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ABSTRACT

The rise in popularity of the Internet has had an enormous impact on scholarly communication, especially with the development of the electronic journal. There are a number of advantages to reading and publishing scholarly articles in electronic form: (1) World Wide Web publications have a simple interface, easy-to-read typefaces, and hypertext links; (2) publishing on the World Wide Web can be learned fairly quickly and makes information available to the masses; (3) increased availability of new technologies and relatively low cost of electronic distribution are valuable in the face of reduced budgets in academic libraries and universities; (4) publication and peer review is faster; (5) primary materials can be made more accessible to a broader audience; (6) electronic journals can also be printed; (7) electronic journals accommodate keyword searching; (8) they are available to many people at the same time and from remote locations; (9) they are self-indexing; and (11) there are helpful links to related articles, bulletin boards, and multimedia materials; (12) they can be customized to individual users; and (13) they use less paper and less storage space. On the other hand, issues of credibility, accessibility, and permanence of electronic journals have to be solved before electronic publication becomes widespread. Some organizations and publishers are trying to find a compromise between traditional print journals and their electronic counterparts. There will likely be a lengthy period of transition as academics begin to see the advantages of mounting their research on the Internet. (Contains 16 references.) (Author/SWC)

The Electronic Journal on the Internet

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Abstract:

The rise in popularity of the Internet has had an enormous impact on scholarly communication, especially with the development of the electronic journal. There are a number of advantages to reading and publishing scholarly articles in electronic form, but there are some problems that have yet to be solved before electronic publication becomes widespread. Some organizations and publishers are trying to find a compromise between traditional print journals and their electronic counterparts. There will likely be a lengthy period of transition as academics begin to see the advantages of retrieving their research via the Internet.

Scholars have always valued the importance of communication with their peers, both through formal means, such as the academic journal, and informally, through what is commonly known as the "invisible college." Both types of interaction are are important to the free exchange of ideas. In the last few years, the rise in popularity of the Internet has brought about a new era in scholarly communication. Academics and researchers are finding that they may communicate with one another faster and more easily than ever before.

Online academic discussion groups have existed for several years now, both through Usenet news groups as well as listserv and other electronic mail distribution programs. Electronic mail, which is probably the most popular use of the Internet, allows scholars to communicate with colleagues throughout the world more inexpensively than by phone, and faster than traditional mail. And many academics routinely use Internet sources such as Gopher or the World Wide Web to track down information in their field, or to make their research findings available to others.

It is only natural then, that more formal scholarly communication should follow in the path of these informal academic discussions. The development of the scholarly electronic journal illustrates the impact that the Internet is having on traditional academia, as more refereed journals make their debut online.

Electronic journals have been defined as "any serials produced, published, and distributed nationally and internationally via electronic networks such as Bitnet and the Internet."[1] The 1996 edition of Ulrich's International Periodicals Directory lists several thousand serials available online, many of which are refereed.

Electronic journals can take many forms, from the "true" electronic journal, which is only available through an electronic medium, to print journals which are merely paralleled by electronic counterparts. Some are subscription-based, and some are available at no charge over the Internet. Electronic journals are also distributed in many different ways. Some send a table of contents for each issue by email with instruction for the retrieval of the articles, other journals send the entire issue immediately. Many are available on the World Wide Web which allows hypertext links between articles and citations, and even sound and video. However, all of the true scholarly electronic journals have the same rigorous acceptance standards as print journals, and contain the full-text of the articles, not just a table of contents and summary information.

The World Wide Web has quickly taken over as the preferred method for accessing electronic journals on the Internet. There are a number of reasons for this. First, it is a simple interface with easy-to-read typefaces. Authors can use devices such as bold, italic, and graphics such as photographs or charts to enhance their work, unlike the plain ASCII text found in other interfaces such as Gopher or ftp. The point-and-click hypertext links make it easy for even inexperienced computer or Internet users to travel from document to document, following a thread of information.

It is also easier to publish on the Web. In very little time one can master the technology of producing a Web page and making it available to the masses. Universities usually offer scholars direct access to the Internet, and may allow Internet users to view research and scholarship directly from the academic institution. An example of this is Project Muse from Johns Hopkins University Press, which offers some of its journals online on an experimental basis. Projects such as this may begin to blur the line between formal scholarly publishing and the "invisible college" of informal scholarly interaction.[2]

The growth of electronic journals has been fueled by increased and more broadly available technical capabilities and the relatively low cost of electronic distribution, in addition to the downsizing of U.S. university budgets and flattening of growth of academic library budgets. The costs of subscribing to traditional scholarly journals has been rising much faster than the rate of inflation, with the largest price increases coming from private, for-profit European scientific publishing houses.[3] Electronic journals may not always necessarily be cheaper to produce than paper, but do offer more options and ways to recover costs. Readers may only have to pay for the actual articles retrieved, rather than for the entire issue. Some of the costs may also be shared with other groups, lowering the per-use costs.[4]

Electronic journals have a number of other benefits over traditional publishing as well. Economic factors such as printing and mailing costs tend to limit the size of print journals. This results in a lower acceptance rate of submitted articles. It is also not uncommon for a year or more delay between the time of submission of a paper to a journal, and when it is actually published. It then takes many more months or years for readers to react and respond to the author's research. Electronic journals, on the other hand, allow for a much faster peer review and publication process and a higher acceptance of articles by editors. The review process is often faster because articles are submitted in electronic format by the authors, and there is no lengthy print publication schedule to follow. And because of the interactive nature of the Internet, feedback from scholarly peers is usually immediate. Often, sending a letter to the author is as simple as clicking on the person's name and sending an electronic mail message.

Another benefit of the electronic format is the ability to make primary materials more accessible to a broader audience, and to allow the reader to add to current knowledge available electronically without disturbing the original research. Projects may be linked to related research, and knowledge may be added continually long after the original researcher has finished. An example is the Civil War archive at the Institute for Advanced Technology in the Humanities. Ed Ayers, the director of the project, accepts (after careful screening and editing) contributions to the project from the public's own personal records and memoribilia.[5]

For authors, electronic journals combine the qualities of print and computerized formats because articles may be read and manipulated on screen, or they may be printed out. In electronic form, they may be rapidly searched for keywords, and may be easily

changed. Drafts may also be printed out in order to make short marginal comments, and to make them more portable.

For library users, a distinct advantage of an electronic journal is that it is never missing from the the shelf or at the bindery, and several people can read the same article at once from separate work stations. Often readers need not even have to come to the library at all, but can access the subscription from their home or office comuter. As many scholars are using computers more and more for research and word processing, they may find it more convenient to use the same terminal to refer to journal articles as well. And as more journal indexes become available online, professors and students alike will be able to perform searches on their topic, locate the article, and print it out all from a remote computer.

Unlike most print publications, the electronic versions are usually self-indexing. They are also searchable, and have the ability to link correspondence and corrections with the original article. They can link citations to an abstract or even the full-text of the cited article, so that readers may easily skip from one related article to another. In addition, electronic journals have the ability to offer bulletin boards and other special-interest forums monitored by the journal's editorial board, formulas and diagrams which may be manipulated by the viewer, and multi-media such as sound and video.[6]

Another benefit is customization: only desired articles need be downloaded and read, and the reader can control how the articles look. Electronic journals definitely use less paper, making them easier to manage along with being environmentally sound. And even though portability is usually cited as one of paper journals' strengths, electronic data actually takes up less room. One computer diskette can hold many articles, and CD-ROM disks many more. Thus, archival copies can be stored much more compactly than shelves of bound journals, a definite advantage for libraries with space limitations.[7] And with the advent of the laptop computer, a user could theoretically carry the equivalent of several bound journals in the space of a lightweight notebook computer.

So with all these clear benefits, why haven't electronic journals completely taken over print already? Despite their many advantages, there are still some problems with electronic publishing yet to be worked out. According to Collins and Berge, there are three major functions of paper journals that must be transfered to electronic versions before they can become widely used and accepted. These are credibility, accessibility, and permanence.[8]

The credibility of electronic journals is often questioned in reference to the following issues: "e-journals do not carry the same weight as print journals in academic credit and advancement decisions, ejournals are neither accepted nor supported by universities because e-journal publishing efforts may not be recognized as an official university activity, and the peer interest that generates the authorship and readership of print journals may not exist."[9] The biggest obstacle seems to be the reluctance of tenure

committees to accept publication in an electronic journal, and to give that publication the same weight as a print journal.

This lack of status of electronic journals continues to be a major hindrance to authors who wish to publish in this medium. Most researchers will not publish in electronic journals unless they are rewarded with the same benefits they can expect to receive from publication in a traditional print journal. These benefits include credit for tenure decisions, citations in other scholars' research, invitations to lecture, awards, assignments to editorial positions and more.[10]

The debate about scholarly electronic journals seems to be centered around the distribution, or medium, of the journal rather than the production. Scholars critical of electronic publishing see it as deficient in some key ways as opposed to print alternatives. However, computers have been used in the production of scholarly print journals for some time now, and authors often submit their papers in the form of a computer disk, or even online. It is the electronic distribution of that same material that is the distinguishing characteristic of electronic journals, and the one that is most debated by scholars and publishers.[11] And even though electronic journals may accept more articles because of lower publication costs, that higher acceptance rate may also contribute to its lack of credibility.

The insecurity of authors regarding the acceptability of electronic publishing among tenure committees was echoed in the words of the editor of *The Online Journal of Knowledge Synthesis for Nursing* after the decision of the Institute for Scientific Information to index the journal: "The decision will enable contributors to this journal, and to other electronic journals that ISI accepts for inclusion in its products, to assure their tenure committees that electronically published materials are valid for consideration."[12] This illustrates the awareness the electronic journal publishing community has of the problem, and their desire to create that aura of credibility that traditional journals have enjoyed for so long. To do this, online journals must maintain the rigorous standards that print journals have employed.

In her study on the electronic journal as a viable channel for formal scholarly communication, Karen Butler defined "acceptable" scholarly criteria for journal publication to include being peer reviewed; accessible through indexing and abstracting services and citations in other publications; retrievable by the scholarly community; known and respected by the scholarly community through strict review policies; well-respected editorial board members; sponsored by a well-respected insititution; receiving good publication reviews; quick publication of submitted material so that authors may establish priority claims to new knowledge; contribution to further scholarly dialogue (feedback and commentary to authors); and serving as an exclusive channel for initial dissemination.[13] Many of these criteria are already being met, including having respected editorial board members and sponsoring institutions, and quick publication. Others may take more time such as being cited in other publications, indexing and abstracting, and being easily retrievable by the scholarly community.

These last problems bring up the next obstacle which must be overcome by electronic journals: accessiblity. Few electronic journals are indexed in common indexing services. This lack of indexing is the reason many scholars are not even aware that an electronic journal in their field exists. Even if the existence is known, one does not always know where to find it; and once found, it is sometimes difficult, especially for computer novices, to determine the contents of back issues and how to access current or future issues.[14]

If electronic journals are not read as widely as print, then they are much less likely to be cited in other works. And if they are not cited, fewer people will know about them. It is this vicious cycle that is working against the quick acceptance of many online publications. One reason some are reluctant to cite electronic information is the confusing transition from paper to computer screen. Page numbers do not always match screen or page breaks, proving to be meaningless except to keep copies in order. However, some form of page numbers will probably continue to be used in order to maintain a standard method of citation.

Electronic publishers are also working against the resistance by some scholars to the conversion to computer technology. While there are still people who are reluctant to use technology to access information, electronic journals will not be easily accessible to everyone. And in all fairness, many online publications do suffer from frustrating interfaces, slow network speeds, and confusing hardware and software requirements. A researcher may discover an online journal in his or her field, but then find that the software or type of connection needed to view it is not available. As technology develops, and standards are created, this may become less of a problem.

Finally, there is the problem of permanence. Authors want to know that years from now their work will still be available to other researchers, and scholars in the field want to to know that the text they are reading is an authoritative version with a definitive date of creation. The lack of physical permanence of electronic publications leads to worries about how available they will be in future years, and whether they can be adapted to new technology. Will they become obsolete as technology changes, and lost to the reading public forever? Authors may also worry about corrupted copies of their articles being stored on other computers after being distributed electronically, even if a definitive copy is archived at a specific site. With print journals, this is usually not a problem because it is much harder to alter a hard copy.

Many wonder who will take over the job of archiving electronic journals. So far, most electronic journal publishers offer access to back copies at their Web site, or by electronic mail or ftp. With print journals, this archiving function is not provided by the publisher, but by libraries which subscribe to the journal and maintain its archives. Will libraries also keep copies of electronic journals? And will these copies exist on a floppy diskette, CD-ROM, or some other format? Another question is if there will also be definitive print versions available, especially for electronic journals with no print

equivalent. Many readers still have computer screens with very low resolution, and they may not be able to view photographs or charts and graphs very well. Will they be able to order a print copy from the publisher instead?

There are some organizations that are seeking to find answers to these questions, and to help electronic journals gain the credibility that print journals enjoy. The Triangle Research Libraries Network (TRLN) in North Carolina has been working on a project to develop strategies for cooperative resources development in the sciences and engineering. A major part of the project is the use of an electronic medium of scholarly publishing in order to combat the rising serials prices, and the opposing forces of for-profit print publishing and not-for-profit research. They defined the fundamental goals of scholarly communication as:

1. To ensure that the worldwide community of researchers has rapid, convenient access at reasonable cost to the validated results of all relevant research.

2. To assure researchers and students seeking information about research results in any discipline that the results "published" have been carefully reviewed by peer experts to meet high research quality standards and then carefully edited for clear and accurate presentation.

3. To ensure that future generations of researchers will have undistorted, convenient access at reasonable cost to the results of important research conducted today and in the past.[15]

They feel that the "ideal scholarly communication system of the future" will have certain characteristics that are already being put in place today. In this ideal world, the preferred means of scholarly publication will be the publicly supported portion of the worldwide Internet. Research libraries would remain the primary access points and archival repositories for both printed and electronically published research.

The current system of primarily for-profit scholarly publication would be supplemented by a new system in which some electronic publishers would be licensed by individual researchers, university presses, and scholarly associations to publish special compilations, indexes, or other value-added products for sale where potentially profitable markets exist. And the technical systems and policies needed to support this new scholarly communication system would grow out of consensus and collaboration among research libraries, universities, university presses, and associations of researchers in all disciplines.[16]

However, none of this will be accomplished until the practice of publishing in peer-reviewed journals available over the Internet becomes more accepted by academic institutions and professional associations. TRLN feels that eventually, in the sciences and technology anyway, that electronic journals with worldwide access will replace

traditional print-on-paper journals, especially if this provides low-cost access for scholarly communication purposes.[17]

Another organization that is addressing these concerns is the Online Computer Library Center, or OCLC, with its Electronic Journals Online (EJO) program. OCLC has promoted electronic publishing of journals for years, beginning with the publication of *The Online Journal of Current Clinical Trials* in July 1992. That made OCLC and the American Association for the Advancement of Science the first to publish a scholarly, peer-reviewed journal electronically. The journal has done so well, that it is now being indexed in the MEDLINE database, one of the few to reach this level of acceptance.[18]

OCLC acts as the "publisher," while its partners carry out the editorial and marketing functions of the journal. As soon as the authors have passed the peer-review process, the editors send OCLC the articles, along with any graphs, charts, or equations to OCLC in Standard Generalized Markup Language (SGML). The articles are then made available online within twenty-four hours.[19]

OCLC has also introduced Guidon software for viewing electronic journals. It allow users to choose between dial-up access or viewing through the World Wide Web, most often the preferable way to browse online. The Web allows readers to jump from text to a cited reference through hypertext links, or to view graphics. In addition, readers can link to the citation database in their field. For instance, in *Current Clinical Trials*, references are linked to MEDLINE citations and abstracts. Guidon also allows readers to link to a FirstSearch database directly from the journal, or to click an icon and send the publisher a letter in response to an article or a rebuttal to a previous letter.

Another note-worthy example of an electronic journal is the *Journal of Artificial Intelligence Research* (*JAIR*). Its publishers have addressed the credibility problem of electronic journals by doing their best to make their journal as much like a print publication as possible. Its pages are formatted to appear like a print journal, and it can also be bought in paper format. When an article in the electronic version of *JAIR* is printed, it looks just like a photocopied journal page, with headers, footers and specific page numbers for each article as they appear in the print version. The editors of *JAIR* encourage readers to cite articles in their journal as they would a paper article, and do not encourage the inclusion of URLs (Uniform Resource Locators, or Web addresses) in that citation. This gives authors and readers the convenience of electronic publishing, while appearing traditional to those who would discount out-of-hand an entirely electronic journal.[20]

It is probable that this sort of compromise between print and electronic will continue with many electronic journals until they become more accepted for their content rather than their format. Eventually the print model will no longer be used to limit the electronic model, which will provide the ability to access and use information in ways which have not yet been discovered or imagined. So far however, in this infancy of electronic publishing, few electronic journals take advantage of the capablities of

publishing in this medium. Most articles could be found in print journals in basically the same form. An exception to this is the aforementioned *Journal of Current Clinical Trials* which creates hypertext links between related articles and letters to the editor related to specific articles. We will probably soon see more interactive features such as executable algorithms and data sets, and audio and video.[21]

The change from print to electronic is inevitable, and is already becoming evident. Many print publishers already offer table-of-contents or current-awareness services online. Many online indexes already offer the full text of articles to be viewed, so researchers are getting used to retrieving journal articles in unconventional ways. Commercial publishers are also beginning to experiment with allowing the full text of print journals to be licensed for electronic access. An example of this is Elsevier's ***T***he ***U***niversity ***Li***censing ***P***roject, or **TULIP**.

TULIP lasted from early 1991 to the end of 1995. The goal of the project was to test systems for the networked delivery of journal articles directly to the user's desktop. For 83 of their materials science and engineering journals, Elsevier produced cover-to-cover bitmap images of each issue, and unedited ASCII full text of each article. They were delivered electronically to nine U.S. universities that participated in the project, and each university then developed its own front-end search and display system for its users. The focus of the research was to test the technical issues involved, study user behavior, and answer organizational and economic questions.

Their research found that the concept of desktop access to full text/image articles underlying the TULIP project was very well received by the end users who required a system that was fast and easy to search, read and print. However, the hardware and software requirements were serious obstacles for convenient use of the TULIP data at most sites.

In the final report of the TULIP project, it was found that there were four major factors which determine how successful projects like TULIP will be. First, there must be dedicated project management and cooperation among all the parties involved in having the right sources available at the right time. Second, institutions must have an understanding of their user community's needs before they begin offering such a service. Third, there must be an adequate infrastructure in place including systems and systems development, networking and printing, the ability of the campus network to handle graphical data, and user desktop systems. Finally, the service must be heavily promoted. At the sites in TULIP that did extensive promotion, the use of the system was increased significantly.[22]

The data from the TULIP project will no doubt be used by other publishers when deciding about offering their print journals electronically. The transition may take longer than many expected however, because the transition to electronic publishing holds many implications for publishers, including the registration of the proprietary date of an article, and the conditions governing access to and copying of published articles.[23] Many paper-

based publishers are also worried that unlimited on-line access to journal articles will cut into their subscription base. Some have proposed a pay-per-use model for electronic access, but that may not go over well with academics used to unlimited access to journals to which they or their universities subscribe.[24] Some are worried that costs may actually rise with electronic journals, if publishers start monitoring who is reading their articles and when, and charging accordingly.

It is difficult to guess what the future holds for scholarly publication. Metz states, " . . . we should not expect to predict the characteristics of an electronic future for scientific and scholarly communication by extrapolating from today's experiences."[25] Clifford Lynch of the Office of Technology Assessment has proposed some future scenarios for the electronic environment. Among other things, he believes that electronic libraries will slowly evolve incrementally out of existing library systems, and that for several more decades, there will be both print and electronic journals. A major sources of controversy will be the increased need for databases to allow access to the scholarly journal literature, and the focus will not be on innovation but on standards. Metz added to Lynch's conclusion with his own belief that whether all of this succeeds is more a marketing question than a technical one. Simply put, electronic communications will succeed if scientists and scholars find it useful.[26]

In order to take advantage of this future electronic environment, academics must become more informed about all of their options both for research and publication. The greatest contribution that electronic journals will make to the present scholarly communication system is more diversity and choice, and in future years, electronic publishing will likely move beyond the imitative phase into something entirely new, changing the way we think about scholarship and communication.

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