing alternatives mentioned earlier. Note that, while an abundance of quantitative economic data concerning scholarly journal publishing was published in the 1960s and 1970s, there is a paucity of such data in recent publications (aside from readership data). There are hundreds of articles on scholarly publishing and on electronic publishing (see, for example, an excellent review by Schauder, 1994, with just over 200 references and the 1992 Serials Review on economic models for networked information); few of the recent references provide more than opinion or speculation.

The Nature and Size of the Scholarly Journal System

Scholarly journals clearly dominate in the amount of information published and read in science, engineering, and medicine and, to a lesser degree, in other scholarly fields. In science (including engineering), the number of journals and the number of scholarly articles has grown dramatically since the genesis of such publishing. In fact, this type of recorded knowledge has doubled in quantity about every seventeen years, a trend which persists today—e.g., in the United States, the number of articles published has increased from 208,000 in 1960 to 382,000 in 1977 to 601,000 in 1990 (see Griffiths et al., 1991; King et al., 1981). However, these numbers tend to reflect the growth in the number of scientists and engineers. Evidence over a twenty-five year period shows that the number of scientific scholarly articles published per scientist or engineer has increased and then decreased slightly (0.110 articles per person in 1965; 0.155 in 1977; 0.114 in 1985; to 0.104 in 1990). The majority of scientific articles are written by scientists at universities and government laboratories. There are many reasons why scientists write articles, including requirements (implicit or explicit) by funding agencies that they do so, the often reported "publish or perish" syndrome, and so on. We believe that documenting research is an integral and enhancing aspect of creativity, and that many authors recognize this. In addition to those who write for the pleasure of it, we also believe that many write for the altruistic purpose of wanting to share their research results and creative ideas with others.

There has long been a misconception of the extent to which articles are read and used, at least in scientific fields. Two lines of inquiry, started in the 1960s, led to the belief by many that journal articles are infrequently read and not particularly useful. The first of these was a series of
studies by Allen (see for example, 1988, 1966) and others (see for example, Rosenbloom & Wolek, 1967; Tushman, 1979; Shuchman, 1981) in which researchers (primarily engineers) were asked to indicate sources of information they used to help address a specific research project. They all found that engineers tend to use interpersonal communication extensively, and they rely on internal technical reports more than on the formal published literature. Later, Allen (1988) pointed out that the literature is the primary source used for two scientific research projects (Rosenbloom and Wolek [1967] reported similar results). Thus, journal articles are particularly useful in scientific research.

In fact, all forms of communication fill special niches, depending on the purpose for the use of the information, time when needed, ease of access, desired depth and accuracy, required amount, cost, availability, and so on. Regardless of the frequency of use of a source of information (or the order in which sources are used), the usefulness and value of information when it is used can be considerable. For example, information obtained from library-provided articles has greater usefulness and value than articles obtained elsewhere, even though less reading is from library collections than from other sources (Griffiths & King, 1993).

Another line of research concerning scientific communication was pursued by Garvey and Griffith for the American Psychological Association (see for example, Garvey, 1979). During the 1960s and early 1970s, Garvey and colleagues also reported a small amount of reading of individual journal articles. Their research was performed by sending copies of tables of contents to a random sample of scientists and engineers and asking if they had read the articles. From the large samples of scientists and engineers, a median of about fifteen readings per article title distributed was observed and reported. In some instances (e.g., Griffith & Mullins, 1992), they reported that the median amount of reading per psychology article is about 200 when extrapolated from a 7 percent sample to the entire population. Both the 15 median readings and the 200 median readings have been quoted often. To some, these results have suggested that journals are not an effective means of communicating. From a statistical standpoint, however, the averages are somewhat higher than the medians since the observations involved highly skewed distributions of readings. Furthermore, the tables of contents were sent fairly soon after publication so that the amount of reading of articles beyond that time was neither included nor projected. The Garvey and Griffith data were reviewed and the results extrapolated to the entire population and over time (King et al., 1976). The time dimension was taken into account using an aging distribution. This produced an average amount of reading per article nearly five times greater than, for example, the
reported 200 readings per psychology article. Later, from a 1977 national survey of scientists and engineers, it was estimated that the average reading per psychology article is 858 readings (King et al., 1981). Garvey's method was later replicated partially to understand it better and to confirm the statistical validity of the two methods and resulting estimates (King et al., 1978). The Garvey and Griffith data continue to be misreported to this day (see, for example, Williams, 1975, in Schauder, 1994). Garvey and colleagues also presented strong evidence of the relative roles of various forms of scientific communication and when newly created knowledge shows up in various forms, again demonstrating that the various forms fill specific niches depending on their attributes and user requirements.

There is some indication that the average amount of reading per person (and time spent reading) has recently decreased somewhat as has the average number of articles published. The current amount of reading is estimated to be forty-seven scholarly article readings per year for professionals located in nonacademic environments (eighty-two readings for R&D professionals) and 178 readings for faculty and academic researchers. We believe that writing and reading may have decreased slightly over the years as a result of competition for professionals' available communication time. In particular, there is some indication that an increase in number of informal meetings one must attend, electronic mail, doing one's own word processing, and so on, are all detracting from time spent reading and writing journal articles (and other formal publications). On the other hand, there is overwhelming evidence of the continued usefulness and value of scholarly journal articles in both academic and nonacademic environments (see Schauder, 1994; Schaffner, 1994, for a summary of journal use and usefulness; and King, 1994, for a summary of the work of Allen, Garvey, and Griffith, and Pinelli et al.).

As shown in Table 1, scholarly articles are read most frequently by nonacademic professionals to apply to their work activities, although nearly one-third of the readings are for keeping up with the literature and 8 percent for communications purposes (Griffiths & King, 1993). Faculty also use journal articles primarily for their teaching (21 percent) or research (33 percent).

One indicator of the value of scholarly articles is the time professionals are willing to spend reading them—51 hours per year per professional in nonacademic organizations (86 hours by R&D professionals) and 205 hours in universities. Others, such as Pinelli et al. (1989), have observed similar results. Professionals and faculty would not expend this scarce resource (their time) on reading if the information read was not of considerable value to them. Professionals must read or they will simply be left behind. Since recorded knowledge doubles
Table 2.
Sources of Scholarly Articles that are Read

<table>
<thead>
<tr>
<th>Source of Articles</th>
<th>Proportion of Readings (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Academic Institutions(^1)</td>
</tr>
<tr>
<td>Personal subscriptions</td>
<td>51</td>
</tr>
<tr>
<td>Organization libraries</td>
<td>35</td>
</tr>
<tr>
<td>Shared department collections</td>
<td>8</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
</tbody>
</table>

about every seventeen years, scientists graduating from college will have been exposed to only one-sixth of the new knowledge that will be created during their careers and which they must master to be successful.

We have observed that performance and achievement are correlated to the extent of reading by professionals and academicians (Griffiths & King, 1993). The amount of work-related reading is found to be correlated to five indicators of productivity; reading is shown to lead to higher quality of work; reading results in substantial savings; those whose achievements have been recognized through awards and high level assignments read more than nonachievers; and, in one company, twenty-five persons designated as the “fast-trackers” read substantially more than their cohorts and others. Similar results were also observed in the 1960s (Lufkin & Miller, 1966). While a distinction is not made in these results for types of documents read, it is known that most reading and time spent reading involves scholarly journal articles.\(^1\)

SCHOLARLY JOURNAL SYSTEM COSTS

In order to examine the economic implications of electronic distribution of scholarly articles, one must determine all of the current functions associated with communication through journals and establish whether and how the functions might be performed by electronic means and the likely cost implications. To our knowledge, this has not been done recently. A list of functions and their costs were reported by King et al. (1981) for traditional scientific journal publications and by King and Roderer (1978) for electronic alternatives. These functions are listed below along with some current costs (Griffiths & King, 1993), and the 1977 costs are extrapolated by inflation factors.
Authorship. Average scientists' time preparing articles was 82 hours per article in 1977. The extrapolated 1977 cost (including salaries of authors and support staff, postage, etc. of writing and reworking articles, resubmission, etc.) is $5,470 per article. Author page charge fees are $490 per article.

Reviewing/referreeing. In 1977, reviewers averaged 6 hours per manuscript for those rejected and 6.25 hours for those accepted. The extrapolated 1977 cost (largely donated) of reviewing articles is $480 per article. This includes review and critical annotation.

Subject editing (donated). The extrapolated 1977 subject editing cost is $95 per article.

Editing. The extrapolated 1977 cost of review by editorial staff, submission to reviewers, decision to accept or reject, and copy editing is $67,900 per journal; $790 per article published; $10.80 per subscription; $0.09 per article distributed.

Composition and graphics preparation. The extrapolated 1977 costs are $102,500 per journal; $1,190 per article; $16.10 per subscription; $0.16 per article distributed.

Subscription runoff. The extrapolated 1977 cost of reproduction of the master image, assembly into journal issue, and distribution to subscribers is $16.00 per subscription and $0.16 per article distributed.

Separates runoff. Preprint and reprint extrapolated 1977 costs are $11.80 per article copy (138 copies per article average).

Miscellaneous publishing activities. Such activities include journal promotion, advertising, etc. The extrapolated 1977 costs are $16,600 per journal; $190 per article; or $0.03 per article distributed.

Library acquisitions. The extrapolated 1977 cost for new acquisitions (placement of order, follow-up on order, cataloging of new titles) is $224 per new journal. The cost for annual maintenance (receipt of journal issues and preparation for access and use) is $72.35 per journal. Annual storage cost is $14.04 per journal and weeding cost is $2.11 per journal. In 1993, the cost is estimated to be $68 per journal (not including new title acquisitions).

Library use. The extrapolated 1977 cost to libraries for use of journals in the library is $4.70 per use. Currently this cost is estimated to be $5.92 per reading ($1.61 per reading in current periodicals room). These costs include photocopying, reshelving, and indirect costs allocated.

Interlibrary lending and borrowing. The extrapolated 1977 cost is $27.14 to the borrowing library and $19.70 to the lending library. The current estimated cost is $18.07 per item borrowed ($19.12 per item via document delivery service) and $20.25 per item loaned. These costs include allocated indirect costs.
• Printed indexes. The extrapolated 1977 cost of printed indexes is $0.44 per article used.

• Automated bibliographic searching. The extrapolated 1977 cost of automated searching is $95.50 per online search or about $14.30 per article read. 1993 costs are estimated to be $160.17 per search or $23.90 per article read (including allocation of indirect costs).

• User acquisition costs. The 1993 cost to order, process, and retain a personal subscription is $9.80 per journal and cost to use (browsing, look-up, etc.) is $3.50 per article read. The cost to use a library article is $11.20. This includes about $8.40 in professionals’ time (salary, etc.) to visit and browse journals (based on an average of three readings per visit). Also included is an average of $2.80 photocopying cost per article read (based on 57 percent of readings resulting in photocopies being made). For all reading, this comes to $400 per year per person or $3.96 per reading (in nonacademic organizations).

• Reading articles. In 1977, scientists averaged forty-five minutes per article read or seventy-two hours per year at an extrapolated cost of $2,340 per year per person or $24.30 per article read. In 1993, this cost is estimated to be $2,970 per year per scientist (R&D) or $36.20 per reading (in nonacademic organizations), based on fifty minutes per article read.

In 1977, the total scientific and technical scholarly journal expenditure (not extrapolated) in the United States was estimated to be $4.7 billion or about $19.25 per article read. At that time, all the distribution channels leading to a reading were described and estimates developed in terms of the number of transmissions and costs. Quantities and costs for electronic alternatives were also estimated.

Economics Related to Demand for Sources of Scholarly Articles

The number of scholarly journal subscriptions varies with price. Classic pricing studies in the past that show this were conducted by Berg (1973) and Braunstein (1977). Recent evidence of this is described by Noll and Steinmueller (1992). They show graphs in which circulation is plotted against subscription price for 1,400 journals. They conclude that “the most important source of subscription price variation among scholarly journals is variation in their circulation” (p. 37). However, there are many factors that determine whether or not an individual or a library subscribes to a journal.

In both academic and nonacademic institutions, most readings result from browsing personal subscriptions, library-routed issues, or current periodicals found in library or department collections. Such
browsing generally keeps readers current with the literature, although sometimes the information has immediate use for research, teaching, or other activities. Browsing sometimes leads to use at a later time when a specific information need arises (13 percent of readings of articles over one month old are from articles that were previously read). Other means for identifying read articles include colleagues (19 percent), citations in another article (6 percent), citations in a printed index (3 percent), and automated bibliographic searches (5 percent).

Read articles are physically obtained from a number of sources including personal subscriptions,\(^5\) library copies, interlibrary borrowing or document delivery services, colleagues or authors, and so on. In Table 2, the proportion of readings of articles obtained from various sources is displayed.

The choices made by professionals from among sources of information appear to depend, to a large degree, on the following factors:

- price of personal subscriptions,
- membership in a professional society,
- discretionary funds available (organizations, grant, personal) for professionals to buy journals,
- number of times a journal is read,
- distance to library,
- age of article that is read, and
- purpose of reading.

Some evidence concerning the dependence of these factors is discussed later.

In the late 1970s, an economist from Charles River Associates, Inc. (1978) conducted an economic analysis of factors that explain
the probability that a professional will subscribe to a particular scientific journal. The five most important factors are listed in their order of importance (i.e., contributions to the probability of purchase):

1. availability of the journal in a library frequently used by the professional and convenience of the location of the library to the professional;
2. the subscription price;
3. the proportion of articles read for current awareness;
4. whether the journal is an association journal; and
5. the amount of professionals' expenditures on journals and other information services.

Obviously, the most desirable source is a personal subscription. However, readers are often forced to choose between subscribing and relying on journals that are available through their library. For current reading, the choice appears to be dictated by the trade-off between the personal subscription price (and relative ease of access and use) and the price paid in terms of one's time and effort to go to a library to read. Most older articles, say over two years, are obtained from a library—even when readers subscribed to the journal at the time the article was first published.

The price of a journal subscription clearly influences whether or not persons subscribe to scholarly journals and, as widely reported, journal prices are increasing at a much faster rate than inflation (see Figure 1 for evidence involving the increasing price of scientific journals and Table 3 in which data suggest that commercially published journals are worse in this regard than nonprofit publications).

<table>
<thead>
<tr>
<th>Year</th>
<th>Commercial</th>
<th>Society</th>
<th>Educational</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>$58.01</td>
<td>$49.13</td>
<td>$14.82</td>
<td>$21.83</td>
</tr>
<tr>
<td>1990</td>
<td>$91.35</td>
<td>$53.99</td>
<td>$13.59</td>
<td>$20.21</td>
</tr>
<tr>
<td>Percent of Change</td>
<td>57%</td>
<td>10%</td>
<td>-800%</td>
<td>-700%</td>
</tr>
</tbody>
</table>

In Table 3, the price increases by type of publisher.

In 1965, the average number of personal subscriptions was 5.0 subscriptions per scientist and the average increased to 5.7 in 1977 (King et al., 1981). Since that time, the average number of personal
subscriptions appears to have decreased sharply to about 3.4 at the present time (Griffiths et al., 1991). The proportion of readings from library-provided articles has increased substantially during that time period—from 18 percent in 1977 to 27 percent in 1984 and 35 percent currently.

Some data collected in companies and federal agencies demonstrate the economic trade-offs of purchasing a personal subscription versus going to the library to read a journal. Professionals average about $11.20 per article reading to use library copies of journals. Thus, it costs about $11.20 to read one article from a typical journal, $56 to read five articles from the journal, $280 to read twenty-five articles, and $896 to read eighty (or most) articles from a typical journal. The question is how this compares with the cost of reading from a personal subscription at these levels of reading. The latter cost includes three cost elements: the price of the subscription; the cost to order, receive, and retain it; and the cost to browse or access an article in

![Average Price Graph](image-url)

**Figure 1.** Average price of U.S. periodicals, all fields: 1975-1990.

Note: GNP Implicit Price Deflator was used to obtain 1982 constant dollars


order to read it (not including the reading time). For example, assume that a journal personal subscription price is $80. The ordering, receiving, and retention cost is estimated to be about $9.80 per journal and the cost to read (browsing, look-up, etc.) is about $3.50 per article read. Thus, the total cost of reading one article from this journal is $93.30 (compared with $11.20 using the library copy). The total cost of reading five articles is $107.30; twenty-five articles is $177.30; and eighty articles is $369.80 compared with $56, $280, and $896 respectively for reading five, twenty-five, and eighty articles obtained from the library. Referring to Figure 2, it is clearly less expensive to read articles from a journal in the library if there are fewer than twelve (11.7) readings from the journal, and less expensive to subscribe to the journal above that number of readings. At the extremes, say one reading and eighty readings, the average cost per reading is dramatically different. At one reading from the journal, it would cost $82.10 less to read the article in the library than to subscribe to

![Figure 2. Journal price and demand relationship (output versus usage).](image-url)
Table 4.
Distribution of Amount of Reading in Journals

<table>
<thead>
<tr>
<th>An Individual's Reading per Journal</th>
<th>Proportion of Readers (%)</th>
<th>Cumulative Proportion of Readers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 articles read</td>
<td>43.6</td>
<td>43.6</td>
</tr>
<tr>
<td>6-10 articles read</td>
<td>34.4</td>
<td>78</td>
</tr>
<tr>
<td>11-15 articles read</td>
<td>8.21</td>
<td>86.21</td>
</tr>
<tr>
<td>16-20 articles read</td>
<td>5.5</td>
<td>91.71</td>
</tr>
<tr>
<td>21-25 articles read</td>
<td>3.37</td>
<td>95.08</td>
</tr>
<tr>
<td>26-30 articles read</td>
<td>1.97</td>
<td>97.05</td>
</tr>
<tr>
<td>31-40 articles read</td>
<td>1.23</td>
<td>98.28</td>
</tr>
<tr>
<td>41-50 articles read</td>
<td>0.82</td>
<td>99.1</td>
</tr>
<tr>
<td>&gt;50 articles read</td>
<td>0.9</td>
<td>100</td>
</tr>
</tbody>
</table>

the journal. At eighty readings from the journal, it would cost $6.58 less per reading or a total of $526.20 less to read the articles from a personal subscription. Under the same assumptions, the breakeven point increases as the personal subscription price increases as follows (based on solving for \( x \)—the number of readings—in the simple equation $89.80 + $3.50x = $11.20x): 16.9 break even at $120; 39 readings at $200; 66 readings at $500; and 131 readings at $1,000.

Clearly under these assumptions, price increases can result in a dramatic shift from reading personal subscriptions to relying on alternative sources for the information, including a library. Some evidence of how this phenomenon might affect the demand for personal subscriptions is given in the next section, but first some caveats concerning the data that are discussed above:

- The trade-offs discussed earlier only include costs to the individual. The reason for this is that the choices made by individuals tend to consider only their time and costs. However, from the university, company, or agency's perspective, the library costs should also be considered.
- Clearly other factors (e.g., availability of the journal in the library, its availability in a shared office collection, journal routing, etc.) will affect the model.
- Also, the parameters of the model are variable, and therefore any departures from the assumed values will affect the economic trade-offs.
- Very little reading of articles over two years old comes from personal subscription issues, presumably because they are discarded.
TABLE 5.

<table>
<thead>
<tr>
<th>Sources of Frequently Read Journals to Which Scientists do not Subscribe and Reasons for Not Subscribing</th>
<th>Proportion of Scientists (90)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of Frequently Read Journals not Subscribed To</td>
<td></td>
</tr>
<tr>
<td>Borrow or obtain from colleague</td>
<td>21</td>
</tr>
<tr>
<td>Library copy</td>
<td>76</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
<tr>
<td>Reasons for not Personally Subscribing to Journal*</td>
<td></td>
</tr>
<tr>
<td>Readily available from colleague</td>
<td>10</td>
</tr>
<tr>
<td>Price of journal</td>
<td>66</td>
</tr>
<tr>
<td>Readily available from library</td>
<td>61</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
</tbody>
</table>

*Proportions do not add to 100 percent, since respondents could have more than one reason.

The reason for presenting a simplistic example is to demonstrate what may well be taking place, and considerable evidence supports this assertion. One weakness of the model is that professionals do not think of their time in terms of dollars, which were used in the example given earlier, although evidence suggests that their economic behavior roughly follows the pattern discussed. Some further indication of this economically rational behavior is given in the next section.

ECONOMICS RELATED TO SUPPLY/ PUBLISHING OF SCHOLARLY ARTICLES

In this section, the economic evidence discussed earlier is extended to the publishers' perspective. Under the assumptions discussed, the breakeven point between using a library and purchasing a personal subscription increases dramatically as the subscription price increases. Knowing the distribution of readership of a journal can help determine how price increases affect demand. Several studies have provided some useful evidence in this regard. Across readings, the distribution of current readings per journal is derived and presented in Table 4.
TABLE 6.
HYPOTHETICAL EFFECT OF PRICE CHANGES ON PUBLISHER’S REVENUES AND PROFITS

<table>
<thead>
<tr>
<th>Individual Reading per Journal</th>
<th>Breakeven Journal Price ($)</th>
<th>Number of Subscribers</th>
<th>Journal Cost ($)</th>
<th>Journal Revenue ($)</th>
<th>Profit or Loss ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 5</td>
<td>$46</td>
<td>5,640</td>
<td>$190,240</td>
<td>$259,440</td>
<td>$69,200</td>
</tr>
<tr>
<td>6 to 10</td>
<td>$85</td>
<td>2,200</td>
<td>$135,200</td>
<td>$187,000</td>
<td>$51,800</td>
</tr>
<tr>
<td>11 to 15</td>
<td>$123</td>
<td>1,380</td>
<td>$122,080</td>
<td>$169,740</td>
<td>$47,660</td>
</tr>
<tr>
<td>16 to 20</td>
<td>$162</td>
<td>830</td>
<td>$113,280</td>
<td>$134,460</td>
<td>$21,180</td>
</tr>
<tr>
<td>21 to 25</td>
<td>$200</td>
<td>490</td>
<td>$107,840</td>
<td>$98,000</td>
<td>($9,840)</td>
</tr>
<tr>
<td>26 to 30</td>
<td>$239</td>
<td>300</td>
<td>$104,800</td>
<td>$71,700</td>
<td>($33,100)</td>
</tr>
<tr>
<td>31 to 40</td>
<td>$316</td>
<td>170</td>
<td>$102,720</td>
<td>$53,720</td>
<td>($49,000)</td>
</tr>
<tr>
<td>41 to 50</td>
<td>$392</td>
<td>90</td>
<td>$101,440</td>
<td>$35,280</td>
<td>($66,160)</td>
</tr>
</tbody>
</table>

What this distribution says is that about 43.6 percent of professionals who read a journal (at least once), read five or fewer articles from the journal, 78.0 percent of the readers read ten or fewer articles, and so on. This means that if there are 10,000 persons who might read at least one article over the life of a year’s publication of a journal, about 7,800 persons will read fewer than eleven articles from that journal.

The average number of journals in which at least one article is read by a professional is 12.4 journals. The current estimated number of personal subscriptions is 3.4 subscriptions per person (with an average 5.6 of the 12.4 read journals found in libraries, 0.6 in shared department collections, and 2.8 from other sources). From the distribution discussed, the number of journals (of the 12.4 that are read) in which more than ten articles are read is estimated to be 2.7 journals (not much below the 3.4 average number of personal subscriptions). In fact, some journals obtained through personal subscriptions are infrequently read (and some above ten readings are from library copies and other sources). For example, 11.6 percent of journals which have five or fewer readings are personal subscriptions and about 2.5 percent of journals having over fifty readings are from libraries and shared office collections. This phenomenon mentioned earlier is to be expected because of varying distances to the library and prices of personal subscriptions.
A 1984 survey of scientists provided some reasons for not subscribing to frequently read journals (see Table 5). The principal alternative source is a library copy (76 percent of scientists), and the reasons given for using alternative sources include the price of the journal (66 percent of scientists) and that the journal is readily available from the library (61 percent).

Distance to the library will have some impact on the trade-off since the time of professionals is relatively expensive. Most of the cost of reading library copies is attributable to this time. Thus, if a person is far from the library, the library reading cost goes up and the breakeven point decreases thereby requiring more personal subscriptions. Some indication that distance to the library does, in fact, affect subscription decisions is as follows (Griffiths & King, 1993):

- Professionals close to libraries take fewer personal journal subscriptions than those farther away (2.8 subscriptions for those less than 10 minutes away versus 4.0 subscriptions for those ten minutes or more away).
- Professionals close to libraries and shared department collections read more from these sources than from personal subscriptions. Specifically, if professionals are:
  - less than five minutes away, 55 percent of their readings are from library and shared department collection copies;
  - between five and ten minutes away, 38 percent of their readings are from library and shared department collection copies; and
  - more than 10 minutes away, 25 percent of their readings are from library and shared department collection copies.

While the economic model mentioned earlier does not fully explain choices as to sources of journals used, it is a good indicator of what appears to be happening.

To demonstrate the effect of the distribution of readership on journal publishing, an example is given later in this discussion. This example assumes that there is a total of 10,000 readers of this journal's articles and that individuals will subscribe to journals only if their amount of reading is above the breakeven point. It further assumes that the proportion of publishers' fixed predistribution costs allocated to personal subscriptions is $100,000, and reproduction and distribution costs are about $16 per subscription. Under these assumptions, the breakeven prices, number of personal subscriptions, journal cost, revenue, and profit or loss would be as given in Table 6.

It is clear, under the assumptions given, that increasing prices result in reduced profit, and charging too much (e.g., over $200) would
lead to substantial losses to publishers. At 5,000 readers, there would not be a profit at any price level from personal subscriptions. The combination of this kind of price sensitivity and not understanding user choices may have led some publishers astray in their pricing policies. While noncommercial publishers are unconcerned with profits, their revenue must at least cover costs and, therefore, they must be concerned as well. Professional societies “bundle” a number of services in their membership fees and thus have been able to keep subscription costs relatively low (see Table 3).

**Library Article Borrowing Versus Purchasing Journals**

The choice between “borrowing” through interlibrary loan (or document delivery service) versus purchasing a journal is very much

<table>
<thead>
<tr>
<th>Subscription Price ($)</th>
<th>Breakeven Point (Readings)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50</td>
<td>6.8</td>
</tr>
<tr>
<td>$100</td>
<td>9.6</td>
</tr>
<tr>
<td>$120</td>
<td>10.8</td>
</tr>
<tr>
<td>$150</td>
<td>12.5</td>
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<td>$250</td>
<td>18.2</td>
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<tr>
<td>$500</td>
<td>32.6</td>
</tr>
<tr>
<td>$1,000</td>
<td>61.2</td>
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</table>

Source: Griffiths and King, 1993.

<table>
<thead>
<tr>
<th>Article Copies (Millions)</th>
<th>1980</th>
<th>1988</th>
<th>1993</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interlibrary loan</td>
<td>7</td>
<td>8.9</td>
<td>12.2</td>
</tr>
<tr>
<td>Document delivery services</td>
<td>1.9</td>
<td>3.4</td>
<td>6.8</td>
</tr>
<tr>
<td>Bibliographic utilities</td>
<td>0.3</td>
<td>1.7</td>
<td>5.6</td>
</tr>
<tr>
<td>Total</td>
<td>9.2</td>
<td>14</td>
<td>24.6</td>
</tr>
</tbody>
</table>
Figure 3. Comparison of the total cost of purchasing a $120 journal versus using a document delivery service.

like that of an individual's choice. If there are few collective readings from a library journal, the library should probably obtain article copies from interlibrary loan (or document delivery), and if there are many readings, the library should subscribe to the journal. Again, there is a breakeven point somewhere between amount of reading extremes depending on the price of the journal, number of times the journal is read, and ILL or document delivery attributes such as cost (including charges), ability to locate copies, speed of delivery, and photocopy quality (e.g., with photographs, etc.). In special libraries, library subscriptions average about 118 readings per journal per year, and journals in shared department collections average 38 readings (recognizing that these latter journals are generally maintained for less than two years).

Library subscription prices are often higher than personal subscriptions and library costs of processing are much higher. The fixed
cost to a library of a $120 journal is about $188 because of an estimated $68 cost for collection development, acquisition, ordering, claiming, storage, and so on. The library variable cost per article read in the library is about $1.34 per article read which includes photocopying and reshelving. Interlibrary borrowing comes to about $18.10 per item borrowed, including staff time, equipment, facilities, and overhead (or allocated indirect costs). The trade-off between these two choices is depicted in Figure 3. The breakeven point is 10.8 readings using the earlier discussed assumptions. As shown in Table 7, the breakeven point increases substantially as the subscription price increases.

Yet, because the collective amount of reading of library journals is so much greater than for personal subscriptions, the library demand is substantially less sensitive to changes in journal prices. For example, if a publisher more than doubles the price from $120 to $250, the breakeven point nearly doubles (from 10.8 to 18.2), but the change in price is likely to affect the decision to subscribe for only about 10 or 11 percent of the journals based on reading distribution observed in two academic libraries (Chen, 1972; Kent et al., 1978). Thus, the price increase would merely decrease demand by about 11 or 12 percent, and revenue (profit) would increase dramatically if all libraries have similar distributions of readings from their journals.

Of course the large price increases over the years have yielded fewer library journal subscriptions and, consequently, there has been a remarkable growth in number of article copies obtained by libraries from 9.2 million in 1980 to 24.6 million in 1993. Part of this growth is attributable to the borrowing versus purchasing trade-offs, where price increases lead to a trend toward borrowing. On the other hand, the amount of use of library copies has increased as a result of a shift from personal subscriptions to library use, thereby dampening the effects of price increases. However, federal and statewide support of multitype library networking, improved verification capabilities, faster fulfillment and delivery, the growth of document delivery services, and article availability through bibliographic utilities (e.g., CARL, OCLC, DIALOG, etc.) have also contributed to this growth. For example, as shown in Table 8, greater relative growth has taken place through document delivery and bibliographic utilities than interlibrary loan.

**ECONOMICS OF ELECTRONIC DISTRIBUTION OF SCHOLARLY JOURNAL ARTICLES**

**True Electronic Journals**

There are currently a few journals processed and distributed exclusively electronically (Elder, 1994). Some, including electronic distribution of preprints, appear to be very successful (see, for example, Stix's [1994] and Leslie's [1994] descriptions of Ginsparg's physics and
mathematics database and Harnad's *Psycoloquy*). It is assumed that any scholarly system in the near future will continue the basic functions now performed (i.e., authorship, peer review, refereeing, editing, electronic composition, etc.). Some have argued against continued peer review; however, arguments for its continuance are persuasive, at least to us (see Daniel, 1993). Technology can enhance and speed all of the predistribution functions, but this is true of paper-based distribution as well. Thus, unless electronic processes limit quality and format of text, thereby reducing display (and subsequent print-out) quality, the predistribution processing costs are likely to remain about $2,000 per article or about $3.10 per reading (at 640 average readings per article). This cost ($3.10 per reading) would be the absolute minimum a publisher or other entity would have to charge (royalty) to recover costs for an article read 640 times. Other publisher and reader costs would be electronic input to a database, storage and access costs; electronic transmission costs; request processing/invoicing; user costs for browsing or identifying, locating, requesting/display, print-out (if desired); and so on. Once these costs are established, one should compare subscription costs and electronic distribution costs (see Figure 2 where electronic distribution substitutes for "cost to use library"). Lesk (1992) suggests that incremental (i.e., distribution) cost is nearly zero (and without loss of quality), and the issue becomes one of who will pay the average cost. He also points out that there are no valid economic analogies to electronic publishing among many possibilities. A major question is who retains the electronic store of articles. Some favorable economies of scale would likely result if a large facility is used. It seems unlikely that with all costs included, the unit costs would be below $5.00 and could be as much as $15.00. This suggests that some readers should still obtain traditional personal subscriptions if enough articles are read.

It appears that the unit cost of accessing articles electronically would have to be well below about $4.00 per article read for this form to replace all personal subscriptions to journals (some argue that this is the case). Returning to choices made by individuals (see Figure 2) as an example, one could replace access from library copies by access electronically at, say, a cost of $8.00 per reading. Thus, the breakeven point would be about twenty readings. Referring back to Table 6, this would reduce the number of subscriptions from 2,200 to 830 subscriptions. About 67 percent of the 640 readings per article would be from journals read twenty or fewer times (i.e., 429 readings). For eighty articles in a traditional journal, the increased amount of revenue would be $154,400 at a charge of $4.50 per use (in addition to $134,460), and increased costs would be $34,300 (since $3.50 of the costs mentioned earlier are to cover an allocation of fixed
predistribution costs and about $1.00 is assumed to cover electronic distribution). Thus, the net revenue potential for electronic article distribution is substantial. Under the assumptions discussed, this appears to be a win-win situation in that readers pay less to obtain their information, and publishers have an opportunity for increased return on their investment. The disadvantage to publishers is that the new revenue takes place at the time of reading and not ahead of time when journal subscription revenue is received, thus reducing their positive cash flow somewhat.

Since $8.00 per reading for electronically provided articles is less than $11.20 per reading from journals provided in libraries, it would appear that library journals would not be used. Again, one can make a strong argument for the niche still to be occupied by library access to journals. In academic libraries, neither the students nor the libraries may want to pay $4.50 (cost to the publisher) for each article read electronically when the cost per reading of many journals found in academic libraries is far less than this amount. As mentioned previously, the distance to the library contributes substantially to the $11.20 library reading cost. Furthermore, for some, the average readings per visit will be many more than three. Thus, for many in an organization who are close to the library, reading costs will be less than the $8.00 cost per reading assumed for electronically provided articles. Finally, a substantial proportion of library readings are of older articles which may not be available electronically.

The example above is based on 640 readings per article. If there are one-half that number, the predistribution costs would increase from $3.10 to $6.20, but subscription price would likely increase as well. The net effect might be that journals or articles with low readership may be more amenable to total electronic distribution. Certainly, there are many high quality and useful articles that have a limited audience or readership which are now "covered" in journals by highly read articles in the journal. They must be considered for electronic distribution as well.

The demand for electronic distribution will depend on attributes of the information and the distribution of readings. Getz (1992) gives some examples of attributes (which he calls "values") of electronic publications and feels they must exceed performance of print. These attributes include readability, durability, portability, manipulability, storage costs, and the ability to index them.

Full-Text Journals Online

Electronic access to full text from commercial database vendors is somewhat like true electronic journals, except that predistribution costs are likely to be incurred only by traditional publishers, and they
would use vendors as a complement to traditional paper-based distribution. Royalties received from such electronic distribution are advantageous to publishers. This form of distribution may well displace the "other" sources of current reading (Table 2) and traditional interlibrary "lending" of scholarly articles. The latter depends in part on the edge of electronic holdings since a significant portion of articles obtained through ILL are older ones. Unit costs for this electronic means of distribution are likely to be less than for current interlibrary loan but higher than for true electronic journals because vendor costs must be added to current publisher costs. There is also likely to be a valuable niche for this form of electronic distribution as a partial replacement for readings now obtained from libraries (see Figure 2), when unit cost is less than the cost to use a library (e.g., when users are far away from the library), and as an alternative to personal subscriptions when the subscription price is high and/or the amount of reading in the journal is relatively low. In some instances, librarians may serve as intermediaries for this means of article distribution.

Image Files on CD-ROM

This form of electronic distribution is seriously being tested in a number of academic libraries (e.g., the TULIP experiment). It is assumed that not only will libraries acquire full text in CD-ROM but also will provide remote access to users by networked CD-ROM (LAN). To examine the economics of this electronic alternative, one can use Figure 2 as an example, where the cost of library use is likely to be significantly less (particularly when users are far away), thereby increasing the breakeven point and reducing the number of personal subscriptions. The costs of library use should be viewed from the perspective of the entire organization (i.e., user and library) since publishers will likely ultimately require royalty payments or site license for locally networked distribution, and there will be a shift in costs from users to the library. The library costs would include distribution costs and fixed costs of price, acquisition, retention, and so on (allocated by amount of use in the library versus remote access). Depending on the fixed costs already discussed, there will still be some need to obtain articles from infrequently read journals and/or articles. These may be obtained from true electronic journals or full-text journals online depending on their accessibility and cost. The economic trade-offs would be similar to those shown in Figure 3. Academic libraries are likely to remain the principal source for both paper and CD-ROM forms of scholarly journals because of student requirements and extensive faculty use. In companies and agencies, distribution from networked library CD-ROM copies is likely to replace journal routing.
Electronic Publishing and Distribution Through Academic Entities

Bryant (1994) provides a discussion of how the university press and academic libraries may collaborate to form a basis for future electronic publishing and distribution of academically created knowledge found in articles. The initiative for this alternative seems to be driven by the dramatic increase in journal prices, particularly prices of commercially published journals. The idea is that most scholarly articles are written, refereed, and read by academicians and thus the major costs of the scholarly article system are already borne by this community. With new technologies widely available, perhaps the “middleman” can be eliminated and costs significantly reduced.

While the concept is a compelling one, two economic considerations should enter into any serious thought regarding this electronic alternative. First, the total and unit costs of all of the current functions must be carefully determined. Some functions are likely to have distinguishable economies of scale in which the average or unit costs decrease as the number of units increase (up to a “critical mass” at which the unit costs approach an asymptote). Editing, arrangement for refereeing/review, composition, and means for identifying, locating, and accessing articles are all possibilities in which economies of scale should be determined and taken into account. Since authorship, review/refereeing, and some subject editing are currently “donated” costs, it has been suggested that editing costs also be donated by academicians. With most costs donated, it is assumed that the information can be distributed “free” or at a very minimal charge (ignoring the fact that the bookkeeping cost of charging any charge is in itself not minimal). Because of economies of scale, our concern is that this model could result in maximizing overall “system” costs (although some costs are hidden costs) rather than reducing costs.

Our second concern involves scholarly articles in science, engineering, business, and so on because most reading of these articles is in companies and government agencies and laboratories. The usefulness and value of this information is enormous in these settings (Griffiths & King, 1993). Thus, some provision should be made by academic publishers to distribute articles electronically (or in paper form) to this nonacademic community. This brings into question the suggestion of ignoring some donated costs and of not recovering costs (sometimes through exchange among universities). If university administrators object to footing the bill for nonacademic use of scholarly articles, some means of charging or royalty payments may be required. On the other hand, the electronic images could be turned over or licensed to a vendor or publisher for distribution. It is believed
that this issue of exchange among academic institutions may be much less a problem in some fields such as history, philosophy, and so on, since this literature appears to be largely read by academicians. For this reason, the latter fields might be better suited to this electronic alternative. However, Altbach (1989) says that: "In my view, at least for the social sciences and humanities, the traditional forms of communication are alive and well—and unlikely to be replaced by any kind of innovations in the near future" (p. 72). This is because of a general lack of interest on the part of the journal system participants.

**CONCLUSION**

We have described the nature and economics of the scholarly journal system, particularly in science and technology. Some simple economic examples are extended to four potential types of electronic distribution of scholarly articles. However, it seems clear that further systemic and economic examination is required before we in the information community can predict which of the electronic alternatives will surface in a prominent manner and the niches they will fill. Further economic analysis should be done of individual journal and article reading distributions and of detailed costs of all relevant functions. This was done in libraries in the 1970s for the reading of library journals (Chen, 1972; Kent et al., 1978), and similar reading distributions are needed for all sources of article reading. Future economic analysis should also take into account a distinction between small and large journals (i.e., those journals and articles having a small readership and those having a large readership).

Based on this sparse economic evidence, we speculate that electronic article distribution could result in the following scenarios over the next five to ten years:

- academic libraries will reduce the size of their scholarly journal collections but not substantially so;
- libraries in companies, agencies, etc., will also reduce the size of their scholarly journal collections to a greater degree than academic libraries;
- scholarly journals on CD-ROM will have a niche in both types of libraries but will not replace some current paper journals;
- all four types of electronic publishing are likely to survive, with each establishing a role depending on the amount of use and attributes of delivery;
- some large organizations and their libraries will begin to negotiate licensing arrangements with large publishers (i.e., those with a large number of titles) so that libraries can distribute articles electronically to their constituents (e.g., within a company, etc.) without copyright infringement;
personal subscriptions to commercially published journals will continue to drop dramatically unless prices are decreased drastically;

personal subscriptions through professional memberships will drop but not substantially;

reduced personal subscriptions will result in more use of library collections and electronic publications;

most distribution through interlibrary loan will be replaced by electronic distribution (exceptions being for older rare journal articles which will be processed by document delivery services at a high cost);

most external electronic distribution will be by one or more online vendors, depending on licensing arrangements by publishers;

universities are likely to play a role in electronic publishing of their faculty and student outputs, however, particularly for science and engineering, they may not be the sole distribution channel; and

electronic publishing will require new emphasis on navigational and search tools and support.

Grycz (1992) summarizes several models in reviewing papers presented in A Special Issue on Economic Models for Networked Information. These "models" are: benchmark print-based model; acquisition-on-demand model; national site license model; discipline-specific literature base model; augmented print model; distributed information model; and corporation for scholarly publishing model. These models describe "generic" ways in which electronic publishing might be done. None of the models is quantitative or mathematical in nature.

Lynch (1992) also prepared a reaction to the Special Issue papers in which he concluded that three options emerge from calls to action among the papers. In the first option, he indicates that an agreement with the existing rights holder is needed to allow the current print-based rights holders to make the transformation to networked information. He goes on to emphasize that the tradition is print based and, for the foreseeable future, networked information will merely be printed information stored and distributed using electronic technology. Virtually all of it will be published both electronically and in print. The same conclusion was reached by King et al. in 1981, but improved technologies and resulting economies since then are likely to push much more toward the electronic alternative. Unfortunately, few economic data exist to allow us to really know. Lynch goes on to suggest that "we need to develop an indigenous electronic scholarly publishing and communication system" involving electronic journals, databases, knowledge bases, bulletin boards, listservs and "other new flora and fauna" in the network ecology. Finally, he recommends developing "better tools for managing, navigating, filtering, and
mining both old and new resources." To that might be added the need to better understand the systemic and economic dynamics of current scholarly communication and the effects of relevant electronic alternatives.

Notes

1 Probably the most comprehensive set of studies conducted with engineers is by Pinelli, Kennedy, and Barclay and colleagues (see King [1994] for a summary of this impressive work).

2 Data are from a compilation of twenty-three proprietary studies of companies and government agencies and four national surveys involving over 10,000 survey responses from scientists, engineers, lawyers, and other professionals (Griffiths & King, 1993).

3 Data are from a survey of 451 faculty and researchers at the University of Tennessee, Knoxville, as part of a University Libraries needs assessment study in progress.

4 Reading is defined as going beyond the title and abstract to the text of the article. Time spent reading is estimated from questions asked in a "critical incident" study of reading.

5 Personal subscriptions are defined as those which are personally addressed to one at his or her home or office regardless of who pays for it.

6 Results from studies done for Procter & Gamble Co., DuPont, and the University of Tennessee.

7 Readership surveys asked questions concerning the article last read by the respondent. For the last article read, respondents were asked approximately how many articles were read the last year from the entire journal. Responses were weighted to account for the fact that articles from frequently read journals are more likely to be chosen in the survey than those from infrequently read journals.

8 The article costs for some scholarly journals may be substantially higher. For example, Odlyzko (1993) indicates that AMS reports mathematics articles' costs range from $900 to $8,700 with the median being about $4,000. On the other hand, both Odlyzko and Ginsparg in personal correspondence suggest that even $2,000 per article is much too high based on more recent evidence.

9 An example of this phenomenon has occurred in statewide interlibrary loan systems in which the system protocol is to distribute requests so that each library lends as much as it borrows. While seeming to be equitable, this policy ends up costing libraries much more than using large libraries for processing loan requests and fulfilling requests (see King et al., 1992).

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Olyzko, A. M. (1993). Tragic loss or good riddance? The impending demise of traditional scholarly journals. Available from: amo@research.att.com


Attitudes in Academia Toward Feasibility and Desirability of Networked Scholarly Publishing

F. W. Lancaster

ABSTRACT

This article presents the results of a survey of directors of university libraries and other academic administrators to determine attitudes toward a networked electronic approach to the publishing of research articles. A major conclusion is that academic administrators do not now consider the academic community well equipped to undertake an enterprise of this kind and would not give it high priority in the allocation of university resources.

INTRODUCTION

It is noteworthy that most of the discontent with the present publishing system has been expressed by library directors and other members of the library profession, and that the initiative behind the establishment of the new electronic journals has mostly come from academic researchers. Little has been heard from academic administrators on this issue.

A survey was performed to determine the attitudes of academic administrators, particularly those directly responsible for research, toward the feasibility and desirability of a networked electronic approach to scholarly publishing. A questionnaire (see Appendix) was mailed on November 17, 1993, to 309 administrators associated with rather more than 100 major research institutions in North America (i.e., universities whose libraries are members of the Association of Research Libraries). Recipients fell into two broad categories: (1) library directors, and (2) administrators who were assumed to hold responsibilities in the academic research area ("provost," "vice chancellor for
academic affairs," "vice chancellor for research," and similar titles). Ninety-nine of the questionnaires went to library directors and 210 to other academic administrators (a few directors and administrators who had participated in a pretest of the survey instrument were omitted from the mailing).

A single follow-up was mailed to nonrespondents on December 6, 1993. A deadline for receipt of returns was set at January 12, 1994. As of that date, 150 usable questionnaires had been received, an overall response rate of 48.5 percent. The response from library directors (72/99 or 72.7 percent) was much better than that from the other administrators (78/210 or 37.1 percent), which tends to support the fact that the academic library community sees this as a more pressing issue than does the academic administration at large. While the response rate for academic administrators was disappointing, it was not completely unexpected: the extremely busy individuals addressed tend to be the target of many surveys. Moreover, the survey was performed around the holiday season, a relatively tight deadline was established, and there was no aggressive follow-up (e.g., by fax or telephone).

The first of three questions on the survey identified ten possible advantages of the networked publishing approach and asked respondents to score each on a five-point scale for: desirability and probability of achievement. The results are presented in Table 1. The benefits judged most important are those associated with the potential for reducing the cost of disseminating the reports of research and for publishing them more rapidly. Also important are the potential benefits to the scholar trying to keep up with new developments in a field: more effective current awareness (through electronic profile matching) and the possibility of thus reducing information overload.

The questions suggested that a scholarly publishing network, freed from commercial interests, could give academia greater control over the results of its own research, might lead to more rigorous standards of acceptance in scholarly publishing, and could result in freer access to information (e.g., less copyright concern). Somewhat surprisingly, the potential for more rigorous publishing standards was not given a very high weight (some respondents pointed out that the pressure to publish would not diminish and that quantity might still be important).

From the earliest discussions on electronic journals (see, for example, Roistacher, 1978), a possible advantage that has been given some emphasis is post-publication peer review. That is, readers of a scholarly article can use the network facilities to comment on it, favorably or unfavorably, and the ensuing electronic discussion could stimulate further research ideas or approaches. Respondents were not enthusiastic about this possibility.

On the whole, the respondents were not optimistic that many of the possible advantages of networked publishing would actually be realized.
TABLE 1.  
POSSIBLE ADVANTAGES OF ELECTRONIC APPROACH, AND PROBABILITY OF ACHIEVEMENT*  

<table>
<thead>
<tr>
<th>Possible Advantages</th>
<th>Score for Perceived Desirability</th>
<th>Score for Probability of Achievement</th>
</tr>
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<tr>
<td></td>
<td>AA</td>
<td>LD</td>
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<tr>
<td>More rapid publication</td>
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<td></td>
<td>4.32</td>
<td>4.68</td>
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<td>Greater control by academia</td>
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<td>Freer access to information</td>
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<td>More rigorous publishing standards</td>
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<td></td>
<td>3.54</td>
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<td>Information overload reduced</td>
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<td></td>
<td>4.06</td>
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<td>Overall average</td>
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</tbody>
</table>

*The highest possible score is 5 on both desirability and probability scales. AA = academic administrators; LD = library directors; T = is the combined scores of both groups.

Most likely to occur is the more rapid publishing of research articles. Greater control by academia, freer access to information, and more rigorous publishing standards were not seen as very likely to occur. Somewhat anomalously, networked publishing might well result in improved methods for current awareness, but this was considered unlikely to reduce information overload on the individual.

The two respondent groups, library directors (LD) and academic administrators (AA), do exhibit some differences. Overall, the library directors are more positive about the potential benefits of electronic publishing but little more optimistic concerning probability of achievement. They are less optimistic that costs and information overload would be reduced. Perhaps most surprisingly, the library directors give more weight than academic administrators to the importance of greater control by academia and to the possibility of freer access to
information. The library directors were more positive toward new ways of presenting information in the electronic medium and felt more strongly that this is likely to occur.

The second question identified six possible obstacles to the implementation of a scholarly publishing network and asked respondents to indicate the seriousness of these on a five-point scale. The results are presented in Table 2. The greatest obstacles are those associated with the academic establishment's ability to implement, manage, and support a publishing network. In general, respondents feel that the academic establishment is not well equipped to take on the task and would be unable or unwilling to support it financially. Given the ready availability of high resolution workstations, readers are considered more likely to accept network publishing than authors are, although the academic reward system is not considered an impossible barrier (i.e., respondents feel some hope that refereed electronic publishing will be acceptable in promotion and tenure considerations'). The possible dangers of electronic publishing (e.g., associated with the immutability of an author's work) were not given great weight. The library directors and the academic administrators showed considerable agreement on the significance of these obstacles.

<table>
<thead>
<tr>
<th>Factors Affecting Implementation*</th>
<th>Significance as Obstacle to Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AA</td>
</tr>
<tr>
<td>Author acceptance</td>
<td>3.42</td>
</tr>
<tr>
<td>Reader acceptance</td>
<td>2.62</td>
</tr>
<tr>
<td>Academic reward</td>
<td>3.05</td>
</tr>
<tr>
<td>Organization and administration</td>
<td>3.79</td>
</tr>
<tr>
<td>Cost of implementation</td>
<td>3.79</td>
</tr>
<tr>
<td>Dangers</td>
<td>2.89</td>
</tr>
</tbody>
</table>

*On a 5-point scale: the higher the score, the more serious is considered the problem. AA = academic administrators; LD = library directors; T = combined score for both groups.

The final question (see Table 3) identified eleven possible priorities for the assignment of university resources over the next few years and asked respondents to weight their priorities, again on a five-point scale. Implementation of a scholarly publishing network was included to see how this would rate in comparison with the other priorities.
The academic library community will be pleased to see that support of the university library appears at the top of the ranking. Not unexpectedly, it is the highest priority of the library directors, but it is also the third priority of the other academic administrators. The library directors give somewhat greater weight to the student-oriented priorities (quality of undergraduate instruction, minority representation, and financial aid) and less to those that are faculty oriented (recruitment and retention, support of faculty research).

Among these rather major academic concerns, the subject of the survey, establishment of a scholarly publishing network, was the lowest priority for the academic administrators and close to the lowest for the library directors despite the fact that the "technological infrastructure" of the university is a high priority for both groups.

The survey instrument presented other opportunities for respondents to express interest in the subject of the inquiry. By supplying a telephone number where they could be reached, respondents indicated a willingness to discuss the issues further. Twenty-two of the academic administrators (i.e., 41 percent) and forty-six of the library directors (64 percent) did so. Sixty-four of the academic administrators (82 percent) and sixty-seven of the library directors (93 percent) asked to receive a report of the survey. Despite the low survey response from the academic administrators and the fact that they gave

---

### Table 3.
**Academic Priorities***

<table>
<thead>
<tr>
<th>Activities Ranked by Assigned Scores</th>
<th>AA</th>
<th>LD</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. University libraries</td>
<td>4.12</td>
<td>4.50</td>
<td>4.31</td>
</tr>
<tr>
<td>2. Undergraduate instruction</td>
<td>4.20</td>
<td>4.37</td>
<td>4.28</td>
</tr>
<tr>
<td>3. Technological infrastructure</td>
<td>4.05</td>
<td>4.46</td>
<td>4.25</td>
</tr>
<tr>
<td>4. Faculty recruitment and retention</td>
<td>4.32</td>
<td>3.93</td>
<td>4.12</td>
</tr>
<tr>
<td>5. Student minority representation</td>
<td>3.99</td>
<td>4.10</td>
<td>4.04</td>
</tr>
<tr>
<td>6. Faculty minority representation</td>
<td>3.97</td>
<td>3.96</td>
<td>3.96</td>
</tr>
<tr>
<td>7. Financial aid</td>
<td>3.71</td>
<td>3.93</td>
<td>3.82</td>
</tr>
<tr>
<td>8. Faculty research</td>
<td>3.92</td>
<td>3.71</td>
<td>3.81</td>
</tr>
<tr>
<td>9. Buildings</td>
<td>3.29</td>
<td>3.52</td>
<td>3.40</td>
</tr>
<tr>
<td>10. Network publishing</td>
<td>2.97</td>
<td>3.76</td>
<td>3.36</td>
</tr>
<tr>
<td>11. Community service</td>
<td>3.25</td>
<td>3.35</td>
<td>3.30</td>
</tr>
</tbody>
</table>

*On a 5-point scale. AA = academic administrators; LD = library directors; T = combined scores for the two groups.
networked publishing the lowest of priorities in the allocation of university resources, those administrators who commented on the survey were (almost without exception) strongly supportive of the idea behind scholarly electronic publishing. Some typical comments were:

"In principle, the vision described in the cover letter is exactly the way to go...I applaud this initiative."
— an Academic Vice President

"I think this is highly desirable nationally."
—an Associate Provost

"I think it will be transformed, with books as much as journals, and we need to prepare."
—a Vice President for Research

"It has to occur. The current system is too slow and too expensive."
—Vice President for Research

"This is extremely desirable. Some of us believe it's inevitable."
—an Associate Vice Chancellor

In at least one case, the survey was discussed in the Graduate Council of the university, and their response was a composite of the results of this discussion. Acceptance of electronic publishing by authors and by bodies involved in promotion and tenure decisions was the problem most often mentioned by administrators, although one Associate Vice President for Research claimed that "a major stumbling block will be the Association of Research Libraries which spearheads the measure of library quality by the count of books and journals on the shelves." Other administrators pointed out that needs and acceptance will differ from one discipline to another.

Comments from library directors indicate that many feel that the library must take a leading role in such a publishing transformation. They see the library community as more receptive to this type of enterprise than much of the rest of the academic community. Progress will be slow, they feel, because of entrenched interests of faculty and the publishing industry. Perhaps the most cogent of all the comments was one from the director of a major library on the west coast:

You have identified the critical hurdles which must be crossed before this can happen: capital to invest in the change, display technology which readers will accept, and reluctance of authors and editors to invest their careers in a new method of publishing until the community shows that it will reward people for doing so. This last is a "chicken and egg" dilemma. I don't know how it will be resolved, but because the system of paper journal publishing is collapsing around us even now, some resolution must
occur, and when it does it will happen rapidly. It will be a tragedy, however, if the new mechanism for electronic publishing is commercially based; in that event, our costs will be no less and our control no greater. Yet that is the outcome which the major STM publishers are actively (if not intelligently) pursuing.

Based on the survey results and on the comments of the respondents, the author is left with the following impressions: (1) the whole idea is completely new to very many of the academic administrators; (2) among the administrators, there exists a small group of enthusiasts that would like to push forward with an academic publishing network; (3) library directors are more aware of the problem and more enthusiastic about the electronic alternative; (4) neither group is very optimistic that such a network will materialize in the near future; (5) administrators, in general, do not consider the academic community well equipped to take on an enterprise of this kind and would not give it a high priority in allocation of university resources.
APPENDIX
Networked Electronic Publishing of the Results of Academic Research

Possible Advantages

Below are listed a number of possible advantages that a networked electronic approach to scholarly publishing might have over existing procedures. For each, please indicate (a) to what extent you see it as a real advantage, and (b) to what extent you consider it likely to be achieved in a networked electronic environment. Please use the final page for additional comments you would like to make on any of these issues.

<table>
<thead>
<tr>
<th></th>
<th>Desirability</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not at all</td>
<td>highly</td>
</tr>
<tr>
<td>Results of research made available more rapidly</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Academic community has greater control over its own research output</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Refereeing of research articles handled more expeditiously</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Open peer review of research articles facilitated (by reader comments and evaluations linked to each article)</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Results of research made accessible to potential users at lower cost</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>More effective means for a scholar to learn of new research in areas of interest (by electronic matching of interest profiles with newly published articles)</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Electronic format allows new ways of presenting research results (e.g., electronic models or simulations replacing some static diagrams and narrative text; programs to allow users to manipulate research data for themselves)</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>The more collaborative academic environment allows freer access to information (e.g., less copyright restriction)</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Insulation from profit-making interests leads to more rigorous standards for acceptance of articles for publication</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Information overload reduced because electronic capabilities facilitate selectivity of access</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

If you can identify other possible advantages, please record them here:
FACTORS AFFECTING IMPLEMENTATION

Below are several statements relating to factors that might influence the successful implementation of a networked electronic approach to the publishing of research articles. Please indicate the extent to which you agree with each.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors will want to contribute to electronic databases instead of printed journals</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>With high quality display facilities readily accessible to them, scholars will want to use journals in electronic form</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>The academic bodies participating in promotion, tenure and salary decisions will accept electronic journals as equivalent to print-on-paper journals</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>The academic community is not well equipped to organize and maintain a publishing operation of this kind</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>The academic community would be willing to absorb the costs of such an operation</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>A completely electronic publishing system has too many dangers associated with it (e.g., problems of &quot;integrity&quot; of the contents of databases)</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

If you can identify other possible factors affecting implementation, please record them here:
**Academic Priorities**

*In assigning university resources over the next few years, how much priority should be given to each of the following activities?*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Very low priority</th>
<th>Very high priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving quality in undergraduate instruction</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Faculty recruitment and retention</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Support of faculty research</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Achieving good minority representation among faculty</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Achieving good minority representation among students</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Developing a networked approach to publishing research articles (the subject of this survey)</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Buildings and other capital improvements</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Financial aid to students</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Service to the community (local, state, national)</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Technological infrastructure of the institution</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Support of the university libraries</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

**Respondent Data**

Name: ____________________________________________________________
Title: __________________________________________________________
Institution: ____________________________________________________

If you would be willing to discuss these issues further in a telephone interview, please give a number at which you can be reached: ____________________________

Would you be interested in receiving a brief report on the results of this survey? 9 Yes 9 No

Would you be interested in attending a small conference to discuss the issues raised by such a publishing alternative and problems of implementation? 9 Yes 9 No
If you have any thoughts on the implications of such a publishing transformation for the academic library, please record them here:

If you would like to comment further on any of these issues, please do so here:

Thank you for your participation.
REFERENCES
About the Contributors

Bryce Allen is a faculty member in the Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign, where he teaches primarily in the library management and reference areas. Mr. Allen is the author of numerous publications on the effects of cognitive differences on information search processes, reference services, and library management.

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José-Marie Griffiths is Vice Chancellor for Computing and Telecommunications and Director of the School of Information Sciences, University of Tennessee. She is developing a vision statement and strategic plan for computing, telecommunications, and information delivery in the academic institution of the future. Recent projects include annual assessment of the automated system marketplace (for Library Journal), development of metadata systems for access to heterogeneous networked information, assessment of STI dissemination in the United States, the design of the next generation of online information retrieval systems, and several statewide automated resource-sharing systems. Ms. Griffiths has authored or co-authored six books and nearly 200 other formal publications. She has taught at five universities and has given over seventy-five invited seminars and workshops on technology in twenty-two countries.
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