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PAPYROPHILES, ELECTROCENTRICS AND PHILISTINES:

THE SLOW GROWTH OF ELECTRONIC SCHOLARLY JOURNALS

by

William J. Brand

A Dissertation Presented in Partial Fulfillment
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ABSTRACT

Electronic scholarly journals have become at once a new and economical means of scholarly communications and, at the same time, a challenge to traditional methods of publishing the fruits of research. The pace of the evolution and the transition from paper to electronic publications continue to be discussed and debated at all levels of academia, among scholars, librarians, scholarly societies, and within commercial publishing "houses" of the scholarly publishing world. The purpose of this research was two-fold: to study (a) why electronic scholarly publishing is evolving so slowly at this point in the ejournal movement, and (b) why some scholarly organizations and disciplines have ventured into electronic publishing while others continue to resist or ignore the transition. The study employed two established research methodologies: (a) 31 qualitative face-to-face interviews and (b) document analysis of over 160 electronic forum responses.

These methods were used in concert to compensate for the fact that each of these sources had particular strengths and weaknesses. The categories of findings regarding the slow development of electronic scholarly communication included economic issues, copyright, speed and convenience, peer review, reward structure, access, papyrophiles, archives, and publisher profits.

Dedicated to Holly Brand

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I would like to sincerely thank my committee members and all those who have contributed to this work. I wish especially to thank my advisor and mentor, Gene V Glass, for his dedication and guidance throughout this project.

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CHAPTER 1

INTRODUCTION

Electronic scholarly journals have simultaneously become a new, economical means of scholarly communication and a challenge to traditional means of publishing the fruits of research. The pace of the evolution and the transition to electronic publications continue to be discussed and debated at all levels of academia, among scholars within the disciplines, librarians, scholarly societies, and within "houses" of the scholarly publishing world.

Peer-reviewed electronic scholarly journals (ejournals) have been in existence for less than 10 years (Harter, 1998). By contrast, the print journal has existed for more than 100 years and is by its very nature a static, one-way form of communication. Published at a particular point in time, the print journal is protected by copyright rules and usually is available for a flat-rate subscription or included with membership to a scholarly society. In addition, this highly mobile print journal goes wherever the reader wishes to take it (Luther, 1997).

Luther (1997) stated:

> The electronic journal offers the capability of two-way interactive communication. Information can be more timely, and access is free or is stipulated in a contract signed by the subscribing institution, which pays a flat fee on a pay-per-view basis. Although the reader is network dependent, rapid distribution directly to the desktops of subscribers ensures timely delivery in geographically remote locations. (p.18)

Electronic scholarly journals offer links to additional data, graphics, and images that can be manipulated. For example, some electronic scholarly journals display images of

molecules and data that the researcher can rotate to different positions on the monitor. Proponents state that electronic versions can lead scholars to think in new ways. Electronic versions allow interactivity-the capability to rerun experiments or tests on the data, or to participate in simple chat sessions in which the readers can pose questions to the writer or the journal's other readers (Rohe, 1998).

The refereed scholarly journal performed a significant service in structuring the professional lives of academicians. According to Dow (1997), the journal was intertwined with establishing academic occupations as professions, differentiating the knowledge domain of disciplines, and structuring the reward system of reputation-based academic occupations.

The following seven factors, investigated to varying degrees in this study, might be influencing the rate at which people adopt the technological innovation of electronic scholarly communication:

1. The "paper culture" of libraries, ERIC, and other document archiving institutions;
2. The "technological comfort" felt by scholars in some disciplines in comparison to others;
3. The unseen costs of production or conversion from paper to electronic media;
4. The vested political or economic interests that are threatened by the eventual transition;
5. The conflicting claims of research fields about what each has established as constituted knowledge based upon the distribution timing of its research

findings (what constitutes knowledge claims in one field over another as it concerns itself to electronic journal dissemination); and

6. The speed with which knowledge production is required or preferred in the discipline; and
7. The absence of any incentives to dismantle the current system.

According to Odlyzko (1997), there has been nearly universal acceptance of the notion that peer-reviewed scholarly journals must become available in digital formats. One of the main reasons cited for the transition to electronic publishing is the cost. According to commonly stated estimates, moving from paper to electronic publication can save 20 to 30% of the overall publishing costs. It must be noted that this cost-savings estimate was derived from an analysis framed within the terms of the existing paper environment. Those from the traditional paper-publishing world focus on the costs of getting the text into the paper form first, and then subtract only what electronic processing does to reduce those costs. On the other hand, proponents argue that a 70% savings is possible because there are no paper, printing, marketing, or distribution costs for free journals that are solely electronic.

When costs were analyzed from an electronic-only standpoint, two categories of costs associated with paper publishing remained: (a) peer review that had a very low or, in some cases, non-existent cost; and (b) editing. All other costs simply vanished or were identified as insignificant (Harnad, 1995). This analysis was based on the distinctive cost structure of books and manuscripts. The same type of cost structure is shared by journals, although in a less extreme form. Electronic scholarly journals, while incurring some

publishing costs, do not approach the costs of the other two publication forms. Most publishing costs are incurred when authors create the first copy or send the first copy over the Internet. Furthermore, additional copies do not add a substantial cost factor. In fact, in electronic publishing estimates, they were close to zero (Okerson & Mogge, 1994). This cost analysis of the electronic-only journal is not restricted to a theoretical economic construct. The actual expenses of *Psycoloquy*, a journal in the biobehavioral and cognitive science area, were about $15,000 per year, according to Odlyzko (1997). *Psycoloquy* is a free, solely electronic journal that publishes approximately 40 articles per year.

Odlyzko (1997) made some additional estimates based on a sample of journals, all within his academic areas of mathematics and computer science. The publications under study were primary research journals, purchased mainly by libraries. According to Odlyzko (1997, http://www.firstmonday.dk/issues/issue2_8/odlyzko/index.html), the main identifiable costs associated with a typical article were as follows:

1. revenue of publisher: $4,000;
2. library costs other than purchase of journals and books: $8,000;
3. editorial and refereeing costs: $4,000; and
4. author's costs of preparing a paper: $20,000.

The publisher's revenue of $4,000 per article was the total revenue from sales of a journal, divided by the number of articles published in that journal. This figure attracted a great deal of attention and was hotly debated among librarians and publishing houses due to heightened awareness of revenues in relation to the continually expanding journal

costs (Odlyzko, 1997). The "journal crisis" was defined by librarians as the inability of academic libraries to keep up with the increasing costs in journal subscriptions and the number of new journals introduced every year. What librarians referred to as the journal crisis had been brought about by dramatic increases in the cost of scholarly journals (an average of 13.5% annually for more than a decade), the effects of which were compounded by the financial constraints that most academic institutions faced. This combination of issues served as a strong economic motivation to find less expensive ways for scholars to communicate and archive their work (Franks, 1993).

The literature in the scholarly communication area is both diverse and diffuse; studies of small pieces of the puzzle range from topics such as computer-human interfaces to the economics of electronic journals. For example, Mahoney (1976) stated that science often was viewed as a highly efficient inquiry system in which there were thousands of volumes on the sciences, but few about the scientists. Thus, for both the fields of study and the scholars within them, one of the most consequential issues is publishing, which is the primary means of scholarly communication.

Mahoney (1976) anticipated that the dynamics of the spread of innovative forms of scholarly communication might differ substantially between what some have designated as "hard" disciplines (math, physics, chemistry) and "soft" disciplines (education, social work, business, and the like). The present study refers to disciplines as "hard" (major) and "soft" (minor), despite the view that all scientific inquiry is valuable and must resolve its own unique problems of method. The speed at which physicists were drawn to their specialized electronic preprint server at Los Alamos, for example, might differ somewhat from the speed with which education journals moved to

electronic means of communication. Garvey (1979) provided an unusually clear and thorough description of the processes of scientific communication. He highlighted the differences between fields of science, and indicated possible impediments and obstacles to change that were found in existing procedures and methods.

The purpose of this research was twofold: to study (a) why electronic scholarly publishing is evolving so slowly at this point in the ejournal movement, and (b) why some scholarly organizations and disciplines venture into electronic publishing while others continue to fight the transition. As a result of further study, many barriers and impediments have been pointed out, from readability and portability (technical issues) to lack of standards and the merit process (cultural). One form of resistance could be a publication policy of a scholarly society. One example, one new 1997 publication policy of the American Psychological Association Publication (APA) stated (in part):

> (1) Authors who post or electronically share their unpublished articles on the Internet should prominently label these documents as "unreviewed draft documents" and clearly state whether they want to allow copying and that these documents have not been formally peer reviewed. Such posted or shared documents may or may not be considered "publications" by a given journal or editor, depending on the circumstance of the posting and the nature or orientation of the journals. (2) Authors of published work should have the prior permission of the publisher to post or to share copies of their articles. The APA will give permission to authors who wish to electronically send their articles on request to others for noncommercial use. However, they should not post copies of published articles on their personal Web pages without explicit permission from the publisher. (American Psychological Association [APA], 1997, www.apa.org/journals/fullposting.html)

Moreover, this policy was considerably less stringent than the previous one that designated all requests mentioned above as requiring the permission of APA.

This study attempts to illuminate the development of electronic scholarly publishing in five different disciplines: chemistry, education, mathematics, physics, and

psychology. The researcher sought to discover and describe the forces that either militated against or facilitated the evolution of scholarly communication from print to electronic media. The researcher conducted in-depth, face-to-face interviews with scholars, librarians, and publishers and officials of scholarly societies to ascertain their perspectives and perceptions of electronic media as seen from the perspective of their various roles.

The growth of electronic scholarly journals in many fields is striking in number and noteworthy in its details. As an example, in August 1993, NewJour began as a directory of electronic journals, newsletters, and discussion groups. In 1995, the index contained 250 journals. However, by early 1998, NewJour's index exceeded 5,000 entries. For NewJour alone, that increase translated into an average of more than 1,500 new electronic scholarly journals indexed annually during that three-year period (Okerson, 1998). Moreover, Harnad (1998b) reported in *Nature*, an international weekly journal of science, that there had occurred a 20-fold jump in the number of refereed journals on the Internet from 1996 to 1997. Furthermore, he also cited Okerson, founder of NewJour who estimated that there were over 8,000 refereed online journals as of January 1998. This growth was due to technological advances in electronic publishing that shifted publishers toward much less expensive electronic-only journals.

Technological advances aside, many opponents were surprised by the speed of this movement (Meadows & Rowland, 1997, cited by Odlyzko, 1997). Opponents insisted that every problem with the innovation (ejournals) be solved before they jumped on board. They held to the status quo. Despite this opposition, the switch to electronic journals, according to Meadows and Rowland, became the order of the decade of the

1990s. Many proponents of electronic publishing were frustrated by the continued dominance of the print journals and the slow transition to online publishing. Proponents studied scholarly journals to discover what new technological innovations were needed. Although some fields have experienced phenomenal growth, others have been slow to move toward this new mode of archiving and scholarly communication.

Many of the evaluations and articles contained in the existing literature lacked the empirical rigor and breadth required to draw valid conclusions about the barriers and opposition to electronic scholarly publishing. This study attempted to identify and bring to light the possible impediments and obstacles to the slow growth of electronic journals. Therefore, this study discovered and described the forces that either militate against or facilitate the evolution of scholarly communication from print to electronic media. In addition to the seven factors listed earlier in this chapter that might influence technology adoption, the following six questions formed an interpretive research framework:

1. To what extent are scholars, libraries, publishers, and scholarly societies aware of, influenced by, using, or building their own work on research published in paper and electronic scholarly journals?
2. What obstacles, resistance, and impediments do the publishers of ejournals face given the existing process of scholarship, research, and the advancement of knowledge?

Subsequently, the study addressed the following research questions about future developments in the field:

3. What is the role of scholars, librarians, publishers, and scholarly societies in the transition from paper to electronic?
4. What is the relationship between the type of publication and the authority of the scholarly text and the nature of the discipline?
5. What keeps the current paper-based system in place when the technological developments and costs suggest a change?
6. What issues and concerns arise among the actors before, during, and after a transition to scholarly communication has taken place?

CHAPTER 2

REVIEW OF THE LITERATURE

The review of the literature is organized in five main sections. The first section presents the predictions and a history of the predictions of the electronic journal's evolution. Section two describes the literature on the study of the scholarly communication process. Section three presents the literature on scholarly communication in different disciplines. The fourth section discusses the objections to electronic journals and technological innovations. Lastly, the fifth section reviews the current studies and research on free online-only electronic journals.

According to Harnad (1991, p. 39) there have been three revolutions in the history of human thought and many people believe they are on the threshold of a fourth. The first revolution took place hundreds of thousands of years ago when language emerged in the process of human evolution, and humans began speaking in this language to express themselves. Humans became the first species able and willing to describe and explain the world in which they live. From this revolution our culture was developed and passed on to subsequent generations by oral tradition and scholarship.

Harnad (1991) stated:

> The second cognitive revolution was the advent of writing, tens of thousands of years ago. Spoken language had already allowed the oral codification of thought; written language made it possible to preserve the message independent of any speaker and respondent. (p. 39)

With the advent of writing, scholarship changed considerably from oral tradition to written works.

The third revolution took place in this millenium, with the invention of moveable type and the printing press, the Gutenberg Revolution, as it has been called. The laborious hand copying of texts became obsolete and both the speed and scale of dissemination of the written word increased enormously. Scholarship was destined to become a collective, cumulative, and interactive enterprise. Evolution had given us the intellectual wherewithal, and the Gutenberg invention provided the vehicle.

According to Harnad (1991), revolutionary transitions of speech, writing, and print were the only communications the mind was concerned with, in respect to nonverbal, oral, and written communication. All other proposed technical transitions such as the telephone were refinements of technology, not to be confused with the indisputable media revolutions created by speech, writing, and print. These three revolutionary transitions had a qualitative effect on both the human thought process and scholarship. For example, speech made it possible to make propositions, handwriting made it possible to preserve them independent of either speaker, and print made it possible to preserve them as a discrete record of the proceeding (Harnad, 1991).

Harnad (1991, p. 43) called the fourth revolution–"electronic skywriting,"–an interactive dialog of real-time and off-line correspondence conforming to the natural strengths of speech, writing, and print. In "Interactive Publication: 'Scholarly Skywriting,'" Harnad noted the following:

> The critical factor will be a spin-off of that very anarchy that I said had given the new medium such a bad image in the eyes of serious scholars, what had made it look as if it were just a global graffiti board for trivial pursuit: For once it is safely constrained by peer review, this anarchy will turn into a radically new form of INTERACTIVE PUBLICATION that I have dubbed "Scholarly Skywriting," and this is what I predict will prove to be the invaluable new

> communicative possibility the Net offers to scholars, the one that paper could never hope to implement. (Harnad, 1993, cited by Glass, 1994)

This fourth revolution removed the constraint of each previous revolution. The increased speed and scale have a cognitive, qualitative effect on how we think (Harnad, 1991). The scholarly spill-over and the linkages created by communications via the Internet and the electronic journal –or "electronic skywriting"–have proved to be a potentially revolutionary means of producing knowledge. This revolution has become the subject of many debates as to when this new mode of communication will become the dominant form of exchanging and archiving scholars' work.

History and Its Extrapolation

Books were the main medium for the expression and diffusion of ideas from the 1470s through the 1660s (Valauskas, 1997). The Royal Society in London was founded in 1660. Some claim that this event marked the beginning of modern science. In 1665, the Royal Society began the first journal ever published, which was entitled *Philosophical Transactions*. The purpose of the journal was to disseminate the results of the society's research to a wider audience than was possible through an exchange of letters. From the 1660s on, the scholarly printed journal was the primary structure and process by which scholars communicated. One hundred years ago, articles were published in journals because journals were the quickest means of disseminating new ideas and findings. The explosion of scholarly journals in the 19th century was due to inexpensive mass publishing, abundant paper as stock, and the increasingly specialized nature of many academic disciplines. According to Valauskas, this led to the rise of discipline-specific journals. The growth of scholarly journals and abstracts continued at

an exponential rate in this century. Valauskas stated, "To meet the demands of many scholars and their libraries in the last two decades, many of the larger abstract journals and services migrated to computers" (http://www.press.umich.edu:80/jep/03-01/FirstMonday.html). Valauskas, in *The Journal of Electronic Publishing,* stated his belief that it was only natural that electronic scholarly journals would flourish in the 1990s, a growth parallel to that of the Internet and the increasing abundance of networked computers and improved means of textual and graphic display.

Researchers who venture to predict dramatic changes in scholarly publications need to be mindful of the long history of failed forecasts in this area. The difficulties of predicting developments in technology have discouraged many. In 1945, Bush made a very carefully considered forecast that predicted the demise of books. Bush presented in his article, "As We May Think," the idea of Memex, a personal data storage device that would contain massive amounts of information (Bush, 1945, cited by Gabriel, 1989). This influential essay was regarded as the precursor of modern hypertext (Meadows & Rowland, 1997, cited by Odlyzko, 1997).

Bush's (1945) article as well as books like Licklider's (1965) *Libraries of the Future* and Lancaster's (1978) *Toward Paperless Information Systems* were just a few influential examples of the aggressive, thoughtful predictions about this transition. Bush's (1945) article forecast a personalized library of information in a single disk named "Memex" (Gabriel, 1989). This system would store books and journal articles and even search them with Boolean capabilities. Licklider (1965) pronounced an advanced system called "Symbiont," which was an online database and library of the future. It had machine-readable files that users accessed via a computer terminal (Licklider, 1965,

cited by Gabriel, 1989). Lancaster (1978) later predicted a scientific community by the year 2000 or earlier where researchers would have office computers that would create, transmit, and receive information. The office would be able to access MEDLINES, Social Science Citation Index, and Psychological Abstracts in machine-readable format. Lancaster (1978) believed that all the information once recorded on paper would evolve into electronic communications, and the new electronic revolution would be a direct analog to the Gutenberg Revolution. Since these predictions, key developments in experimental scholarly information systems have attempted to keep the promise of ideas predicted and discussed many years ago. These three forward thinkers and prognosticators each predicted, albeit not accurately, that the transition from paper to electronic journals would have occurred by this time, 1998. The driving force for many optimistic predictions was the expanding number of computer databases developed for online searching in the 1960s.

In 1970, the U.S. Government Printing Office published several documents related to new technologies for typesetting and publishing. This interest, coupled with the growth of computerized bibliographic databases, incited the serious investigation of paper versus electronic publishing. The government spoke of cost savings of nearly 40% when it used electronic composition rather than camera-ready copies (Gabriel, 1989).

During the 1970s, Bamford (1973), of the National Science Foundation, argued that computer technology had been introduced into every aspect of the scientific communication process except the dissemination of information. He insisted that computers could assist writers and editors of scientific journals. However, due to the dispersion of the various volumes of a discipline's work throughout the world in many

separate operations, none appeared to try. In 1972, Bamford argued that in order to achieve scale, all the works would have to exist on a computer in "Editorial Processing Centers" (EPCs; Bamford, 1973, cited in Gabriel, 1989). These locations would assume all the same functions that editors, referees, compositors, and printers would have done in the traditional journal publication system. A very large group of researchers believed in computerization of journals and the EPC concept. They predicted the end of the slow, expensive journal publication process that they felt was inefficient (Gabriel, 1989). These scholars pointed out that Bush's "Memex" was finally inevitable, after 30 years of debate, given the cost of published journals and the new systems in place. However, despite large amounts of capital and support, the EPC did not assume the prominence many predicted for it.

A few years later, King and Roderer (1978) proposed basically the same ideas; however, they envisioned a "National Periodicals Systems" with point-of-use transactions. They predicted a quick transition to electronic journals with this system, but saw a standardization of technology constraint. Later, Roistacher (1978, cited in Gabriel, 1989) imagined "Virtual Journals" that used a computer network of time-shared scholars using the same traditional refereeing procedures, but with increased speed of dissemination and unlimited storage space. King (1979) performed a Delphi study that focused on the actual year by which scholars believed journals would become available in a machine-readable form as well as on paper. The results are indicated in Table 1 (King 1979, cited in Gabriel, 1989).

Table 1

Results of Delphi Study by King

Year Predicted for Electronic Format	Percent of Responses
1980	18.0%
1985	49.0
1990	23.0
1995	6.0
2000	2.0

King's (1979, cited in Gabriel, 1989, p. 19) study indicated that scholars held a very utopian view of the question and were overly optimistic about when journals would be available in both electronic and paper formats.

In the 1980s, a new set of scholars was exposed to the rapidly advancing technologies of microcomputers, fax machines, and laser printers. They predicted a revolution accompanied by the phone connection to a regional library data center to access abstracts. That access would change the existing library paper-focused system to online reading (Gabriel, 1989). This marked new discussions in support of the enormous superiority over the existing system proposed by Hickey (1981) and Singleton (1981, cited by Gabriel, 1989).

In 1980, Guillaume (1980, cited in Gabriel, 1989) proposed the electronic journal *Mental Worldload*, which worked with the assistance of email and text editing and would eliminate paper journals. Turoff and Hiltz (1979) further explored this idea. They found

that in the wake of other more prestigious paper journals, it was difficult to motivate either writers to submit or referees to edit (Gabriel, 1989). Moreover, the environment of the 1980s led others like Seiler and Raben (1981, cited in Gabriel, 1989) to offer a provocative perspective on the effects of electronic journal publishing on rank, promotion, and tenure decisions. They mentioned that if electronic journals proliferated and were not accepted as fully certified for academic advancement, a major problem would result and a need would thus arise to separate the new discoveries and information from the unrelated ambitions of junior faculty.

Not all the demands and developments for electronic journals came from researchers. Many publishers started series of electronic journals like *Comtex,* which boasted of its ability to move from submission to publication in six to eight weeks. *Comtex* proposals attracted attention because of pay-to-use charges rather than the yearly subscription model that libraries were tiring of (Gabriel, 1989). Campbell (1982) predicted that the present format of research journals would be obsolete within 10 years due to computer editorial and typesetting efficiencies. Campbell proposed a unique solution to the copyright controversies. He suggested the copyright issue could be handled through individual use, that is, paid at the source via computer networks and according to the printout of the electronic journal at the reader's desk.

The 1980s generated the study of numerous electronic journal projects like Burmingham and Loughborough Electronic Network Development (BLEND) and Electronic Information Exchange System {EIES). The decade also marked the advent of electronic magazines (Gabriel, 1989). Katz (1985) differentiated between electronic journals and online magazines and predicted that electronic journals "will never succeed

compared to online magazines" (Katz, 1985, cited in Gabriel, 1989, p. 27). In making his argument, Katz took into account the decade's rising magazine costs and declining subscriber bases. Furthermore, 1985 saw the introduction of more than several hundred online magazines, such as *Time*, *Fortune*, *Sports Illustrated*, and the *Harvard Business Review* (Gabriel, 1989). Online magazines and articles ranged in price from $10 to $15, a cost that alarmed many librarians, scientists, and engineers.

Auld (1986) proposed the concept of reading the online article from the computer screen and allowing readers to append signed comments to the article for all to see. This was a catalyst for debates on the advantages of online versus print articles. These debates touched on cost comparisons, readability, and the development of more technical features (Gabriel, 1989). In the 1980s, many other educational media experiments like "disk magazines" were unsuccessfully tried, along with the advent of a new robust medium, CD-ROMs. In the late 1980s and early 1990s, optical media were the revolutionizing technological innovation. However, they did not become mainstream in the electronic journal field due to the lack of CD-ROM drives (Gabriel, 1989).

Throughout the last 50 years, there has been little argument that the computer would change the way in which many tasks were done. As people became dissatisfied with the current paper journal system, the resulting unrest was coupled with technological utopian beliefs. As a result, the discussions moved from the desire for electronic journals to the debate about how to solve electronic journal problems. The literature marked a turn from debating the merits for change to discussing new concepts and features to accompany the change. The evolution was underway, and feasibility discussions flourished.

In more recent times, others have predicted how electronic publications might sweep the world. Most of the developments were described more than 20 years ago, and proponents had predicted a conversion that would take, on the average, just five years. Scholars in library science were among the pioneers in this area, since they had to deal most directly with the exponential growth in literature.

Everyone began to feel more confident that the growth would accelerate in light of Moore's law, which states that the number of transistors that can be placed on a chip doubles every 18 months (Odlyzko, 1997). Despite this newfound search for feasible technological solutions and excitement over the transition, organizations like the American Physical Society (APS) expressed skepticism. In 1991, the "Loken Report" predicted the wide availability of ejournals around 2020. However, according to Odlyzko (Meadows & Rowland, 1997, cited by Odlyzko, 1997), all the APS journals would be available electronically by 1998.

Okerson (1991) pointed out in many articles and symposia that the information "explosion," coupled with today's journal distribution conventions, mandated that the printed article would take as long, or longer, than an electronic monograph to reach the reader. This was contrary to one of the original tenets established when the printed journal was created. Due to this slow dissemination of scholarly information and the rise in journal costs incurred by libraries, Okerson (1991) predicted the electronic journal evolution would be complete in the 1990s. As articles awaited peer review, editing, and publication in the paper journal, distribution delays of many months were the norm. Delays of two to three years were not unusual. Meanwhile, as scholars demanded the latest ideas, more and more papers were distributed in advance of "normal" publication

outlets through informal "invisible colleges," which consisted of distribution lists of colleagues and friends (Okerson, 1991).

Given researchers' information expectations and the perception that high-speed distribution was possible (and indeed already extant), alternative, rapid means of sharing information seemed destined to displace the print journal as the sole means of scholarly communication. For already established journal titles, advance descriptions of articles (e.g., cataloguing copy) could become available routinely, followed closely by prepublication delivery of the articles themselves (Okerson, 1991). The success of such a program eventually would alter the fundamental characteristics of the paper journal.

Okerson (1991), while at the Association of Research Libraries, worked with her colleagues to note these changes already begun. Despite the predictions, Okerson went on to state, "The paper journal has been given the imprimatur and loyalty of the best scholars as authors and editors. Continually expanding, it has resisted all attempts to supplement it, let alone supplant it" (p. 10).

Much less favorably disposed toward the current scholarly communication system than some of the librarians who Okerson (1991) represented, many faculty at the time were urgently demanding that the system be changed.. In May 1991, Arnold (Kenneth, 1993) wrote about an online *Humanist* discussion group:

> Where Robin Cover alarmed a number of people by suggesting that the present scholarly publishing system rips off scholars who should take control of their own work and self-publish on the Net. Cover is an anarchist. He questioned the role of the publisher as "authenticator" and owner of academic work. The scholar who produces and uses scholarly work buys it back through university-subsidized programs—or so this argument went. Cover properly noted that publishers did not create this situation. They merely exploited it. (http://www.arl.org/scomm/symp2/Arnold.html).

It was this type of faculty feeling toward the current scholarly communication system that produced predictions in 1993 that the current situation was unhealthy and in need of a change. An example of the sentiment of the time was offered by Arnold (1993, in Harrison & Stephen, 1996): "It is imperative that we recreate a model for scholarly communication that retains the best of the present system, but there is not much time in which to accomplish this task" (http://www.arl.org/scomm/symp2/comserve.html). Arnold continued his observation by comparing the troubles in the current journal publication system with the demise of the monograph. According to Arnold, this demise was a symbol of the seriousness of the situation. He pointed out that in the absence of a new vision, publishers and librarians would be left out and viewed simply as agents of preservation and not part of the evolution.

The literature review has revealed many predictions and proclamations of the desire to transform scholarly communications. Those at the forefront of the evolution are professors like Harnad (1991), one of the most vocal in arguing for change. His views were based on his experiences with both the electronic journal *Psycoloquy* and the more traditional *Behavioral and Brain Sciences* (Valauskas, 1997). Harnad (1991) routinely invoked the experiences of Paul Ginsparg at Los Alamos Laboratory and his archive of papers in high-energy physics as proof that the evolution from paper to electronic journals had already taken place in some fields. Harnad (1995) believed the scholarly communications revolution was moving at the speed of the Internet. Valauskas (1997) pointed out that, due to the differences in the fields, it was dangerous to compare scholarly communication in the fast-paced world of high-energy physics to the mere academic deliberations of humanists, social scientists, and non-physics scientists.

Harnad (1991) revealed that a written language allowed us to reach many people with our message. He felt, however, that this medium resulted in the written word becoming a much less interactive medium of communication than speech. Harnad related that even when the topic was the same, carrying on a conversation with a group of colleagues at a conference was much more interactive than publishing in a journal. Traditional journals did not support exchanges between authors and readers of a type similar to serious conversations because of the delays that were inherent in print publication (Willis, 1995). Harnad predicted that the fourth revolution would make it possible "to restore scholarly communication to a tempo much closer to the brain's natural potential while still retaining the rigor, discipline and permanence of the refereed written medium" (http://info.lib.uh.edu/pr/v2/n1/harnad.2n1).

According to Drucker (1969), today's information world is the age of discontinuity. Discontinuous change happens when an innovation, or a series of innovations (e.g., social or technological), leads to a sudden acceleration in the process of change, so that the smooth curve of development moves quickly to a higher plane (Wilson, 1997). Numerous management gurus, from Drucker to Peters to Handy and others, have drawn attention to this phenomenon and have proposed ways in which organizations are likely to change as a consequence. Whether any one of these thinkers was right in those predictions remains to be seen, but according to Wilson (1997) there is at least preliminary consensus on the need for change in the scholarly communication system.

Scholarly Communication Process

This section describes the literature regarding the study of the modern scholarly communication process. Garvey's (1979) work at Johns Hopkins University represented a major contribution to the understanding of the scholarly communication process for librarians, scientists, engineers, and students. Garvey's research was directed at answering some of the following questions (p. x):

1. How do people seek scholarly information for journal publication?
2. Why do people seek scholarly journal information?
3. Why do people fail to find scholarly information in the scientific communication system?
4. Do different disciplines seek information in different ways and if so, how can information systems be designed to suit different types of disciplines?
5. How do scholars process journal communication?

Garvey's (1979) seminal work on the use of journals focused on the behavior of 2,030 scholars associated with several major and minor disciplines. Garvey (p. ix) defined scientific communication as "the full spectrum of activities associated with production, dissemination, and use of information from the time the scientist gets the idea for his research until information about the results of this research is accepted as a constituent of scientific knowledge" (p. ix). Garvey's "scientific communication" (p. ix) definition included the informal exchange activities that take place between scientists actively involved on the research front. He focused on the complete spectrum of communication from the informal to the formal journal publication. Garvey stated that he conducted

these studies because it was evident to him that the technology for providing information services to scientists was less successful than the sophistication of technology itself. Although this was not his discovery, while attending a NATO Advanced Study Institute in 1973, he arrived at his belief that the field of scholarly communications studies had ignored the nearly invisible social processes that affected the work (Garvey, 1979, cited in Olsen, 1994). Others in the field mentioned that it appeared to be absurd to continue the increase in sophistication of computer technology applied to documentary systems without taking a critical look at the material these systems handle and the use scientists make of it (Garvey, 1979).

Garvey's (1979) work was important to this study for five reasons. First, he emphasized the role of journal literature as the scholar's most significant means of communication. Second, Garvey illustrated the dissemination process from the time research scientists initiated their work until their findings became published in a journal. The reader can therefore see clearly the dynamic and orderly process infused with technological solutions. Third, he warned the technologist that altering the system was viewed as a matter of changing the social structure of science (with consequent changes in the communication behavior of scientists). According to Garvey, the alteration should be performed in such a way as would not destroy the distinctive feature of scientific communication, which was the essence of scientific progress and integrity. What Garvey meant was that if the goals of transitioning the paper journal process to the electronic process were not compatible with the individual scientist's goals and those of the scholarly community, then not only would the transformation not take place, but the effort would also adversely affect the whole scholarly- and knowledge-formulation

process. Fourth, Garvey's work pointed out the differences between major and minor disciplines with respect to scholarly communication and journal publication. He concluded that even though macro-level communication and literature patterns were alike, these similarities disguised huge differences in the disciplines. Whereas technological electronic journal innovation might be appropriate in one discipline, it might be damaging in another. Lastly, Garvey's paramount message was that librarians provided better services when they understood what patrons needed concerning either a paper or electronic method of dissemination. The findings of this study serve to illuminate Garvey's assertion.

Garvey's (1979) study of the scientific information exchange within the American Educational Research Association (AERA) was particularly relevant to this study since education was investigated as a minor discipline. This professional society was important since it sponsored various types of meetings and published the most important journals in the field. Garvey's (1979) study focused on three groups involved with the association's annual meeting: (a) authors (those who delivered meeting presentations), (b) attendants (those who heard the presentations), and (c) requestors (those who requested copies of the presentation). All of the authors were sent questionnaires, some of the attendants were questioned at the conference and, some weeks later, the requestors were questioned about the interactions with the authors. One year later, follow-up questionnaires were sent to the authors to check journal submission of their work.

Two striking trends emerged that indicated serious problems with the dissemination of scholarly communication. First, the informal network for the dissemination of "premeeting" information was poorly structured, as indicated by the

tremendous lack of awareness concerning which researchers were working on what (Garvey, 1979). Second, the pre-meeting disorganization was only temporary; information was unified at the meeting and finally diffused again. Of all 10 disciplines studied, AERA was almost 50% lower in awareness of authors' previous works than the next lowest group. Garvey demonstrated the inability of the educational research community to establish a strong informal network. Compared to all other groups, AERA seemed to be extraordinarily diffuse in its range of publication outlets. For example, the 102 authors who submitted their presentations to journals identified over 64 different journals to which they submitted. The AERA paper abstracts and the ERIC database attempted to unify the field's scholarly communication, albeit without much success (Garvey, 1979).

Olsen's (1994) study grew out of her concern "that if journals are to be electronic, it is important that they should be structured to accommodate not only the physical tasks carried out by scholars, but also the human experience at stake" (p. 4). Olsen's work answered the broad question, "What are the particular processes carried out by scholars with journal literature which are so fundamental to scholarship that they must be accommodated by the electronic version of journals?" (p. 4). Olsen's research examined the interaction between the scholar and the journal literature. From these understandings, Olsen postulated the best design features to match the scholar's needs.

Olsen's (1994) methodology consisted of pilot interviews used to structure a survey. The survey was administered to 48 randomly selected faculty from two large Research One universities. From the population of the study, one discipline was selected from the physical sciences (chemistry), one from the social sciences (sociology), and one

from the humanities (English). Olsen used an unstructured framework and approach to the interviews. Her seven categories of question consisted of the following:

1. Reasons and techniques for locating journal literature
2. Methods of reading journal literature
3. When and where journal literature is read
4. Which journal literature is most useful
5. Speculation on the advantages and disadvantages of printed journal literature compared with electronic journals
6. The scholar's demographics
7. The scholar's computer usage

Throughout the study, Olsen (1994, p. 14) confirmed the importance of communication through journal literature, restating the unanimous belief among all interviewed that journal literature is "indispensable" to their academic work. Olsen's study revealed the differences in the use of journal literature among the three fields. For example, 62% of the chemists used the journal literature "every day, every other day, or two-three times a week" compared with 25% of the sociologists and none of the humanists. Olsen attributed this to the fact that journal literature was the "research front" or current state of knowledge to a greater degree among chemists than among sociologists and those in the humanities.

Olsen (1994) also found that going to the library created a serious problem for all participants. First, they did not like to go; and, second, many chose to subscribe to more journals in their field rather than go to the library. It seemed the faculty, in light of its

disdain for the library, would much rather pay and subscribe to journals. Therefore, she argued, each member would be more inclined to subscribe to an online journal. Scholars in the study remarked that they browsed by author, title, and footnotes. Furthermore, chemists and sociologists browsed specifically by abstract, graphics, and captions. The study concluded that while the use of electronic journals provided scholars with some advantages over the use of printed journals, the same technology had disadvantages that militated against the effective use of journal literature. Therefore, at times, it actually worked against the progress of scholarship. To illustrate this warning to electronic journal proponents, Olsen pointed out two problems that required attention. The first problem was that the selection of literature required a unique human, not computer, identification. Olsen provided in her research the requirements to overcome these problems (p. 63):

1. Browsing graphics to determine the value of an article;
2. Flipping pages and scanning to provide a mental model of a whole context;
3. Having tactile connection with what is being read to assist comprehension;
4. Experiencing serendipity to locate an article which would not have been found otherwise, and to make chance visual connections with an author's phrase or sentence which unpredictably stimulates a new line of thought;
5. Searching in a non-predetermined manner to gather "outliner" articles on a topic and to generate new ideas;
6. Browsing to support ongoing education where the boundaries of what is "appropriate" literature are not clearly distinguished; and

7. Participation visually with a wide body of literature.

The second problem Olsen (1994) found was that it was unacceptable to read text from a computer screen. The recommendations that emerged from the survey research to solve this problem were as follows (p. 64):

1. Ergonomic conditions to alleviate eye strain, difficulty with the use of the keyboard and screen by wearers of bifocal glasses, fatigue of sitting in one position
2. Presentation of text on a screen of adequate size and resolution to overcome degradation of reading performance
3. Scanning, using some mechanism other than scrolling to support navigation and comprehension
4. Combined tactile and visual scanning to provide control in seeing and understanding pages of an article
5. Underlining and annotating text to assist deliberate reading and transmission to the mind of the intellectual content of "the page"
6. Creation of a printed version of the article to overcome the reader's sense of being "cut off" from the electronic version of the text
7. Portability of the text to support the typically nomadic reading patterns of scholars
8. Type fonts and text design which give the text an appearance of "weight" and authority, establish a visual impress on the reader's mind, and support comprehension as well as aesthetic needs where appropriate

Many of Olsen's (1994) conclusions and the possible solutions for the two problems of selection of literature and readability of online text are being studied intensively at the Chemistry Online Retrieval Experiment (CORE) project at the Mann Library at Cornell University and at many other institutions researching the field of human-computer interface design. Despite these extensive works, however, lacking was a comprehensive study of scholars' interactions with online journal literature and their perceived values and opinions of the impediments and obstacles to a smooth transition from paper journals to electronic scholarly journals.

Shackel, Pullinger, Maude, and Dodd (1984) studied many aspects of electronic journals ranging from the scholar's use of printed journals to experiments with readers using text on screen versus on paper. These studies yielded overall conclusions that reading from screens was as fast and accurate as reading from paper. Yet, despite all the empirical studies and experiments of online journals conducted in the 1980s at both Cornell and Loughborough universities, direct conversations with scholars were missing.

What was significant about Olsen's (1994) findings was that the ejournal had no analog such as corporate records, newspapers, handbooks, technical manuals, or patents. Olsen (1994) pointed out that journal literature was communication among scholars at the research front. The literature served as a formal discussion of discoveries, methods, theories, and verification of truth, not simply as a convenient information dissemination vehicle. At the core of this communication was the interactive nature of journal literature. Olsen's (1994) concepts of "wayward thinking" and "casting around for intellectual adventure" were the key differences between scholars using paper journals and those using online text.

Although it was a foregone conclusion that automated journals, search, and retrieval enhanced science, it was not known whether the same could be done online. The challenge to electronic journals, according to Olsen (1994) and Garvey (1979), was their flexibility and browsing capability, referred to as the "wayward and unpredictable mental model." This model was analogous to going to the library section JL 300, searching everything there, and finding a great article serendipitously.

Despite this challenge, proponents stated that methods allowing researchers the same wayward flexibility to stumble onto a discovery using online journals already existed. They believed that ejournals and directories worked as well as or better than paper journals in this respect. They also recognized that years of working with paper journals and browsing libraries had conditioned the consumer. Some of this conditioning continues to transpire. However, other browsing needs are being addressed through continued technological innovations in database searching and browsing via the World Wide Web (Ginsparg, 1998; Harnad, 1991; Odlyzko, 1997; Okerson, 1998).

Olsen's (1994) most interesting findings included the notion that ejournals need to accommodate scholars' intellectual activities of creative thinking, learning, and analytical thinking. Such learning occurs when the scholar is about to begin some research and is reviewing a whole body of published work. According to Olsen, creative thinking occurs when the individual or group discovers an unpredicted inquiry due to unexpected intellectual connections with existing knowledge. Looking for relevant articles of interest while culling irrelevant literatures prompts analytical thinking. Successful reading and thinking lead to comprehension, and the weighing of the piece of literature against other journal articles brings one to a higher level of understanding.

Lastly, Olsen concluded, whatever technological innovation was used, it had to solve the problems of readability and serendipity, thus allowing creative thinking, learning, and analytical thinking. If this were done, the whole system of electronic publishing would function to accommodate all users and disciplines. Others pointed out that Olsen might have profitably considered the simple expedient of "dumping" electronic articles to paper printers to overcome the disadvantages of electronic publication.

Differences in the Disciplines

New York Times quoted Paul Ginsparg as saying, "Tens of thousands of physicists in more than 100 countries surf the web for their scholarly communication at a site maintained by the Los Alamos National Laboratory in New Mexico, every day" (Hafner, 1998, p. B12). Paul Ginsparg, a physicist, believes that the Internet is quickly bringing to an end paper-based communication among research scientists. For example, Ginsparg's site receives more than 40,000 visitors a day and more than 2,000 submissions a month (Ginsparg, 1998). Once at the web site, visitors peruse research papers that have been posted since their last visit, browse new works, and send emails to one another based on the day's postings. On April 21, 1998, according to the *New York Times*, "Many of them no longer read print journals. They don't need to" (Hafner, 1998, p. B12).

Today's physicists disseminate scholarly information via the web, thereby altering the system and changing the social structure of science in a way that many of these scientists believe is the essence of scientific program and transformation. According to Hafner (1998), the physic discipline's success in transitioning to electronic

dissemination sparked a debate among scientists from a cross-section of disciplines. Many viewed the Los Alamos archive as a forerunner of what lay in store for all scientific discourse. This development may be what Drucker (1969) claimed was "discontinuous change"; whereas Ginsparg's innovation has led to a sudden jump in the process of change, moving it quickly to a higher plane (Drucker, 1969, cited in Wilson, 1997, p. 8). Others believed it was an anomaly in science, well suited to physics, but not easily adapted to other disciplines (Hafner, 1998).

The physicists are not the only scientists developing electronic journals. Other fields are moving slowly toward a paperless scholarly communication system. Since January of 1993, Gene Glass, a well-known education researcher at Arizona State University, has edited a refereed scholarly journal entirely electronically. As far as he was concerned, the contents never had to touch paper (Glass, 1994; http://olam.ed.asu.edu/ ~gene/papers/papvcyb.html). Glass had edited three journals prior to this venture into the electronic medium. In 1978, he began a two-year term as methodology editor for the *Psychology Bulletin* for the American Psychology Association; and in 1983, he assumed co-editorship of the American Educational Research Journal with Mary Lee Smith and Lorretta A. Shepard. From his unique perspective, Glass stated:

> In my experience, the ejournal has been superior in every respect: cheaper to produce, faster, more accurate, better written. Typically I receive an article submitted to EPAA (Education Policy Analysis Archives) in the form of an email letter and mail it that day or the next to the entire editorial board, thirty individuals who donate their time to the journal just as referees always have. Those who submit reviews are self-selected on the basis of how busy they are and how appealing the topic of the article is. Within a week to ten days, I receive back from the board an average of about five to ten reviews. This compares with an average of two reviews in four to five months, which was average for any paper

> journal I have edited or submitted to. I make a decision and send it and the reviews to the authors within a day or two of receiving the editorial board opinion. The article is in my office for less than two weeks. And for some reason that is not at all clear to me, the reviews I have received from the EPAA board are longer and more carefully done than what I received when editing paper journals—perhaps it is because since I can canvas the entire board on every submission, those who send reviews have special interest and expertise on the topic of the article being reviewed. The result is that authors are grateful for the reviews, which surpass any of those in their experiences in scholarly publishing, they work harder on revisions and they produce better final drafts. The first article that we published in EPAA was submitted, reviewed, revised and published in 14 days. (http://olam.ed.asu.edu/~gene/papers/papvcyb.html)

Education Policy Analysis Archives (EPAA) has had more than 250,000 articles downloaded since 1993, and more than 200 submissions from scholars (personal communications, Glass, 1998). Despite Glass's (1994) and other educational ejournal editors' successes, EPAA and the discipline of education does not mirror the popularity of the Los Alamos archive and the physics discipline. That archive serves as a vast repository of physics preprints and is the primary means for today's physicists to exchange information.

The field of education, as Garvey (1979) pointed out, is much more diffuse and disorganized than the "hard" sciences. Glass's (1994) work represented an interesting attempt to change how scholars in education policy communicate. Unlike physics, the discipline of education has not embraced the ejournal as a means of publication. Glass (1994) apparently did not expect the differences between people who preferred paper journals and people who used ejournals to disappear soon. In 1994, he predicted that the paper journal and the ejournal probably would co-exist in the education discipline for many years (Glass, 1994).

However, Meehl's (1978) remarks in "Theoretical risks and tabular asterisks: Sir Karl, Sir Ronald, and the slow progress of soft psychology" illuminate the differences between what he referred to as the "soft" and "hard" sciences, sometimes referred to as the minor and major disciplines. Meehl brilliantly described the nature of the fields and the sociology of knowledge claims. Meehl labeled the claims as "truthlikeness" while Popper labeled the theories as "verisimilitude." The fact that one discipline developed electronic journals in the dissemination of scholarly communication more quickly than another might be due to the specific discipline's ability (i.e., physics) to falsify knowledge claims and another discipline's inability (i.e., education) to do so due to the "unavoidable looseness of the nominlogical network." Meehl explained that the "soft" disciplines lacked the cumulative character of scientific knowledge. Meehl stated, "They tend neither to be refuted nor corroborated, but instead merely fade away as people lose interest" (p. 806). On the other hand, according to Meehl, the "hard" disciplines with which Popper and Fisher were so familiar could test the null hypothesis via "significant differences" and "consistency tests." The "hard" disciplines' Faustian bargain can best be explained by the differences in fields. For example, theoretically speaking, a few young researchers claimed they created/replicated "Cold Fusion." There was brief enthusiasm about the new theory, but in this "hard" discipline, the experiment first was replicated; and then, operational definitions and methodology were inspected. The scholars in the discipline quickly could falsify their knowledge claims and reject the findings as a "nice try." On the other hand, suppose a group of young researchers in the field of education theorized that the teaching of "Ebonics" would increase the comprehension scores in all subject matter for all inner-city children. According to Meehl, it might take scholars with

authority in the discipline to refute the claims. Yet, the findings would not be put to rest due to unreplicable empirical results. As the mixed positive and negative data were reported, people finally would lose interest in the notion and pursue other endeavors (Meehl, 1978).

Labaree's (1998) article, "Educational Researchers: Living With a Lesser Form of Knowledge," provides a useful framework from which to discuss educational knowledge. Labaree stated that educational knowledge is soft versus hard and applied versus pure. Educational knowledge provides use value versus exchange value. Hard knowledge, according to Labaree, occurs when research findings are verifiable, definitive, and cumulative. The natural sciences were most notably talked about as being hard. They have very developed scientific methodologies and verification rules that allow others to reproduce their findings. Labaree pointed out that disciplines that produce soft knowledge were defined as those that were less structured. Labaree made what is, perhaps, the most pertinent observation for the current research when he remarked that educational research by its very nature is far more open to criticism and challenge (because of the weak relationships it probes and the huge number of mediating conditions to which these relationships are subject), even by relatively novice researchers.

Disciplines that produced peer knowledge are oriented toward the construction of theory. They focus on establishing claims of more universal and generalized findings. Labaree (1998) stated peer knowledge researchers were called cosmopolitans of intellectual inquiry; they seek to gain distance from the local scene in order to establish something that is credible and generalizable. He further argued that disciplines that

produce applied knowledge focus primarily on practical issues that arise in specific contexts. The aim is not to generalize but to solve particular problems.

Labaree (1998) based his work on Tony Beecher's 1989 book entitled *Academic Tribes and Territories.* The article by Labaree pointed out that soft knowledge in education has problems of description and interpretation. For example, problems exist when portraying or making sense of events under study in the absence of clear rules and validated methodologies. Labaree pointed out that in the soft knowledge disciplines, and specifically in applied knowledge, it is very difficult for practitioners to build on a solid foundation of findings to move to the next tier. The author also pointed out that many of the soft knowledge areas must deal with human behavior; therefore, it is quite difficult to look at effects and causal relationships.

In contrast, according to Labaree (1998), the theories of the hard sciences are gradually validated to such a point that the claims come to be accepted as almost definitive laws or theories. Many researchers say this is what we know about a particular component of the natural world. In the hard disciplines or hard knowledge areas, this kind of finding establishes a bottom line or first tier upon which others can build and from which the pursuit of knowledge can be pushed to the next level. This scenario is viewed as quite superior to the soft knowledge areas in which each and every research is either duplicating previous research or refuting it. Therefore, the building blocks of educational research, or soft knowledge, are never built upon but simply shuffled or reshuffled by research study after research study. Labaree (1998), in his article, did not assert that hard knowledge is foundational and soft knowledge is not. He was simply making an argument that hard knowledge producers were in a stronger position,

especially rhetorically, to make a claim that their work was definitive; therefore, it could be cumulative. Labaree pointed out that education, due to the nature of soft knowledge and despite its best research efforts, can do little to construct cumulative knowledge.

In discussing peer versus applied knowledge, Labaree (1998) built on Merton's distinction that was mentioned earlier between cosmopolitans and locals. His research asserted that researchers were cosmopolitans of intellectual inquiry. Much of the natural sciences fit in this cosmopolitan role because it encompassed mostly theoretical work, i.e., mathematics. On the other hand, Labaree defined applied knowledge as the professional schools like education, which in general deal with a wide array of problems and focus attention on solving those specific problems rather than building theories. For example, Labaree pointed out that education was not a discipline like physics, which was defined by a distinct theoretical perspective for viewing the world. Therefore, education has no boundaries, being quite diffuse as an applied knowledge field versus physics as a peer knowledge field.

Labaree (1998) took Beecher's model further in discussing the exchange value versus the use value of knowledge. Beecher described the exchange value as a credential that could be exchanged for something that has intrinsic value. For example, students who received a degree could exchange that degree for a job or higher standard of living. On the other hand, the use value gives students a set of skills and an accumulation of knowledge that would be useful to them in carrying out whatever life brought them. Therefore, if one is maximizing one's exchange value, one is concerned with the reputation of the university or program that one attends. If one were interested in maximizing use value, one would value a setting that provided the maximum education

that would be of practical use in the field. Labaree made the assertion that educational researchers and education schools offered low exchange value and high use value. Specifically, one learns quite a bit about actual settings and practical skills usage, but the exchange is quite low. For example, education students are over represented among women, the lower classes, public employment, and a semiprofession. It has weak academic standards and modest institutional origins compared to other disciplines.

Labaree (1998) went on to explain that high use value did not really threaten the prestige of the field. Take medicine, for example, where the high use value guarantees a high status, not only within the university, but also in society generally. Labaree opined that educators are closer to nurses than doctors in the professional hierarchy. With all this being said, the most interesting aspects of Labaree's work that apply to electronic scholarly journals are the varying organizational consequences that affect disciplines; the roles that the disciplines play; and possibly the study's resulting categories.

Labaree (1998) wrote that hard peer knowledge production calls for a social organization of scientists that he called urban and convergent. This means that everyone is focused on solving the same intellectual problems. The result of being urban and convergent is that the work takes on an urban feeling as if one was building high-rises that made a solid social structure and were quite hierarchical. For example, it takes novices in urban and conversion fields substantial time and effort to go from the bottom to the top. Labaree stated that, as a result, only senior people can occupy the highest authoritative positions because they alone have "risen through" the existing research work and issues. Students and researchers who had not yet climbed the proverbial scholarly ladder, he argued, could not participate in high-level discussions.

On the other hand, the soft, applied knowledge calls for an intellectual practice that is rural and divergent. As stated earlier, soft knowledge researchers cannot build towers because a foundation is nonexistent. Rather, it is simply reconstructed or debated. Therefore, educational researchers are thinly spread over diffuse areas of subjects and issues; the most basic issues in the field of education are only interpretative approaches. Even the layperson or novice can attack the most senior researcher or expert. Therefore, to follow Labaree's analogy, education or soft knowledge areas can be compared to rural dwellings, rural diffuse areas, or hamlets upon which high-rises and elevators cannot be built.

Labaree (1998) pointed out that senior people in the soft disciplines, therefore, have less control over the work of intellectual production. Their own work is subject to challenges by novices. The discourse that stems from this becomes quite diffuse, resulting in many divergent research communities. Labaree observed that within rural and divergent intellectual practices, scholarly societies are concerned more with the state of the political apparatus of the discipline than the state of the research itself.

Technical ambiguity is found in a diffuse or rural and divergent framework, which means the methods that intellectually should be focused on are not known. There is a resource dependency and the environment could be temporarily in flux or always in flux. Therefore, the focus is on applied research, not theoretical knowledge.

To combat these problems, Labaree (1998) noted that education schools felt a pressure to transform education into a hard science. One example that was found was the effort to move education into the hard science, or something like a hard science, through the construction of large federally-funded centers that would foster an urban style

organization of knowledge production. Secondly, there was a pressure to transform education schools into peer research institutions. These two efforts have faltered. Labaree (1998) pointed out that this gives education a sense that the field is getting nowhere. An example of this occurs when, at the end of long and distinguished careers, senior educational researchers find themselves working on the same question that they attempted to answer in the beginnings of their careers.

In summary, Labaree's (1998) article is important to this study because of the organizational and political consequences of various disciplines being at various levels in their development. Labaree pointed out issues that may be revealed through studying the differences of the five disciplines and the roles that each of these actors in the five disciplines wish to play in communicating or archiving the findings of research. The second relevant assertion involves the kinds of knowledge produced by the different disciplines. Whether these consequences are negative or positive, they have the potential for enlightening the mode of scholarly communications through journal articles, scholarly society meetings, and knowledge construction. The key characteristics of educational knowledge constrain and enable the work of scholarly communications and specifically, the design and development of online scholarly communications in many ways.

Objections to Technology Innovations

Postman (1993) is a popular Luddite known for his disdain of technology. Postman stated, "The great problems of education are of a social and moral nature and have nothing to do with dazzling new technologies" (p. 25). Postman also related that

"he would bar educators from talking about technical improvements until they have disclosed their reasons for offering an education in the first place" (p. 25). Postman's relevance to this study was fourfold. First, he is an articulate advocate for questioning discontinuous change and technological innovations. Second, he offered parallels to the function of scholarly journal literature. He posed the issue that journal literature might not be about getting more information dissemination to scholars; rather, that its function might be to teach junior faculty researchers how to behave in scholarly groups and scholarly discourse. Third, he asserted that the production of the journal literature might not be to teach methods and research, but to provide researchers with narratives that help them find purpose and meaning in their respective discipline. Finally, any problem that scholars cannot solve without electronic journals, Postman argued, cannot be solved with them.

Many who opposed electronic journals remarked repeatedly that journals not only should be leather bound to hold thick paper to caress, but also should have the hefty feel of a weighty volume in one's hands. Although everyone understands these positive characteristics of the paper-based journal, Grenquist's (1997, (http://www.press.umich.edu/jep/03-01/Iconoclast.html) complaints about the electronic journal best typified the general arguments against its emergence:

1. The difficulty of reading a screen
2. The difficulty of establishing the source and authority of the text
3. The absence of conventions (titles, headings, careful punctuation, indentation, paragraphing, page breaks) that facilitate use

4. The jumbled incoherence of computer display
5. The inability to mark up an article or to find and use it again conveniently
6. The inability or uncertain legality of transmitting an article to a friend

To sum up his reasons, Grenquist (1997) said, "Just mail me the journal."

Another perspective on questions of publishing, archiving, and accessing electronic journals was offered by an information scientist. Rowland (1994) felt that "the continuing debate actually has little to do with the paper versus electronic issue. It is in fact quite an old controversy that predates the computer, and reflects the animosities that often exist between academics, librarians and publishers" (http://rachel.albany.edu /~ejournal/v4n2/article2.html). Many people place most of the blame on the publishers.

Current Studies and Research on Free Online-Only Scholarly Journals

Three articles from *Nature*, *Science*, and the *American Scientist*, in the fall of 1998, discussed electronic scholarly communication concerns and issues. The first article by Walker (1998) established a discussion about free Internet access to traditional journals. Walker looked for ways in which publishing could occur. He pointed out that scientific, medical, and engineering research was paid for by the public and by private industry; therefore, it served as a public good and could be considered a public good. Walker's contention was that since the copyrights were signed over by the authors, the journal articles became commodities. Following from this, the commodity could be sold by publishers to a captive audience, specifically university libraries. This resale commodity issue caused a serious crisis due to the fact that prices were dramatically spiraling upward, and productivity (if measured by number of published journal articles)

also was growing. Therefore, the result was more journal articles at higher prices, with minimal competition. This escalation caused information poverty and local hardship for many libraries.

The Walker (1998) article pointed out that existing technology permitted online free access to local knowledge. Thus, it was not a question of when or how the access should have occurred. The author believed that access should be available, free for everyone. Holding back the growth or development of online scholarly journals by allowing commercial publishers to use faculty articles as commodities was likened in Walker's article to creating tollgates and charges for research. The economic situation of for-profit publishers was that they provided ways to access scientific knowledge in a model that was simple: subscription, site license, and pay-per-view. Walker pointed out that these tollgate approaches did not allow for the broadest dissemination of scholarly journals, which is the aim of scholarly authors. Walker's article attempted to show how societies and universities could pay for articles out of the savings the publishers would have by going electronic. Therefore, the articles would be available, free (subsidized) to all in the scholarly disciplines by selling immediate access to authors in a form of author charges that were simply paid by the authors through grants, their institutions, or themselves. Walker's hypothesis was that this would hold down subscription prices and permit free access to knowledge throughout the world.

Walker (1998) discussed the evolution of scientific publishing and pointed out that in the 1960s most of the societies and publishers had subscriptions that were low cost due to the fact that most of the societies' publications were paid by membership dues. Commercial publishers, at this point, wanted nothing to do with the field because

there was no profit in it for them. However, the postwar brought a boom in the number of science and engineering Ph.Ds awarded between 1958 and 1968 and this increased until the 1970s (http://www.amsci.org/amsci/articles/98articles/walker.html). This graduation rate caused a surge in academic jobs and grants. Furthermore, an important indicator of success for these new Ph.Ds became the number of articles that they published. In 1961, to alleviate some of the strains on journal publishing, the federal government approved payment of page charges. At the same time, commercial publishers began to see opportunities in the hard science areas where societies could not grow new journals. As new outlets for their articles, they started new journals in long established fields and, in addition, made a positive move to develop popular, newly developed research areas through commercial journal literature.

Walker's (1998) article further discussed that the serials crisis noted earlier was best exemplified by the fact that between 1960 and 1970 twelve established research universities increased their acquisitions in constant dollars by 150% and the number of volumes by 117%. As a practical matter, this growth could not be sustained. Journal literature consumers in the 1970s, due to the emergence of commercial for-profit publishers, witnessed extraordinary increases in pricing. This trend continued, exemplified by the fact that since 1986 the 121 members of Association of Research Libraries (ARL) have spent 124% more to purchase 7% fewer serial titles (http://www.amsci.org/amsci/articles/98articles/walker.html). Each year libraries have been forced to cancel some subscriptions in order to continue receiving other journals. This activity causes a feedback loop when publishers raise subscription prices due to

subscriber bases shrinking. Therefore, instead of ending the serials crisis, the feedback loop continues to spiral out of control.

An example illustrating the tendency of for-profit publishers to move into the electronic realm and to build tollgates is the American Chemical Society (ACS), which offers libraries a site license for web versions of its journals. However, ACS charges 25% more for the web versions than the paper subscriptions alone (Walker, 1998, http://www.amsci.org/amsci/articles/98articles/walker.html). Walker mentioned that this served as an example of what was not the world of free digital information envisioned by some of the prophets of the Internet. Within some fields like physics and mathematics, many scholars submitted their manuscripts or articles as eprints. At the same time they submitted the article to a traditional journal. Although many of the papers in eprints were eventually published, these online versions have been available more easily and, in all probability, more frequently. Physics and mathematics also have a history and tradition of widely circulating information in the preprint format. These two areas, specifically mathematics and physics, moved away from costly for-profit publishers to the free online access to electronic archives or eprints.

Walker (1998), in his article in *American Scientist*, narrated the story of the Florida Eptimological Society (FES) journal that he brought online for the association. He discussed that his association could have all of the articles from the society's journal from 1917 to 1994 scanned (some 20,000 pages) for the price of $12,000 (http://www.amsci.org/amsci/articles/98articles/walker.html). Walker pointed out that prepayments or page charges (fees) could simply make his journal free. Through Walker's FES journal, he discovered that societies dependent upon library subscriptions

to help pay their publishing costs no longer needed to be dependent because they could realize profits from article reprints and page charges. Walker described how this plan alleviated the society's concerns that free access would ruin them financially in the all-electronic future. If societies, according to Walker, acknowledged that their mission was to serve members, they should realize that restricting access to refereed results did not fit the mission. Restricting access would not be productive because free access has become affordable for societies through subsidies. In fact, other mechanisms have been made available to avoid altogether the commodity market characteristics of journal articles.

Walker (1998) foretold an all-electronic future when traditional journals had to change rapidly. He made five assertions. First, to achieve the free access advocated by Walker, central printing had to end many of the large costs or the present paper system would simply vanish. As a result, publishers would no longer pay for printing and mailing of issues and repeats, the cost of which accounted for 30% of the total publishing cost. Second, libraries no longer would pay for subscriptions or site licenses to journals, an estimate of cost savings that exceeded $2.5 billion annually. For example, if current estimates were true, revenues generated per article would be about $4,000. If three fourths of the revenue was from libraries, the cost per article would be about $3,000. If these estimates were combined, the savings to libraries from subscriptions to U.S. scholarly journals alone would be $3,000 times 6,771 (the U.S. science journals that are published) times the average number of articles, which is 123. Therefore, the cost reduction, in a single academic area, would be $2 billion (http://www.amsci.org/amsci/articles/98articles/ walker.html). Third, according to Walker, libraries no longer would have to display and preserve paper issues. Therefore, if

libraries chose to bind book-size volumes, they could simply print them at the local site. Lastly, many of the costs that would continue in the free access model were those of editing, referring and revising, and composing. Although these costs were measurable, $300 to $1,000 an article as estimated above was sufficient. Walker noted that in order to provide free access the publisher would have to be paid up front. However, if authors and their institutions believed free access was worth continuing, they would find funds from their savings to maintain this model.

In conclusion, Walker (1998) pointed out that free access to traditional journals was affordable and achievable. He believed that his model of author page charges (subsidies) was the right thing to do for research. Those who performed research should pay for the articles since those who performed the research also want widest dissemination. Therefore, Walker's model proposed in his article titled "Free Internet Access to Traditional Journals" satisfied all goals of authors, readers, institutions, librarians, and societies.

The second timely article on electronic scholarly communications was published in *Science*, a global weekly of research published by the American Association for the Advancement of Science (Bachrach, Berry, Blume, von Foerster, Fowler, Ginsparg, Heller, Kestner, Odlyzko, Okerson, Wigington, & Moffat, 1998). The article focused on intellectual property and the ownership of scientific papers (http://www.sciencemag.org/cgi/content/full/281/5382/1459). Bachrach et al. wrote that the most effective way scientists could disseminate their results through journals was by working with professional societies and independent publishers to create new ways to distribute their results and to reassess old procedures and consider the new possibilities

offered by the Internet. The authors were members of the American Academy of Arts and Scientists Committee: The study of Electronic Communications. Their experience on the transition from paper led them to believe that works based upon government-supported research should be free to distribute. Furthermore, those works should be free in electronic postings, journals, and other new methods that may appear.

This article (Bachrach et al., 1998) cited the U.S. Copyright of 1976 Act (http://www.sciencemag.org/cgi/content/full/281/5382/1459). The act shifted the legal balance of control from publishers to authors. The copyright stated articles were "fixed in a tangible medium of expression" (p. 1459) and by statute belonged initially to the creator. This was very important to science, technology, and medical (STM) journals where the authors were required to transfer the copyrights that the law had vested in the creators. The main point of the article verified that authors did not have to relinquish those copyrights. This regulation would serve to match scientific research goals with public policy goals. Historically, scientists writing up their research have been much different than professional authors in that they have received no money and their goal has been to share their new findings, to advance research inquiry, and to influence other scientists. The motivation of these scientists or authors has been so strong that they frequently have paid page charges in order to publish their articles.

This article demonstrated that the goals and motivations of research and publish scientists were aligned with the purpose of Section 105 in the U.S. Copyright Act (http://www.sciencemag.org/cgi/content/full/281/5382/1459). Although the motivations and the Copyright Act were aligned, widespread distribution of results through the Internet has not materialized in science technology and medical journals. The publishers

are enforcing tighter controls over Internet copyright dissemination and pricing than in the traditional print world. Since research is a public good, many stated the copyright policy should encourage the notion that ideas and creative works that are produced at universities should be used for the greatest possible benefit; therefore, widest dissemination possible of those ideas would be the goal (Bachrach et al., 1998).

The Transition from Paper Working group proposed that federal agencies that funded the research recommend or require, as a condition of funding, that the copyrights of the articles or the works describing the research, remain with the author (Bachrach et al., 1998). The author retained the right to distribute original papers informally through the web; therefore, the formal paper was owned and worked with either by the society or by the publisher. The publisher could request, as a condition of publication, that the author cite the form of publication. That is, the one in traditional paper print version. This simple proposal would allow the winners to be the scientists. They could distribute, read, and respond quickly and freely to new results. The publishers also would gain through new opportunities to aggregate and to add value beyond what the individual author can do. Publishers who failed to find new ways to enhance the value or contribution of the author would not generate any revenue.

Many scholars and publishers were divided over this proposal for the government to insist that authors keep their rights to access for their own work. For example, *Science*, *The New England Journal of Medicine*, and the *Journal of the American Chemical Society* adamantly opposed authors posting their own articles to the web. However, other associations or journals like the *American Journal of Mathematics*, the *Journal of Neuroscience*, and *Nature Medicine* have considered distribution via the web consistent

with and even advertising for their own journal (Bachrach et al., 1998). This intellectual property issue is quite pivotal. It is the publishers, not the scientists, librarians, or archivists who face the problem of ensuring viability of the STM journals. In conclusion, intellectual property issues may be a vehicle for or a catalyst to change from traditional economic models of publishing to the open, free access of electronic scholarly communications.

The third article, authored by Harnad (1998) in September, published in *Nature* focused on the interconnection of online journals and financial firewalls. Harnad believed the move to online and free access was not only inevitable, but also optimal. He wrote of learned inquiry which always was cumulative. Learned inquiry was informed, new findings percolated through the minds and media instantaneously; and reporting became more interactive, more collaborative, creative, and self-corrective by being online, free, and almost at the speed of thought (http://helix.nature.com/webmatters/ invisible.html). Harnad's main point was that everything necessary to accomplish this goal was in place, technologically speaking. He noted, however, that what had to be found were ways to break old habits and shake up the status quo so that publishing interests were forced to develop free access to online scholarly journals.

Harnad (1998) named five beliefs or myths that he wished to dismantle. The first myth was preservability of the text or print in the new medium. He stated that preservability should not be a concern because bits are bits; and when they are digital, they can be saved in any location and multiple times. Thus, he postulated that saving things electronically would preserve them much better than in the existing paper forms (http://helix.nature.com/webmatters/invisible.html). The second bone of contention that

Harnad looked to dismantle was the perceived difficulty of reading from the screen. In fact, most people did not read a whole journal, or an entire article, on screen. If they read it in the bathroom, the bedroom, or the beach, it was because they had printed a hard copy. Also, he believed technology would move so quickly that a "huggable copy" would become available for those in need of the smell of paper or the feel of a bound book (http://helix.nature.com/webmatters/invisible.html).

Harnad (1998) also stated that quality control was an issue that concerned many in the electronic medium. He pointed out that the new medium was as reliable and rigorous as paper. Peer review could be performed easily, and in some cases more easily, using electronic medium. There was, in his estimation, no difference.

The fourth concern was scholarly credit for the research. Many opponents asked the question: "Will electronic scholarly journals bring recognition and advancement as paper once did?" Harnad (1998) responded in the affirmative. Credit also was medium independent. Kudos and good work were just as easily assigned to electronic journals as to print articles.

The last concern that prominent scholars identified was that of plagiarism. Harnad (1998) also refuted plagiarism as a barrier to the transition to electronic journals. Copyright regulations also were medium-dependent. If researchers stole text, it was much easier to track down using the power of the Internet than would be the case in paper form.

Harnad (1998) noted that despite these five obstacles, the online electronic journals were continuing to grow. He pointed out that a 2000% increase was occurring (http://helix.nature.com/webmatters/invisible.html). Harnad mentioned that more new

online only journals entered the market because startup costs were quite low. This also caused many new online journals to exit the market. This flux appeared to reinforce people's fears that there was something unreliable about the medium. That was simply not the case, according to the *Nature* article (Harnad, 1998). Harnad emphasized that the central issue was not electronic or paper-based, but fee or free. He stated that this was a crucial, controversial issue that needed to be faced. In the consideration of pricing mechanisms, subscriptions, site license, and pay-for-view, these models did not enhance electronic scholarly journals; instead those models hindered them. Harnad was discouraged that current paper journal publishers moved into the online editions and, that those moves, in fact, caused costs to rise in spite of the known distribution cost reduction of 30% actual savings that these publishers have not returned to libraries in the field.

Harnad (1998) also noted that it was a difficult fact to judge online only journals. No equivalent pairs existed. No comparison could be made between two journals with similar submission rate, acceptance rate, pages per year, subject matter, readership, authorship, impact, or even prestige factor. Harnad also stated that online only journals can manage for 70% fewer dollars than required in the print world. Harnad believed that even using only a 30% savings it was worth going on online, if only to save those dollars. Harnad also noted that in order to achieve the 70% savings and the hundredfold productivity in journal publication publishers must move to online and restructure their operations. His proposal was simple and subversive. He suggested that all authors should continue to entrust their work to the paper journals of their choice. At the same time, authors could publicly archive their preprints to their home web servers or to eprint journals such as Physics E-print Archive referred to as XXX. He described Paul

Ginsparg's eprint journal archive as one model that the rest of the field could follow. Harnad remarked that the forward-thinking American Physical Society, publisher of one of the most prestigious physics journals in the world, already has agreed to collaborate with XXX. They could accomplish this through a certification process; that is, APS will put the "Good Housekeeping Seal of Approval" on reviewed and outstanding articles.

In conclusion, Harnad (1998) stated that mathematics, computer science, and cognitive science were already transitioning to the preprint archives, and there was no reason that other fields should not be finding either home servers on which to place their works or electronic journals in which to place their preprint articles in XXX. He concluded that this transition could be accomplished through page charge, based recovery or by publisher competition for authors' papers instead of reader payments. There was no need for fee firewalls to segregate papers from readers, according to Harnad. He referred to this transition as "scholarly skywriting" into the Gutenberg Galaxy (Harnad, 1991, http://www.cogsci.soton.ac.uk/~harnad/Papers/Harnad/harnad91.postgutenberg.html).

These three articles illustrated proponent dissatisfaction with the current print-based model and suggested not only solutions to the field concerning scholarly communication, but also perceptive, feasible proposals that were subversive to for-profit publishers.

Harnad's (1998) latest article in *Nature*, entitled "The Invisible Hand of Peer Review," discussed free access combined with peer reviewed quality control. Harnad stated that the invisible hand (of peer review) maintained the quality of free access articles. His hypothesis was a response to this question: "Is there a way to continue

providing this quality control at no cost to the reader?" Harnad described his definition of peer review as the process during which specialists submitted their work to qualified adjudicators or editors who in turn selected specialists or referees to advise them about whether or not the material had the potential to be published in the journal, or if it needed to be edited or corrected to reach publishable quality (http://helix.nature.com/webmatters/invisible.html). The *Nature* article pointed out that there were pitfalls in peer review policy. For example, referees might not be experts, might not be informed, or might not be fair.

Another pitfall pointed out in the Harnad (1998) article verified that virtually every paper managed to get published; in what journal it was published remained the question. This desire for all papers and all professors or scholars to publish provided a hierarchy among journals extending from top quality academic journals through low quality vanity presses. In this model, authors started at the top of the hierarchy and moved down until, at some level, their paper was accepted for publication. "The Invisible Hand of Peer Review" remarked that no one yet had brought forth an alternative model. Some models discussed were self-policing processes, a radical means to eliminate peer review. Many believed that the problems of this model were manifested in the fact that the reader would not have a navigation tool or guide to the ever-swelling supply of literature. An analogy offered by opponents of the model consisted of being a patient and entering surgery to be performed by a doctor, one, who had read only unfiltered, free-for-all journal articles about our health, or two, only peer reviewed medical journals. Contemplation of these serious issues and questions, prompted greater understanding of the seriousness of the acquisition of knowledge.

Harnad (1998) also posed this question: "Do we need expert opinion or opinion polls?" Harnad questioned whether or not experts who were self-appointed commentators simply harvested articles. He wondered if they allocated the time and demonstrated the inclination to correct them, thereby protecting quality control. It was felt that reviewers did not have the time because they were the overburdened, overworked folks in the classic peer review. Thus, if peer review was peer commentary, was it the same? Many opponents of the model believed that it was not due to the attention that accompanied public assessment of the flaws in another scholar's manuscript. They believed that this process hampered personal networking and, in some instances, the outcome of their next grant application.

Harnad (1998) related that, after two decades of reviewing two journals, one in the print entitled *Behavioral and Brain Sciences,* and one electronic journal entitled *Psycoloquy*, he found the electronic journal provided open peer commentary over and above peer review. Both journals were rigorously refereed, rejecting 25% of those submitted. Peer commentary was a powerful supplement to peer review but, in Harnad's opinion, it was not a substitute by any means. Harnad's example was in the field of physics where rejection rates were lower. He believed that rate was due to authors being disciplined and realistic regarding their initial choices for article submission. The physics discipline boasted the smallest rejection rate and the largest online use of an archive index, a public repository for preprints. Harnad believed that the invisible hand of peer review was exerted on this archive by the journals into which these articles were destined to be deposited. Harnad believed that if authors were allowed a simple process to archive

their articles without encountering peer review, quality control would became a free-for-all, much like chat rooms and use net groups.

Harnad's (1998) basic tenet or conclusion was that a subversive proposal, such as in an earlier article entitled "On-Line Journals and Financial Fire-Walls" in *Nature,* was needed to accelerate a transition to all electronic journals to reduce costs. Authors, according to Harnad, should pay charges from the institutional or publication funds that were redirected from the savings that library journal subscriptions retrieved. This process, in his estimation, would make all scholarly electronic journals freely accessible to everyone. Therefore, he envisioned archives, such as the physics archive, that offered both an unrefereed preprint section and a refereed published section tagged by the journal article and name. Harnad also proposed, in the *Nature* article, that the peer review process could be streamlined by making it all electronic. An advantage of this model, Harnad reported, was that larger populations of potential reviewers would respond if they had the time and the inclination. In conclusion, Harnad believed that the "combination" ejournal provided the best options and alternatives both for peer review and for free preprint archives.

CHAPTER 3

METHODS

This study employed two established research methodologies: (a) qualitative face-to-face research interviews and (b) document analysis. These methods were used in concert to compensate for the fact that each of these sources had particular strengths and weaknesses.

Theoretical Foundations

Little was known about the habits or attitudes of university faculty, libraries, professional organizations, and publishers toward the use of electronic scholarly journals. A qualitative research design was used to examine the influences that accelerated or retarded the transition from the paper to electronic journals. Moreover, the research explored how these influences differed across disciplines and how the actors saw their roles in the new transition from paper to electronic journals.

To gain understanding of this matter, the researcher conceptualized and focused on the development of electronic scholarly journals in order to identify the potential problems and solutions, and to develop useful and relevant theory about electronic journal growth. The study incorporated a reflexive process operating throughout every stage of the project, where each component of the design might have needed to be reconsidered or modified in response to new developments or changes in the study (Maxwell, 1996). This study used an inductive approach, focusing on the hard (physics, chemistry, and mathematics) and soft (education and psychology) disciplines. The study focused on specific people and situations, emphasizing their words rather than the

discipline's numbers (Maxwell, 1996). This study attempted to describe and explain the obstacles and impediments to electronic journals using the interpretive approach. Maxwell's five qualitative purposes, formulated by asking six, remained at the forefront of the investigation (p. 4):

1. What are the ultimate goals of this study?
2. What issues is it intended to illuminate?
3. What practices will it influence?
4. Why do you want to conduct it?
5. Why should we care about the results?
6. Why is the study worth doing?

They six questions were used as references to assist in understanding the following:

1. The meaning of events, situations, and actions through participants' perspectives as part of the reality of the phenomenon
2. The particular context of the participants that they act in and or acted upon the unanticipated influences and obstacles
3. The process by which the events in scholarly journal publishing take place
4. The development of local causal explanations

The work intended to develop categories and issues that stemmed from the research data and were based on existing grounded theory and research about electronic journals. The general framework illustrated the connections among the data pieces, and a descriptive theory about the development of electronic journals emerged.

The qualitative research was inductive and grounded, allowing flexibility and adaptability for finding new insights. Despite the limitations, the study used an unstructured approach to ensure the gathering of the appropriate rich data that lies across the five disciplines (physics, mathematics, chemistry, psychology, and education) among the four actors (scholars, librarians, society officers, and publishers).

Qualitative Research Interviews

The researcher negotiated research relationships and gained entry to the four classifications of informants: leading researchers, scholarly society officials, librarians, and publishers. Each of these informant roles was studied in the hard discipline (physics, chemistry, and mathematics) and the soft discipline (education and psychology). The researcher used criterion-based selection (LeCompte, 1993, p. 69) or purposeful sampling (Light, Singer, & Willett, 1990) because many of the people were uniquely informative as recognized experts in the field, or were privileged to witness the development of electronic journals and scholarly communication.

Semi-structured interviews were conducted in both the hard and soft disciplines with leading scholars, librarians, officers in professional scholarly society organizations, and publishers. Table 2 is an example of the type of interviewee, the role each played, and the organization affiliation. Table 2 is only a sample of the informants in two disciplines: physics and education. This study used an elite interviewing strategy for the informats in Table 2. Elite interviewing was used to give each of the informants special nonstandardized treatment, which they required. The researcher stressed the interviewee's definition of the situation, encouraging the interviewee to structure the

account of the situation, and letting the interviewee introduce to a considerable extent what he or she regarded as relevant, instead of relying upon the investigator's notion of relevance (Dexter, 1970).

Simple descriptive questions (Budd & Connaway, 1994; Olsen, 1994) were asked spontaneously at the beginning or end of the interview to obtain background in technology experience not found on the vita, resume, or web site. These descriptive questions dealt with accessibility to networks, submission and/or subscription to electronic journals, use of networks for other purposes (such as access to data sets or surfing the Internet), effects of ejournals on tenure, some structure issues, and information on networked collaboration (Budd & Connaway, 1977) The primary set of questions focused on issues of economics, access, copyright, authority, service, preservation, speed, value-added, peer review, and plagiarism. In particular, the researcher probed and analyzed comments regarding the success, barriers, and concerns in the transition from paper to electronic journals and the success of ejournals. The interviews explored the scholars' use of electronic journal literature; their styles of reading it; their perceptions of the why electronic journal publication was not evolving faster; and their description of the political, cultural, and economic barriers to ejournals (Olsen, 1992).

Table 2

Data Collection Technique Classified by Informant's Level of Discipline and Role

Informant	Major Discipline Physics	Minor Discipline Education
Leading Researchers (authoritative)	*Interviews*	*Interviews*
Scholarly Society Officials Publication Committee Chair Senior Officer	*Interviews* American Physics Society (APS)	*Interviews* American Education and Research Association (AERA)
Librarians Deans, American Research Libraries. Coalition for Networked Information	*Interviews* Science Libraries and Librarians	*Interviews* Educational Libraries and Librarians
Publishers Paper and Electronic	*Interviews* Elsevier Science	*Interviews* Jossey-Bass Publishers.

To discern the catalyst identity and the thoughts of discipline leaders and scholarly organizations that have embraced ejournals, the researcher probed and interviewed to discover what issues were the basic reasons why electronic scholarly journals were evolving so quickly in the scholars' respective fields. On the other hand, to discover the gatekeepers and the sources of resistance, the researcher questioned scholarly organizations and publishers as to why electronic publication had not been accepted.

Leading scholars of each discipline, who were usually editors and productive researchers, proved significant to the journal's position in the structuring process (Dow, 1997). These gatekeepers maintained the mediated mechanism that sustained the relationship among academic producers of ideas, their audience of readers, and their academic careers. Gatekeepers were surveyed to learn their views on the traditional role

of the journal in the social structuring of academia, on the development of electronic journals, and on a developing an agenda to replace paper-formatted journals with electronic alternatives (Dow, 1997).

Dow (1997) in his research assumed that many scholarly authorities supported the development of electronic journals as an expansion of existing informal communication mechanisms of the discipline. Despite their support for the development of electronic journals, this group of scholars continued to support the publication of journals in paper formats. Dow found that group members did not support supplanting existing paper journal titles with electronic versions and they did not wish their own journal, the journal on whose editorial board they sat, to be available in electronic format. These views were differentiated by discipline of the respondents, strength of the paradigm of respondents' discipline, or by their support or lack of support for the role of the journal in the social structuring of their professional lives. Open interviews were performed with over 30 informants in their respective fields. The interviews illuminated what persons who occupied a "gatekeeping" role in the academic world viewed as the barriers and obstacles to the acceptance and promulgation of electronic journals.

The interview questions focused on topical areas (see Table 3) when interviewing different informants as scholars (leading researchers), scholarly societies (senior officers, publication committee members, and electronic journals staff), librarians (deans, librarians, library association organization members), and publishers (for-profit, not-for-profit in paper and electronic). The interviewer roles were not exclusive. For example, one interviewee was a librarian and publisher working for a scholarly society. Even though the interviews were unstructured, if the informant required prodding, then the

researcher followed the interview protocol until the elite could get back to an area he or she felt more knowledgeable in and where there was free flow information to the researcher.

Table 3

Interview Question Categories Classified by Role

Role	Major/Minor Disciplines Categories
Leading Researchers (authoritative)	*Interviews* Cost Truth Convenience/Speed Plagiarism
Scholarly Society Officials Publication Committee Chair Senior Officer	*Interviews* Economics Peer Review (Quality of Work) Service to Members Preservation of the "Central Office"
Librarians Deans, American Research Libraries, Coalition for Networked Information	*Interviews* Economy Access Archives
Publishers Paper and Electronic	*Interviews* Profit Service Value Adding

Interview Strategy

The naturalist intent was to infer "This is what you are doing, and this is what you believe" (Kvale, 1996, p. 88). According to Kvale, the interviews were conversations where the outcome was a coproduction of the interviewer and the subject. This study centered on a variety of interviews about electronic scholarly journals with

productive scholars, librarians, scholarly societies, and publishers. For the interviewer to fully understand the issues of electronic scholarly journals, an interchange of views was achieved through active listening and confirming. As a result, the interviewer was able to expand the descriptions and explanations about the richness and scope of the growth of ejournals as well as the impediments to that growth.

There is no common procedure for interview research, but many conventions and ideals of the craft were used in this study. The interviewer analyzed many of the methodological decisions during the actual face-to-face interviews. The purpose of the qualitative research interview was to explore the everyday world of the interviewee and the relationship of each to scholarly journals, whether connected through paper or electronic means (Kvale, 1996, p. 30). In this study the researcher's purpose was to interpret the meaning of central themes concerning electronic scholarly communication through the world of the subject. Face-to-face interviews were chosen because it was important to interpret and record the meaning of what was said as well as how it was said. The focused research interview was aimed at discovering knowledge using the normal language of the interviewee to enlighten the reader, not quantification that would serve only to cloud the deeper issues at work (Kvale, 1996).

The interviewer attempted to gather open-ended descriptions of electronic journals and the scholarly communications process. Efforts converged on the attempt to elicit specific actions and situations, not just general opinions. The interviewer exhibited openness to new and unexpected phenomena rather than having a ready-made scheme of interpretations and categories. The interviews focused on particular central tenets to electronic scholarly communication. They were not strictly structured with standardized

questions, but directive to elicit both opinions and deeply held values about scholarly journals. Concerted attempts were made by the researcher to probe ambiguous and conflicting statements during the interview process.

The interview process yielded many new lines of questioning and insights. In the course of several interviews, the subjects changed perspectives about a theme, or became aware of an issue (Kvale, 1996, p. 31). Most of the interviewees were very personable during the interviews and the interaction produced a great deal of knowledge; however, each interviewee viewed the interviewer as a student researcher, not a peer. Researcher creditability was achieved through development of a rigorous and thoughtful understanding of the subject prior to the interviews. The study of each interviewee's web site, vita, and resume allowed the interviewer to dig deeper into the issues by asking questions in the context of the interviewee's background. Throughout the interview process, depending on the interviewee's knowledge of the topic, the interview turns out to be a rare and enriching experience for the interviewee, who obtains new insights into his or her scholarly communication (Kvale, 1996).

The methods and procedures employed in the investigation were those referred to as Kvale's (1996) seven stages of interview research: (a) thematizing; (b) designing; (c) interviewing; (d) transcribing; (e) analyzing; (f) verifying; and (g) reporting. In order to retain the initial vision and engagement throughout the study, Kvale's outline was useful in assisting the study through the transition from the original idea to the final report. Confirmed by Kvale, even though this section may be explained in a linear progression, an interactive nature and continued interplay occurred during the conceptualization, interviewing, and analyses phases as well as with each new contact in

the field. Furthermore, the researcher's own study of electronic scholarly journal development exemplified the stages.

Thematizing

The first stage was identified as *thematizing*. It consisted of formulating the purpose and describing the concept of the topic to be investigated by communicating with many highly regarded scholars in the field. Many emails were used to question scholars debating the growth and merit of electronic journals as to the research's relevance and the study's purpose. All the emails were returned with summative and formative changes to the research topic and questions. According to Kvale (1996), "Thematizing refers to a conceptual clarification and a theoretical analysis of the theme investigated, and the formulation of the research questions" (p. 88).

The reformulations of research questions changed and clarified the "what" and *"why"* of the study even before the question of *"how"* was decided. The preliminary responses to the research question of why electronic scholarly journals were growing and developing in some disciplines and not in others criticized the question somewhat. The research question was broadened to investigate something more interesting. For example, "What issues and concerns are raised when electronic scholarly journals are developed?" Another research question emerged from that process: "What are the obstacles and barriers to electronic scholarly journal success?" As a result, the purpose of the study again was broadened to a greater explorative emphasis. The interviewer introduced the electronic scholarly journal issue, charted the area via responses from the interviews, and uncovered major issues and concerns about a complex problem. Previous researchers of

electronic scholarly journals performed surveys, developed citation analysis, and wrote case studies about different electronic journals. However, no one had simply interviewed prominent scholars, librarians, scholarly societies, and publishers to enlighten those involved in the field of study about central issues and concerns.

Design

The second stage of the study was to determine "*the what*" –the substance of the study. Knowing the *"what"* influenced the "how" which, in turn, dictated the *design*. Good research design consisted of the overall planning and preparing of the methodological procedures for obtaining the intended knowledge (Kvale, 1996). Yin (1994) stated that interviews were one of the most important sources, because interviews provided participants with an opportunity to address specifically the subject of the inquiry. According to Kvale, interview research design obligated the researcher to plan for varied interview types, the number of interview subjects, and the resources available for the study, as well as aspects of the study for which interviews were not particularly suitable. The researcher decided to conduct face-to-face interviews. Two advantages of this kind of interview were identified: (a) the interviewer was better able to elicit information from the interviewee and (b) the interviewer could interact more effectively with the subject. As a result, the interviewer was able to obtain data that addressed the questions directly and that helped to explore new issues. The key informants held a special status as productive scholars (over 200 publications), highly placed scholarly associations' officers (directors and officers), extremely profitable publishers (in the top

tier of scholarly publishers), and longstanding librarians (serving as deans of libraries for over 20 years).

Yin (1994, pp. 84-85) identified a focused interview as one in which a respondent was interviewed for a short period of time 5 (4minutes, for example). In many cases, the interviews remained open-ended and assumed a conversational manner. However, in this type of interview setting, the researcher was more likely to be following a certain set of topics with an interview protocol backup.

In this instance, the researcher chose a different approach. Denzin's (1978) non-standardized interview was used as a guide. In this kind of interview, the interviewer addresses general questions and anticipates receiving specific information. However, the interviewer also addresses these topics informally in any order and context that happen to arise.

From the start of the investigation, there had been one pervasive question regarding appropriate interview methodology: "How many interview participants were needed?" This researcher determined this answer: "As many subjects as were necessary to discover the concerns and issues that arose from the development of scholarly electronic journals." Because the aim of the study was to obtain general knowledge. and because the law of diminishing returns became apparent to the researcher after 25 interviews, 30 participants were chosen. The hard science scholars came upon diminishing returns much faster than the soft science scholars. Later, peer review analysis revealed 30 interviews was the appropriate size for the study. The group was large enough to allow the researcher to make limited generalizations and to test hypotheses based upon differences among groups. Of additional importance, the

participant number was small enough to enable the interviewer to make penetrating interpretations of the interview data.

The researcher did not overlook the volume of resources available for this study. Because the interviews were conducted face-to-face, the researcher spent over two months traveling across the country, from our nation's capital to the California coast. Due to the amount of time it took to travel to each destination, concentrated effort was centered on careful preparation both for the interviews and for their. This procedure emphasized the quality of the data gathered more than the quantity of interviews.

During this study, knowing when not to interview was just as important as knowing when to interview. It was not necessary to interview the key researchers of electronic scholarly communication due to the emergence of the *American Scientist* September Forum (http://amsci-forum.amsci.org/archives/september-forum.html). Many of the key members of the field were present at this forum and fully discussed electronic scholarly journals. This documentation analysis was the best way for the researcher to study the proponents' understanding of the meanings in their world (Kvale, 1996). The researcher read the descriptions of their experiences, in light of their role and discipline, which clarified and illuminated the findings.

Interviewing

The third stage of the study was *interviewing*. The purpose of this stage was to learn from the interviewee. As Spradley (1979) expressed it, to discern the world from the interviewee's point of view is knowing what the interviewee knows in the way that he knows it. Spradley wanted to understand the meaning of the interviewee's experience, to

walk in his shoes, to feel things as he felt them, and to explain things as he explained them. Spradley asked, "Will you become my teacher and help me understand?" (p. 30). The researcher attempted to keep Spradley's approach at the forefront during the interview process. The researcher's status as a doctoral student fostered that purpose while securing interviewees as well as in the interpersonal situation.

Advanced preparation was essential when interviewing faculty and scholars. In every instance, attempts were made to get as much unobtrusive information about the interviewee as possible that was relevant to their publishing career. This knowledge, coupled with the researcher's expertise on the subject matter, assisted in establishing rapport with the interviewee. The researcher framed the interview by introducing topics and through defining the situations, if necessary. The researcher probed further to get deeper understanding and to steer the course of the interview. The researcher briefed the interviewee immediately before the interview took place; however, he did not directly discuss the research questions so the interview process would not be biased. The researcher revealed the interview's purpose either during the interview process or afterward in a debriefing session that often yielded either new informants or issues to discuss following the recorded interview. The interview focused on exploration, description, and, to a lesser degree, hypothesis testing. An interview protocol was used to guide the researcher's choices regarding topics to be covered. At times, the researcher engaged the interviewee in spontaneous questions to keep the discussion lively and unexpected.

Four research protocols were used. See Tables 4, 5, 6, and 7 which are the research protocols for scholars, librarians, scholarly societies, and publishers,

respectively. Each interview included introductory, follow-up, probing, direct, and structuring questions. The researcher attempted to listen intently and to take notes on the major points while the interview was being recorded. The interviews usually took place in the informant's office. This setting permitted the participant, on occasion, to provide illustrations of different scholarly journals in person. To ensure quality in the interview process, the investigator elicited rich, relevant answers with thought-provoking inquiries, using follow-up questions to clarify responses. Knowledgeable interviewees were able to answer shorter, topical questions, while others needed questions with longer introductory sets and examples. The interviewer sometimes had to lead the interview; however, in those cases the interviewees were open to the discussion and sometimes challenged the leading question.

Transcribing

The fourth stage, according to Kvale (1996), is *transcribing*. Interviews were audiotaped and transcribed verbatim with dialog attributed to each speaker. The interviewer wrote his first memo right after the interview from the notes taken during the interview process. The second memo was written usually a few days later when traveling back home. Data derived from these interviews, field notes, and vita documentation were analyzed for recurring issues and themes using the constant comparative method (Bogdan & Biklen, 1992; Glaser, 1978). The researcher listened to recordings of the interviews twice and read the transcripts repeatedly in the search for quotations that went beyond the singularity of individual opinions and thus suggested a central theme or unique notion about electronic scholarly communication. It proved practical during the

process to create graphs and tables by discipline and role as an aid to data analysis and reduction. Data display (Glass, 1997; Wolcott, 1990) allowed for the sort and categorization of data in a way that brought out and illuminated discrete, disparate parts and interwove them into a cohort cloth that could be linked in previously unrecognized ways.

Analysis

The fifth stage of qualitative interview research was *analysis*. Based on the purpose, the topic of the investigation, and the nature of the interview material, a software program for coding and categorizing was necessary. The program first used was QSR NUD*IST 4.0 (Non numerical Unstructured Data Index Searching and Theorizing). This was a multi-functional software system for developing, supporting, and managing qualitative data analysis (QDA) projects (Scolari, 1997). While the interview process of the research was proceeding, the researcher began loading the data analysis into NUD*IST 4.0 and began some initial analysis.

Upon careful review a new program called Ethnograph v5.0 was employed for the analysis of the interview transcripts. The Ethnograph v5.0 for Windows PCs was a more versatile computer program designed to make the analysis of data collected during qualitative research easier, more efficient, and more effective. This helped the researcher since two different transcribers were used with different word processing software. Ethnograph v5.0 can import text-based qualitative data, typed in any word processor, straight into the program. Ethnograph helped import the researcher's two sets of memos. The program helped search and note segments of interest within the data, marked them

with code words, and ran analyses that were retrieved for inclusion in reports for further analyses. Due to the switch in the software programs, the researcher was able to analysis two different sets or data before merging them together in Ethnograph. This allowed the study to treat the two forms of data separately and then combine them for more clarity and precision.

This project involved the analysis of unstructured data (i.e., text from interviews) and documentation from a forum in order to develop an understanding, interpretation, and appropriate application of the documentary materials. The emerging themes became the structure and conceptual frameworks within which to best explore the data and its associated labeled parts. Then the quotations and evidence were categorized accordingly. The illuminating quotations were removed from the transcripts and collected into files, with each file representing a distinct idea or theme (Glass, 1997). To understand and code text with detailed proof for the assertions, Ethnograph was used to repeat the analysis several times. To verify coding validity the researcher coded and recoded at a later date one of the interviews. Quotations in files retained identifying codes that linked each quotation to its source interview, role, and discipline. These major theme files or categories were then edited and organized into a core set of ideas about the growth of electronic scholarly journals (Glass, 1997).

After the researcher coalesced, split, and eliminated themes until a satisfactory framework became apparent, a reorganized structure emerged from the coding. This process was undertaken to illuminate key issues and to enhance the report of the findings. The construction of categories became the basis for formulating a framework for conceptualizing the differences that may or may not have existed between the hard

and soft disciplines concerning electronic scholarly communication. The conceptual frameworks were used to describe the ways in which major and minor disciplines viewed electronic scholarly journals–where they were different and how they perceived obstacles and impediments to the growth of ejournals. The analysis of data and the reporting of interpretations were uniquely tied together in this study through the additional data provided by the online forum (Glass, 1997).

Verifying

Kvale's (1996) sixth stage of interview investigation is *verifying*. The concepts of generalizablity, reliability, and validity of the interview findings are of primary concern in this stage. According to Miles and Huberman (1994), the researcher groups the data and decides what it means, "noting regularities, patterns, explanations, possible configurations, causal flows, and propositions" (p. 11). The frameworks and major themes were tested continually against the rest of the data, and then verified or discarded. Checking reliability occurred at all stages of the investigation. Miles and Huberman stated that the meanings that emerged from the data had to be tested for plausibility, sturdiness, and conformability—that was their validity. Kvale (1996) stated that a valid inference was correctly derived from the data. Each of the findings presented in this study was verified using either an alternative data source or a confirming interview with local participants. Sometimes an interview with a scholar was confirmed by data recorded in the *American Scientist* September Forum. Finally, each data source was used to check the framework discovered. In future investigations the model should be refined and challenged against competing sources.

Reporting

Kvale's (1996) last stage is *reporting*. In this investigation, reporting did not mean re-presenting the views of the interviewees, accompanied by the researcher's viewpoint through interpretations. Rather, reporting meant writing with a regard for the reader, using lively description and a summary of the findings. In order to protect the privacy of the interviewees, the researcher used labeling and, at times, changed personal characteristics. Throughout the first six stages of the qualitative interview research, the researcher kept the final stage, reporting the findings, in mind.

In the report, the researcher discussed the overall implications of the results. Doing so involved connecting the findings to the literature research and to the theoretical and practical implications of the findings. The report style presented verbatim interview quotations extracted from the transcripts as documentation for summary and conclusions. The researcher attempted to contextualize the quotations that were related to the general text with a balance of interpretation and interview text. This study used the best quotation that was of reasonable length to describe and explain the connecting threads.

Eisner (1993) approached the representation of qualitative research from an artistic point of view. This report attempted to go beyond the standard requirements of reliability and validity by using an approach of comparing and contrasting the hard and soft disciplines, where appropriate differences existed. Miles and Huberman's (1994) techniques of expressions were used to enlighten the reader visually with metaphors, analogies, and symbols. Interview quotations and documentation analysis evidence were used as illustrations and examples of specific themes in the growth of electronic scholarly journals. This report was an objective investigation in that the object

investigated was allowed to speak. The interview inquiry, when combined with the objects studied in the documentation analysis, illustrated the objective investigation process.

Table 4

Prominent Scholar Interview Protocols

	Subject Area	Questions
1.	Descriptive	What is the approximate number of articles published in your career? How often do you as a scholar use journal literature? How do you weigh the journal literature in your field? What method of dissemination do you use to find out about journal articles (citations from colleagues, personal subscriptions, Internet, library, or bibliographies)? How do you *read* an article? How do you make margin notes; make notes on paper; photocopy parts; cite files, put notes into an article, hand out articles to class, put articles on reserve? Have you been published in an electronic journal? If so, how many? Do you put these up on your web site?
2.	Major Points	What are the particular advantages and disadvantages of print and paper journals as you see them?
3.	Field Question	What do you think about *Psycoloquy*? Is the APA experiment working? Explain the APA online strategy. What do you think the APA should do concerning electronic journals?
4.	Intellectual Property	Who owns the ideas, concepts, theories, experimental data, facts, and opinions that authors record in speeches, articles, books, and other forms of publication? For example, Cal Tech Institute is deciding whether to keep copyright on journal articles. What do you think about that?
5.	Ejournal Supporters	Proponents to electronic journals like Stevan Harnad propose subversive action to claim back economic property for scholars, their university, and funding agent. How do you feel about that? Do you believe that whoever invests in the publishing process has a right to profit from such an investment? How do you judge publisher value-added?
6.	Ethical Conduct	Does electronic publishing foster and encourage plagiarism and worse, or is ethical conduct indifferent to technology change?
7.	Associations	How do you feel about the APA Publication's new 1997 policy? What do you think about free available web access from an author's web page or preprint journal?
8.	At http://www.apa.org/journals/fullposting.html	"This policy is much less stringent than the previous one."—"(1) Authors who post or electronically share their unpublished articles on the Internet should prominently label these documents, as 'unreviewed draft documents' and clearly state whether they want to allow copying and that these documents have not been formally peer reviewed. Such posted or shared documents may or may not be considered 'publications' by a given journal or editor, depending on the circumstance of the posting and the nature or orientation of the journals. (2) Authors of published work should have the prior permission of the publisher to post or to share copies of their articles. The APA will give permission to authors who wish to electronically send their articles on request to others for noncommercial use. However, they should not post copies of published articles on their personal Web pages without explicit permission from the publisher" (APA, 1997).

Table 4 cont

	Subject Area	Questions
9.	Academic Legitimacy	Does electronic publishing have the merit accorded to the same information in print on paper?
10.	Cost	What do you spend professionally and personally on journal literature? Do you feel your university keeps up with your field with journal literature in its spending? How do you gauge the value of a journal? When is it too expensive? Overall, all libraries spend approximately $2.5 billion on journals and your university spends $6 million ($1 million goes toward online journals and information technology). Is this appropriate spending?
11.	Editor	As an editor do you think the *Psychological Bulletin* will be an electronic-only free journal? How do you feel about peer review? What do you think about pricing? What do you feel about pay-per-view from Elsevier that is going on?
12.	Comparisons	With the advent of many eprints (preprint archives) taking over other disciplines' scholarly communications process—like the physics field's xxx.lanl.gov site, which gets over 70,000 visitors a day and over 100 articles—do you see this happening in psychology? If not, why not? Is it the ease of falsifying knowledge claims in physics that leads to this phenomenon?
13.	Convenience/ Speed	Do you like the speed with which the paper journals come out in your field? Would faster, more convenient journal literature in your field be helpful to you?
14.	Roles	What role do you see the scholarly societies or organizations playing in electronic publishing? Librarians? Leading scholars? And publishers? Editors?
15.	Scholarship	How easily can electronic publishing give scholars rapid access to wider audiences? Does it help scholars, as readers, to access a wider variety of materials that are more up-to-date?
16.	Quality Control	Will the new medium be as reliable and rigorous as paper? What do you think about archiving?
17.	Credit	Will ejournals bring recognition and advancement as paper did? Will changes to tenure and promotion have to take place before electronic journals become mainstream?

Table 5

Librarian and Information Technology Director Protocol

Questions
1. What is the role of the library in collecting, organizing, providing access to, preserving, and archiving electronic journals?
2. How has the role of the librarian changed in light of the electronic journals and databases? Are the librarians trained properly in electronic or online media? Have expenses drastically changed?
3. What is your library doing to create more access to its journal literature? Do you feel you are doing a good job? I have not found many free peer-reviewed electronic journals, some even from your university?
4. What do you believe are the resistances and obstacles to the growth of online scholarly journals?
5. The latest (7th) edition of the Association of Research Libraries' (ARL) *Directory of Electronic Journals* shows that a 2,000% increase comes largely from the fact that more and more existing paper journals are now making electronic versions available for a fee. As an educational researcher my big concern and curiosity is free access to scholarly information. Why the lightning speeds of commercial for-a-fee electronic journals and the slow online development at the university? Do we need more money? Training? Collaborations with librarians, etc.?
6. Is there a "serial crisis" at your university? What are you and the library doing to keep up? Is cataloging free electronic scholarly journals an answer?
7. Do you see an end to the spiraling cost of journal subscriptions? Between 1970 and 1995 a 417% increase has been discovered. Is the cost increase by the publishers described as "value-added" justified?
8. There is a tendency, especially in the United States, to think of information from libraries as a free commodity. Despite this feeling it is estimated that in total, libraries pay over $2.5 billion annually for subscriptions or site licenses. Approximately what does ASU pay and do you see this going down, up, or staying relatively the same? A few electronic journal proponents believe the electronic medium may allow universities to reduce significantly their dependence on commercial publishing. Do you think this is true? They are thinking intellectual property will return to the university too. Do you think this is true?
9. Critics of libraries have stated that libraries and librarians have taken a passive status quo role, and have aligned more with publishers than the researchers at the university. Is this a fair criticism? What are libraries doing globally and how are you acting locally? ARL? OCLC, etc.? And what is your university doing to support these efforts?
10. A few libraries are archiving and providing what they call overlays to electronic journal and preprint literature. Do you see the library having a role in archiving campus referred journals?

Table 5 cont.

Questions
11. How do you propose to work with fields like physics, where all of the scholarly communication is taking place at an eprint archive (xxx.lanl.gov), where 70,000 visitors a day review, edit, and update over 100 articles posted daily?
12. Do you believe Andrew Odlyzko when his research showed that libraries pay for providing space and full-service access to journals at around $8,000 per article? Is space an issue that will really be the catalyst to digital libraries?
13. If you believe that the current subscriptions, pay-per-view, and other for-fee methods of scholarly communication are not working in the interest of the library, what are the best incentives to dismantle the current system?
14. The Andrew W. Mellow report pointed out two main issues. One was the explosion in quantity of desirable published material and escalation of prices. The second was the development of information technologies to change the ways of organizing collections and services. One other main discovery was the serials crisis specifically in science journal prices that are driving the crisis. What are you doing in this area?

Table 6

Scholarly Society and Professional Organization Protocol

Questions
1. Online Strategy: What are your organization's online strategies, goals, and strategy-planning assumptions concerning publications and electronic scholarly journals? Are you working with SPARC, High Wire Press, the Physics XXX system or your own initiatives (NSF funding)?
2. Are integrity issues with electronic scholarly journals a concern of your organization and its members?
3. As an educational researcher my big concern and curiosity is free access to scholarly information. Why the lightning speed of for-profit commercial journals and the slow online development at universities and societies?
4. For-profit publishers have a considerable economic stake. Do scholarly societies have an economic stake in electronic scholarly communications? How does your scholarly society measure value-added and measure the cost of its journals?
5. What roles do you think libraries, university presses, prominent scholars, publishers, and scholarly societies should play in developing electronic scholarly communication?
6. What do you think about Ginsparg's XXX preprint archive? Will a preprint journal work in your discipline?
7. How do you measure the impact of peer-review on scholarly communication?
8. Are scholarly associations too conservative to be innovative and pioneering in the electronic scholarly journal field?
9. What barriers of success do scholarly journals face?
10. Who should pay for electronic scholarly journals? Some say that authors (page charges), government labs, universities, advertising, and librarians should. What do you think?
11. Do you believe that a 10- to 100-fold increase can occur by bringing the journals online? Is a 70% savings by publisher really obtainable (30% distribution, 30% copyediting, and 40% peer review)?

Table 7

Publisher Protocol

Questions
1. Publishers have an economic and political interest in both paper and electronic journals. Do you feel they can keep justifying publisher value-added for spiraling journal costs?
2. How do you feel about online electronic preprint archives like Physics XXX? Will this model work in your subject area? What role can the publisher play? Aggregation? Certification, etc.?
3. Would the preprint archive work for all disciplines both major and minor?
4. Do you feel the minor disciplines, like education, will have a harder time developing an archive like physics has? What reasons can you account for the harder time?
5. What incentives are the catalysts to growing electronic scholarly journals?
6. Do you feel the cost savings of 30% to 70% is realistic when moving from paper to electronic publishing?
7. I do not wish to write about the nonsense most people say over and over again about electronic scholarly journals, so what issue do you think no one is thinking about? Why the slow growth of free electronic journals at universities and societies and the fast growth in the commercial publishing world?
8. Why are scholarly society journals cheaper? What additional value-added do for-profit publishers provide?
9. What do you think about High Wire Press? SPARC? XXX? Other initiatives like faculty putting all their articles on their web sites?
10. It is said that publishers need $2,000 to $4,000 per article to make their ends meet. Is anything to be said about XXX, when it can publish an article for $10 per article? This is a factor of 100 in productivity. Are you adding 100% value-added? Is the old model paper-centric and inefficient?
11. Who should pay for electronic scholarly journals? Some state that authors (page charges), government labs, universities, advertising, and librarians should. What do you think?
12. Do you believe that a 10- to 100-fold increase can occur by bringing the journals online? Is a 70% savings by publisher really obtainable (30% distribution, 30% copyediting, and 40% peer review)?

Document Analysis

Timely online documentary information from the *American Scientist* September Forum was relevant to this study (http://amsci-forum.amsci.org/archives/index.html). The September Forum was a moderated forum conducted by *American Scientist* and published by Sigma Xi, The Scientific Research Society (Walker, 1998). According to the publisher of *American Scientist*, Peter D. Blair (1998),

> The pace of scientific discovery over the past half-century has been unprecedented, and the pages of *American Scientist* have chronicled a great deal of that discovery. As the electronic and print words wrestle with the future of publishing, readers of *American Scientist* have had the opportunity to expand their experience with the printed magazine through the Web pages. *American Scientist* welcomes readers to the online resources that are not available in the printed magazine (e.g., American Scientist forum) which provides readers with the opportunity to register comments regarding selected articles through a series of moderated electronic discussion groups. (http://www.amsci.org/amsci/staff/peter.html)

American Scientist included a discussion of the issues raised in the article entitled "Free Internet Access to Traditional Journals," a provocative article by entomologist Thomas J. Walker in the 1998 September-October issue of the *American Scientist*. The discussion archive is available at http://amsci-forum.amsci.org/archives/september-forum.html. Stevan Harnad of the University of Southampton acted as the September Forum moderator for over 150 subscribers. These documents from the Forum proved to be a valuable data source because they contained timely and prestigious information relevant to the case. The documents were an incomplete source by themselves, but complemented the interview research. Merriam (1998, p. 106) stated that if documents were used as part of the process of inductively building the categories and theoretical constructs, then their fit with preestablished concepts and models would be of less concern. In this study, the

documents played three important roles. First, they were timely, and were used to provide background and questions for the interviews. Second, they provided a guide to whom the researcher should interview and to the current state of affairs in the small electronic scholarly journal field. Without these documents, accurate information would have been difficult to obtain (Garn, 1998). Third, the documents were a confirmatory source used to verify and strengthen the interview data (Yin, 1994). One advantage of documents. according to Merriam (1998) was that

> Most are prepared independent of the research study. They are thus nonreactive and grounded in the context under the study. Because they are produced for reasons other than the study at hand, some ingenuity is needed in locating documents that bear on the problem and then in analyzing their content. (p. 118)

In this study, documents proved to be a critical data source. This source of data provided important insights and illuminated the issues connected to the development of electronic scholarly journals, specifically the many issues of economics and intellectual property.

CHAPTER 4

FINDINGS

Three successive analyses of the data were performed. In the following sections, the investigation retraces the key issues concerning the growth of electronic scholarly journals. The initial analysis organized the data into three interpretive frameworks determined as the best to illustrate the issues, concerns, and development of the electronic journals phenomenon. The three frameworks discussed in this section are as follows:

1. major categories that emerged from the research
2. differences in the hard and soft disciplines
3. how the four major actors view the issue and the roles they play as scholars, officers of scholarly societies, librarians, and publishers

The first analysis categorized the data based upon the interview and documentation analysis. The second analysis, employing a descriptive framework, imposed meaning on and identified comparisons and contrasts among the actors in the hard and soft disciplines. In the third interpretive framework, the researcher reconsidered the first two analyses in light of the role assumed by the major types of actor-participants in the development of electronic scholarly journals. In the conclusion, the researcher enumerates the possible implications of the analyses for those in the field of education who are concerned with scholarly communication.

Major Categories

This section presents a discussion of what the participants in the study viewed within their contexts as the major issues and concerns in relating to paper and electronic scholarly communication. Nine major categories resulted from the data analysis. They formed a complete picture of the ideals–both written and spoken–and the interpretation of those ideals, by scholars, scholarly societies, librarians, and publishers. The purpose of the interview analysis was to develop an understanding of the beliefs, assumptions, and values held by these individuals. The nine major categories with subcategories that emerged from the data are listed in Table 8.

These categories were formed by noting patterns, identifying themes and counting occurrences (Miles, 1994). The categories (Table 8) were the key issues that the interviewees and forum participants raised concerning electronic scholarly journals. Time was spent subsuming many particulars into the general in order to shape these emergent categories.

Table 8

Categories and Subcategories of Data Analysis

1. Economic Issues	a. Costs b. Savings c. Free versus fee d. Vested economic interests
2. Copyright	
3. Speed and convenience	a. Networks serve as speedy dissemination b. Staying current
4. Peer review	a. Quality control b. Prestige and rejection rates c. Speed d. Medium independence and eprints e. Citation analysis
5. Reward Structure	a. Promotion and tenure b. Faculty peer issue c. Discipline specific e. Research infrastructure
6. Access	a. Authors seek widest possible access b. Paper versus electronic c. Control of access d. Serendipitous discovery
7. Papyrophiles	a. Replace b. Readability and portability c. Printing problems d. Cultural artifact
8. Archives	a. Preservation b. Collection c. Indexing d. Aggregation e. Centralization f. Space
9. Publisher profits	a. STM serials crisis b. Culture and economics c. Competition d. High Wire Press and SPARC e. Profit margins

Economic Issues

This section presents a discussion of economic beliefs about electronic scholarly journals. In the following sections, opinions about costs, savings, free versus fee, and vested economic interests are examined.

Interviewed scholars reported, to a strikingly similar degree, a general ignorance of costs and economical issues. Many scholars knew the cost of their particular scholarly journals, but did not know of any national or global issues concerning the serials crisis, costs, and the savings that moving to electronic journals could bring about. On the other hand, librarians and publishers described ways in which they experienced economic issues daily in decision-making, in generating support from the administration, and striving to work around or address spiraling costs. These conversations informed the understanding about why scholars were not more knowledgeable about scholarly publishing, something in which they were engaged for the majority of their careers.

Costs. Throughout the interviews, numerous instances of outrage and disgust were displayed by those who knew about publisher mark-up and the rising costs of selected specialty journals supported by large for-profit publishers. The department head of a large research university, referred to in this study as Psychologist B, reported,

> That's the one [publisher] that's just raping the universities. Their brain research—the price of it is just astronomical!

The harsh words and rough tone convey the feeling that many scholars have for publishers. Scholars also viewed publishers as adding very little value to the scholarly journal process, except for copy-editing and typesetting. It seems that publishers must either do a better job justifying the cost increase, or be cognizant of the ill feelings of scholars and librarians.

Librarian participants in the study were the most knowledgeable about the economic issues facing the scholarly journals. When asked about the Walker (1998)

article that states "Libraries will no longer pay for subscriptions or site licenses to journals. The total probably exceeds $2.5 billion annually, " Librarian C pointed out,

> That figure 2.5 billion from our perspective is only the money that's at play from subscriptions to the top 500 most cited journals in science, technology, and medicine. It does not include spending in the next 6,000, nor does it contain figures for spending in the humanities and social sciences in general. . . . We spent probably over 4 billion in total for our own work.

Another research librarian, Librarian B from the science, technology, and medicine (STM) area, explained the economic situation of journal collections this way:

> We then developed a list of journals that were inflating over 20%; we used that as the target basis, even though many of those in the STM areas were considered key journals. We did $700,000 worth of serials cuts with about $540,000 of those in the STM areas of high inflaters. We have benefited in that we have had less inflation than other libraries, because our problem hasn't been as bad. When we did that cut, we had eaten severely into the book budget and we were able to restore the book budget and keep a serials list that we at least could somewhat manage. The crisis has led us to put more money into improving document delivery and interlibrary loan. It's led us into our digital efforts.

Librarian B illustrated that the increasing costs of some high inflaters drove the librarian and university into looking to electronic scholarly journals as one possible savior to the economic crisis.

The issues concerning the amount of dollars publishers can save by going to an electronic-only publication was hotly debated on the electronic forum. A few more knowledgeable interviewees, expressed feelings more would be achieved by educating the decision-makers in the scholarly publisher world to the potential of big savings than merely debating savings amounts. A prominent scholar who produced free online scholarly articles was asked to describe how the societies and publishers first treated his electronic scholarly communications experiment. Physicist B replied,

> My perspective is part of why they're [publishers and societies] frightened of me is—or why people would say they're frightened, and why they should be frightened points to something Andrew Odlyzko has detailed in his most recent article. The article is existing proof that what they're doing is very inefficient; that many of these publishers need income on the order of $2,000 to $4,000 per article. They [publishers] claim they need this just to make their ends meet. If you look at the numbers for this system, it's more like $10 an article. Even that's something of an overestimate. And that's a hallmark of new technology. Ordinarily, if costs are going down; and [normally] it's very tiny; there are small efficiencies. But, when there's really a break in a new technology that can turn everything upside down, suddenly you get this factor of a 100 or more savings in price. And they can't compete with that without completely retooling.

Savings. The costs were not the only hotly debated economic issue. The questions posed by online forum participants to those in the publishing field focused on actual savings that resulted from going digital. They demanded to know what savings were made and what generated the savings. The responses ranged anywhere from no savings and a cost increase, to 70% savings. One forum participant informed the *American Scientist* organization that

> The American Physical Society costs for journal production are somewhere in the neighborhood of 1/3 for editorial/refereeing, 1/3 for composition and copy-editing, and 1/3 for printing and distribution. So I think your 70/30 split is quite reasonable.

Forum participant A, who is a not-for-profit publisher, stated:

> The problem with some other analyses is that, as you point out, they don't even begin to analyze how the proper use of electronic media can greatly reduce the costs associated with the first 70%—it is clear that to see such dramatic savings, it is necessary to transform the entire process, not just the final distribution. However, this transition requires the participation of the authors and referees, which is a major impediment to a fast, smooth, and low-cost transformation.

The savings described by this informant demonstrated that the savings were there; but Librarian B disagreed: "That's what could be; that's not what's happened." As indicated, not everyone believed these reduced costs and savings could be realized today.

Free versus fee. Forum participants indicated that, if large savings could be realized by both the societies and publishers producing the journals electronically, advancing scholarly communications with the new electronic form could be discussed. There seemed to be a conflict as to whether or not journals for scholars could be free given the potential of reallocated savings and reduced costs. Forum Participant B who best represented this line of thinking stated,

> What will the true cost of certification and publication be once everything is online-only? In other words, what will be the cost of quality control for content [refereeing/editing] and form [copy-editing/mark-up] once all expenses associated with paper production are gone? Paper publishers say they will not be much lower, 30% at most, but today's brave new online-only publishers are finding otherwise, 70% at least. If the latter are right, then it will no longer make sense to recover those reduced costs from S/SL/PPV [subscriptions, site licenses and pay-per-view], with its attendant restrictions on access: Author pages charges, funded by university savings from journal subscription cancellations, could cover them up-front, and all authors, readers, and Learned Inquiry itself would be the beneficiaries.

Many forum participants and interviewees reported instances in which the most important goal was the widest possible access to their journal articles. Without exception, and without the conservatism of economic concerns, authors who contributed their papers for free preferred that everyone, everywhere, have full, free, electronic access to the journals (Harnad, 1998).

Vested economic interest. Participants, in great numbers, appeared to understand the existing economic interests that all parties (publishers, scholarly societies, librarians, and scholars) wished to maintain. All informants agreed that the subject was limited to scholarly journal articles, not royalty-based trade magazines or newsletters. Since scholars did not receive direct monetary rewards from writing journal articles, they did not want others, whether publishers or societies, to make obscene profits from their

gratis. When asked if publishers should receive compensation, Forum Participant B stated,

> The publisher is entitled to recover necessary costs and a fair return. But how much are those necessary costs for a refereed online-only journal? And what is the optimal way to recover them: With or without access tolls?

Two remarkably similar statements illustrating scholars' were made repeatedly. The first concerned the APA restrictive policy. The second concerned the revenue publishers should make on scholarly content received for free. Most scholars, when interviewed about the APA policy restricting email distribution of preprints and web postings of their journal articles responded as Educationist A did:

> Yeah, I think that's just plain stupid. And I think it's ultimately counterproductive. . . . So I don't see that my distributing it is in competition with the journal. If anything, I think it's in support of it. . . . I can't imagine why they did it, because it certainly looks backward from the perspective of anyone in the field. It's certainly backward! Whether it works economically or not, I don't know. . . . So maybe APA did it as a matter of fiscal principal or something like that. I don't know how that's going to play out. I don't think there are other major societies that have pulled that one.

This was a popular sentiment expressed by scholars regarding the attempts of scholarly societies to protect vested economic interests by thwarting electronic dissemination. Scholarly Society Officer H stated,

> It is clearly in Elsevier's best interest in retaining the journal itself as the authoritative "final" version of papers—it is possibly also in the best interest of general support for peer review. It is not in the best interest of the immediate researchers who use these articles, I agree. That is why we do not have such a policy at APS.

In the electronic scholarly journal field, most mechanisms to control the scholars have not prevented scholars from giving their work out to students, posting it on the web, and passing it out as preprints to trusted colleagues. Scholars' desires for electronic

dissemination appear to be quite strong. Controlling dissemination through the publication policies and legal copyright documents has not fazed scholars. Authors/scholars sign away the copyright without thinking and are not aware of society and publisher policies by societies and publishers unless informed by a peer. Scholars view their policies as "stupid," blatant tactics to protect the publishers' vested economic interests.

Copyright

The *Chronicle of Higher Education* (Guernsey, 1998) published an article entitled "A Provost Challenges His Faculty to Keep Copyright on Journals," and the *American Scientist* forum had an online discussion thread on copyright issues and whether or not professors should try to retain the copyrights on articles published in journals (http://www.chronicle.com/colloquy/98/copyright/ background.htm). Some faculty members cited in the *Chronicle* article thought that going along with the provost would hurt their chances of getting published (Guernsey, 1998). During the electronic forum, the provost featured in the article, Forum Participant C, stated:

> The driving issue for me, as I believe it has been for you and many others I've talked with, has not been "university control" of the scholarly record, but rather the prevention of "publisher control" of the scholarly record and the preservation of that record as a common good, freely accessible. I would be happy to see copyright reside solely with the individual scholars, but then there is the associated nuisance of responding to requests for reproduction rights, etc.

The majority of the scholars interviewed did not understand this complex issue nor did they care about ownership of ideas, concepts, theories, experimental data, facts, and opinions that they as authors record in speeches, articles, books and other forms of publication. One interviewee, Educationist H, stated:

> Most of us, I think, never paid much attention to it. We played the game in submitting the article. . . . They send the stuff [copyright legal documents], and we sign it off, and send it to them because it's part of the process of getting something published. Because we were interested in getting these things published we never paid much attention to the details.

This scholar's response was typical across the spectrum, from experienced scholars with more than 250 articles published in journals, to one with fewer than 50 articles published. Retaining copyright arose as a concern only for those inventions or discoveries appropriate for patent. The limited knowledge about intellectual property and copyright was illustrated by Educationist G's response:

> Well, I think in the world of refereed journals, for example, or in that realm, the notion of intellectual property has been a very gray area. And likewise, in terms of the intellectual property in the realm of even course delivery, course creation and course delivery within the university system has been a gray area. Since it was a gray area we did not bother with it.

Non-scholar participants understood the issue quite well. Some believed societies and publishers abuse the copyright. They feel the copyright should belong to the authors, sponsoring universities, granting agencies or even the federal government, but not to the publishers. Numerous proponents for electronic scholarly communication felt "that copyright is the linchpin" for changing the current system (Guernsey, 1998). One scholar, Physicist C, mentioned the following:

> They [publishers] are to protect and encourage the development as far as science and the useful arts. It's being abused against authors if a publisher says, "Ah, you spent half a year working on this research to the tune of many tens of thousands of dollars of salary, or much more; and even more than that, if there's experimental equipment, and we've come through and typeset it for you for a couple of hundred dollars, we completely own the final results of this research." And so our feeling is that it should be the funding agencies or the institution's response to the researchers who are the real risk-takers. It's not the publisher taking a risk.

Publishers have argued that universities and professors do not understand the burden involved with owning copyrights causes, for example, granting reprint permission, tracking down cases of abuse, and handling administrative paperwork. Publisher B's response exemplified that perspective:

> Most organizations and editors that we work with, [that wish] to take on the responsibility for rights and permissions, and if they don't want to give up the copyright, what they've done is they've hamstrung us so we have to go to them every time we get a request. Usually, they see the light and say, "Oh, that's what you guys do." "Yes, that's what we do." The other thing is authors are—I'm saying authors here, but I include organizations and editors. Frequently, because they don't understand publishing, and that's not what their background is, they'll say, "Well, the publisher wants the copyright and they're robbing me, you know. It should be mine; I should keep it." What they really underestimate is the ability of the publisher to protect them, to protect their royalties, and to send in a legal team if necessary, if there is any infringement on that copyright.

During the interviews, publishers tried to explain their added value in helping authors. According to Karen Hunter, vice-president of *Elsevier Science*, the world's largest publisher of scientific journals, her company had rejected papers that stipulated specific, narrow licenses. She also stated in the *Chronicle of Higher Education* (Guernsey, 1998) that Elsevier "allowed" professors to post copies of their published papers on the web, as long as the dissemination of the document did not "commercially compete."

In another view from a large research one university, Librarian C viewed copyright more as the "linchpin" to hurt the publishing world:

> The academic senate library committee, which is one of the advisory committees [that reports] to me, will propose the establishment of a copyright management office and a licensing office, which will assist faculty in writing licenses and otherwise managing their own copyrights to the benefit of the academy rather than the benefit of the for-profit world. It's another aspect of taking back control and of effecting a correction in the market place. Yale is up to the same thing.

> There are several other institutions. I think the University of Wisconsin at Madison is doing this also.

Guernsey (1998) pointed out, despite tough talk concerning copyright, there was a risk to the professors' ability to publish; the institution that takes a tough stance can really put the faculty out to dry. For copyright to be a "linchpin" in electronic scholarly journal growth, more universities than the ones mentioned in the interview above must regain control. One scholar, Mathematician A, best summed up the scholars' perspective on copyright by saying,

> It's not a big issue with me. I know it is with others, but not with me.

In conclusion, copyright is a complex issue for those not directly involved in scholarly publishing. Many proponents of electronic scholarly journals see copyright as means to increase publisher responsiveness. Others see copyright as a transition to electronic, free access. They feel it will deny publishers complete rights and enable scholars to post their work on the web for all to view. However, the majority of the scholars, whether in the hard or soft disciplines, attach little significance to copyright.

Speed and Convenience

There is wide-spread criticism of the slow speed at which journal articles are published and then placed in circulation in the local library. This study focused on speed, defined as: the time it took to publish an article; the speed at which the scholar needed to get journal literature in order to stay current; and the speed at which the field moved in theoretical advancements. Other issues of speed were addressed in the interviews, but the focus of each supported these three key speed themes. Speed in the peer review process

is discussed in the "Peer Review" section of this report. One senior productive scholar, Educationist C, described the speed he wanted his research to be published and the speed at which he wanted his colleagues' research to be published:

> I think it depends—This is a little cynical, I guess, but if you ask me, "Do I want my articles out there as soon as possible?" the answer is "Of course," you know, because they're brilliant. Do I mind if my colleagues' articles take six months or a year to get out, the answer is "No." . . . So I think nearly every author who has gotten an article finished really would like to see the thing in print relatively quickly.

Networks serve as speedy dissemination. Overall, scholars wanted their work to be published faster. Numerous productive scholars were getting preprints through their "invisible college" informal network sometimes years before they were published. However, concern was expressed for those academicians who did not have a good network, particularly young scholars. The scholars questioned how their peer colleagues could work around the publishing lags. They were also concerned by how far behind other academics would be if they had to depend on publications in print to keep them current. The scholars mentioned that by time young scholars receive the print journal article for the first time, they are often behind the leaders in the field by a year and a half or more. Educationist A asserted,

> Let me come at it slightly differently. I think there are two parallel mechanisms, and one of them is the formal distribution mechanism. And that right now is the official journal publication on paper. And then there's informal knowledge dissemination, okay. Lag time in terms of formal journal publication is usually between one and two years from the date you finish writing the article to the time that it enters the press. That's a fact of life; that's an uncomfortable fact of life for people who live in the boonies; because it means if you wait until things appear in the press, you're basically one to two years out of date now.

Another interviewee agreed that scholars lacking networks or at less prestigious schools could not keep up with the field using only paper journals. The response from Educationist E to a query on the topic provided this insight:

> Well, I don't think that that's true. I think others are making it sound like things happen faster than they do. I also think that journals are not the only vehicle. That's why ERIC does the service that it does. That's why you can write to people for online papers. Or you can write to people for papers. As a young scholar, if you find somebody whose work seems to be in an area you're interested in, you can write to them and that gets easier electronically and ask them if they're working on anything currently and would they send you something current. So I don't think you have to wait for articles to come out in print you just network.

When one scholar, Educationist G, was asked whether or not his field (education) needed to be faster, he replied,

> No, I think it certainly needs to be timely. From the perspective of the reader or researcher I want access to timely information. From the perspective of someone publishing, I'd want my work to be published in a timely manner. In the traditional print world that certainly is a decision-making factor in terms of which publication I submit to.

Another educational scholar responded to a question about the speed differential between two fields. Educationist C voiced his belief that education did not need to keep the pace of hard science disciplines. He further explained how a slower system may have merit:

> No, I mean I think the disciplines are somewhat different. I mean if you are working on DNA replication or cloning or something like that, then if someone in Cambridge in the United Kingdom makes a really major breakthrough, then that maybe is going to save me hundreds of thousands of dollars here at the university. I really need to find out about that as soon as possible. If I make a breakthrough in thinking about some philosophical issue in education it seems to me it's hardly in the same category.

Staying current. All researchers agreed that they wanted to stay "current." However, each researcher's definition of "current" was different. For example, an

educational researcher was asked whether or not he would feel behind if he left for a sabbatical for six months to a year without access to educational research. He answered simply "No."

Scholars, especially in the hard sciences, stated almost unanimously that they would be behind the field (in research findings) if gone for just a few days. Physicists, for example, were drawn to the preprint archives to keep up with the more than 100 new articles published daily. Physicist C explained his desire for an online preprint archive:

> Suddenly, there's a new way I can instantly broadcast to everybody, "Why shouldn't I be able to do it?" So that's the incentive to research, which is to maximize ease, dissemination, and maximize the availability of their research in a timely fashion.

Peer Review

Peer review is the quality control process of journal literature. Though many scholars acknowledged the pitfalls of the peer review process, it has endured through time. Harnad (1998) best defined peer review as the process "in which specialists submit their work to qualified adjudicators ('editors'), who in turn select specialists ('referees') to advise them as to whether the material has potential and if so, what further work is needed to make it publishable" (p. 1). The scholarly publishing field has found no viable alternative to assure the quality control that readers expect other than having expert reviewers judge the work of their peers.

This section reveals the value that scholars assign to peer review and the impact it has on both paper and electronic journals. Furthermore, it reveals interviewees' and forum participants' beliefs about quality control, prestige, medium independence, speed of the review, rejection rates, unreviewed eprints, and citation analysis.

Quality control. Every scholar, librarian, publisher, and society officer share concerns about quality control when questioned about the transition of journal literature from paper to electronic. A large public research university department chair, Psychologist B stated,

> With the things that are happening so fast now—I think that the primary concern is always *review*, the review process and having quality control on the front end. As these things are coming online, I don't think it's going to be a problem. There's nothing incompatible with the review process and having electronic journals. I think it's well on its way.

Numerous scholars spoke of the need for stronger peer review to reduce the amount of research that scholars feel they must keep up with. Other interview sessions emphasized the idea of the perception of quality control. One senior educational scholar, Educationist A stated,

> I think quality control and perception of quality control are really serious issues.

Prestige and rejection rates. Hard scientists favored peer review over nothing at all, but if they had to choose between timely access and peer review many would have chosen timely access. This was not the case in the soft disciplines. Issues of quality and prestige also were spoken of as being somewhat subjective. Two factors that were used interchangeably with quality and prestige were rejection rates and the age of the journal. Rejection rates and the age of the journal were alluded to by many of the interviewees as indicators of quality. An educational scholar, Educationist C, stated,

> Within the category of refereed journals, there are ones that are powerfully refereed. *Harvard Review*, I think has a high rejection rate, only one out of 110 papers that are accepted. But that isn't an absolute guarantee of quality, because they might accept the wrong one. To get a paper accepted by them is pretty good. One of the philosophies of educational journals I'm associated with, the

> acceptance rate is more like, say, one in 20, while that doesn't necessarily mean the quality is bad. . . . New journals are appearing, and there's a period of time in making their reputation. People aren't sure how good they are. I guess the same is probably true about the electronic journals.

Speed. Not only were electronic journals viewed skeptically due to their rejection rates and age, but factors of speed were brought up as peer review concerns. There was an acknowledged perception and criticism and that if journals are electronic and therefore published quickly, they lacked rigorous peer and publishing standards. For example, one scholar, Educationist C mused that

> [A journal] like *Nature* and so on, which go to press very quickly, I guess I am somewhat skeptical.

Another scholar, Educationist G, stated,

> Concerning the notion of careful peer review, a revision process is important. I think it's something that's not directly facilitated by being as immediate as a spoken oral discussion or a synchronous online electronic discussion. So I would say that there is a desire, both from a publisher as well as a consumer or reader's perspective, for information to be published as quickly as it can be. But likewise, it's necessary to also look at the value of the refereed review-revision negotiation process.

Medium independence and eprints. Many of those interviewed from the hard sciences areas (physics, math, and chemistry) believed that peer review was necessary, and could function effectively either online or on paper. Forum Participant B described his feelings about peer review, how it could function in preprint archives and be paid for:

> Peer review is medium-independent. Refereed journals are simply implementers of peer review. They should continue to do that; there is no alternative I know of. And there should continue to be a hierarchical spectrum of peer-reviewed journals, varying in their subject matter as well as their quality and rigor. That should all be financed out of the page charges. The archive is just the means of access. Papers in the archive should be explicitly tagged as *unrefereed* or *refereed*, and if the latter, tagged with the brand-name of the journal.

Citation analysis. Citation analysis was another way quality control concerns were addressed. Many attempts were made to illustrate the validity of electronic journals and eprints using citation analysis on the electronic forum. However, many of the electronic journals and the eprint archives have not existed long enough to get into the citation index. A physics librarian from the *American Scientist* forum attempted such an analysis using the Physics E-print Archive. This librarian labeled Forum Participant D stated,

> The citation analysis process involves isolating the physics and astronomy literature, counting the total number of citations in this group, and from that extracting the citations to the eprints. The numbers have remained pretty consistent over the time period. Of course the percentage of eprints will diminish in time as more and more articles are published citing the print literature. However, citations to eprints do represent a significant number of the total citations to the most current literature. I have included a number set from our in-house subscription to *Science Citation Index* through *Web of Science*—we only have 1997-98 data—but the numbers are even more impressive, 9% of the total citations to 1997 literature were to eprints.

Citation analysis would be more useful when major indexes started to catalogue electronic journals and eprints. Harter (1998) stated, "To be meaningful, comparisons between journals must be for journals in the same field, since disciplines vary widely among themselves in their citation practices" (http://info.lib.uh.edu/pr/v7/n5/hart7n5.html). Because "like pairs" of online journals and paper journals did not exist, citation analysis yielded only two participant references to it during the *American Scientist* forum.

Reward Structure

This section presents a discussion of the rewards of academic publishing and the ensuing relationship with paper and electronic scholarly journals. Scholars expressed

several reasons for publishing. The most prominent reason for publishing was based upon considerations for promotion and tenure. Throughout this discussion, participants explained how they were rewarded and how that related to publications. Scholars described what was not rewarded, what constituted appropriate publications in order to receive appropriate recognition, and how they judged their peers. In this section, the study addresses a reward issue referred to as infrastructure. The infrastructure issue proved to be pertinent to the growth of electronic journals.

Most of the participants had not published articles in an electronic journal. In addition, numerous education and psychology scholars stated that they would not do so because they would not be rewarded and because electronic publications were not recognized as valid. The participants had no simple answers to the questions regarding faculty reward structures. Visibility and access were concerns when publishing, but the paramount concern was the prestige factor. Publishing in the most highly regarded publication that would accept the paper was the foremost objective. A department chair and prolific scholar, Psychologist B, stated,

> I think that tenure will always require publications and review journals. Otherwise there's no quality; there's no way of knowing if there's been any sort of serious [tenure] review. But I just don't see anything incompatible with electronic publication in the review process.

Promotion and tenure. Many scholars, when questioned as to whether or not they gave academic credit to electronic articles submitted for tenure, stated they were never involved in a tenure review decision based upon any electronic journal articles published. When asked if they would accept electronically published articles, they stated that they would have no problem giving credit if the articles had been rigorously reviewed.

Another educational scholar did not believe that electronic scholarly journals would flourish until personnel and review committees supported their authenticity. This productive scholar and editor, Educationist B, stated:

> As soon as the promotion and tenure all the way up the line believes in it and believes it has just as tough a review, then I think it will be accepted. I think as yet, I don't think electronic journal have as tough a review. I need to be convinced, and people like me sit on those boards.

Another scholar, Educationist G, mentioned the reward structure as the most important barrier to the success of online scholarly journals. This director of information technology, an experienced educational scholar, stated:

> In terms of what to overcome, several barriers or I guess several issues. One the wide spread acceptance within the field of the value of contributing to such an [electronic] archive which would then directly relate to the rewards system in place within the profession, within the academic structure that those authors would be operating within. A redefinition of value placed on participating in the contribution to that type of an archive, that type of a work. And that change is already taking place in the mindset of personnel committees and review committees. And so it's not a major leap. But conceptually it is a leap and it is something that would need to take place and to transpire for the value of that [electronic] archive to make it successful.

Faculty peer issue. Librarians, officers in professional scholarly societies, and publishers had beliefs and opinions about academic reward structures, but many stated they had no direct influence on the structures. Librarians, societies, and publishers wanted the academic to be rewarded by having a vested interest in either visiting the library for their research or, in the case of societies and publishers, being rewarded through publication in their respective journals. An example of tenure and promotion as a faculty-centered issue was offered by a research library dean at a large public university. Librarian B stated,

> We don't control the reward structure, and that's part of what this is all about. Scholarly publishing is intertwined with the whole reward and recognition structure on campuses. We don't tell the faculty which journals are the best; they tell us which journals are the best.

Discipline specific. When faculty come together to judge junior faculty for promotion and tenure, the policies are never cast in stone. They vary from one department to another and are incrementally different from campus to campus. However, as discovered by this study, there were only a few, if any, significant differences among them. One significant difference was that the hard sciences seemed to reward creativity and innovation more than the soft disciplines. A scholar and former department chair, Mathematician A, stated:

> In the end, in mathematics, our traditions are very much the issue of what did you do, how important was it, how novel was it, how creative, how unique, how pioneering. Quantitative things are much less important. Take some things like how many papers did you publish, in which journal did they get into? Yes, those things matter. You can't escape the fact that all other things being the same, this is better than this. But on the other hand, it may be worse. If you have a limited number of publications and you said, now that one, that's a great one, because that did this, that opened this up, so and so tried to solve it, they couldn't do it. If it's around for 15 years and look at the techniques that spawned from this publication, well then you're looking good. You got 15 papers, a young person, and somebody says, well, yeah, that's 15 papers, what's there impact? There's nothing there.

Education scholars have specialties and emphases in many disciplines within education, but also within related fields like mathematics education. Many spoke of a need for a multidisciplinary method to be devised for promotion and tenure. However, according to these participants, neither method- nor discipline-electronic journal articles have had impact on reward. A past tenure education committee member, Educationist J, stated:

> In various areas where someone is coming up for tenure, we tend to be influenced by the norms of those respective cognitive disciplines. So the expectations may be different. For some people, it will be important to have written a book. For

> other people, a book would not be a typical expectation. What journal things appear in is important. I don't know of any areas yet where the premier journals are in electronic form. By and large, the most prestigious well-established journals in most areas remain in paper journals. Until those changes, it's unlikely that electronic journals are going to be having major impact.

A possible reason that many scholars did not publish in the new electronic journals might have been that few wished to risk their professional livelihood on something so new and potentially unacceptable to their peers. One physics department chair (Physicist A), when asked whether anything in the rewards process took electronic journals into account, answered:

> I presume it will, but it has not yet, because it has not come up in this department. That may be because the people that are seeking tenure don't wish to take any chances. I mean, that's pretty important.

Research infrastructure. Importantly, the interviewees mentioned more than 10 instances in which developing a new research infrastructure of scholarly communications was not rewarded in the promotion or tenure system. In fact, many who were not involved with new forms of scholarly communication (i.e., electronic journals) did not understand the motivation possessed by others who spent their time on such "unscholarly activities." The inventor of the Physics Pre-Print Archive, Physicist C, explained the following during his interview:

> Research infrastructure doesn't constitute research. And so the average researcher wouldn't be able to take time off to do this kind of thing, because they get no credit for it. Infrastructure doesn't really count for anything as far as funding agencies or even progression where one's career is concerned. It was just nobody else was going to do it. So it's just the serendipity that I saw myself in a government lab doing the work and rewarded for it.

In summary, participant assessments revealed that concerns about legitimacy were valid. The concern about the reward structure of scholarly publications proved to be

one of the most interesting, fundamental, and complex constraints to ejournals. In order for electronic publishing to flourish, universities will have to make a commitment to the electronic delivery of scholarly materials.

Access

All of the authors interviewed stated that they attempted to increase the visibility and accessibility of their work. Authors' concerns about access to their work were as great as, or greater than, their concerns about academic credit. Access issues were two-way streets. Many of the prominent scholars concerned themselves primarily with access to their research. At the same time, young researchers, international scholars, and those who had smaller library holdings were distressed about the inability to gain access to scholarly journals. Three issues that arose concerning access were public use data, control of assess, and access in the fields. Publishers concerned themselves with assets and profits searching for maximized profits while greatest access. Librarians stated that they were concerned about access to their holdings via electronic means. Officials of scholarly societies remarked that they wanted wider access to their scholarly journals made possible without reducing publication subscriptions rates and revenues.

Authors seek widest possible access. Scholars described various ways they disseminated information about their newest papers. A scholar described his unique method to broadcast news about his papers to those with whom he interacted. Educationist A stated:

> My paper is up on my web site. My assumption is, first of all, that I want people to know about it and have access to it. If someone gets an email note from me, it's [web address of my new publication] in my signature file. So when people get a note from me, there's a little thing on the bottom that says, "If you want to

> trace my papers, here is where you go." And if they trace those papers, that's one of the papers they will find. I'm sure the editor of the journal would not say, "This is going to lure more people to the journal than costs us [subscribers]." ...So I don't see that my distributing it is in competition with the journal. If anything, I think it's in support of it. So I don't see that as being subversive. And I don't think the editor should either.

Another scholar, Educationist B, stated his desire for greater accessibility to readers:

> One thing I would probably try to do is get a bigger readership. You could argue that by making it available cheaper and electronic than the journals can, you could get more people to read it so you've convinced the world first that you're disseminating more information to more people faster. So that makes my electronic journal the way to go. More people are getting it cheaper and faster. More people are reading it. That's a hell of an incentive for people to publish in it and it's a heck of an incentive for people to say, "Oh, gosh, that's where we should credit people for publishing."

Paper versus electronic. Scholars in the hard sciences (physics, math, and chemistry) believed that technology enabled wider access to all. By contrast, many participants representing the soft sciences (education and psychology) believed wider dissemination could be achieved through paper. One hard scientist, Physicist B, stated:

> To me a good example is India. I think that there are a lot of bright physicists in India that are very isolated just because they're in impoverished areas and their institutions are impoverished. But all they need are a few computers that can hook onto the Internet and they keep abreast of things in my field.

On the other hand, an eminent and respected scholar, Educationist F, stated:

> I think that there is not yet wide enough availability of the technology so there are definitely international limitations... Think of it this way. A person in New Delhi could buy the AERA Journal cheaper than they could buy for themselves the computer would let them search for all the different electronically available journals. So it's true that if they wanted to buy all of the available journals it would be cheaper to buy a computer! But in terms of what they could manage, it still may be the case that they can purchase the hard copy before they could purchase accessibility to everything.

A science, technology, and medicine librarian (also an electronic publisher), Librarian C, pointed out the following:

> It's peculiar that our [electronic scholarly journal] service is getting rave reviews in places with notably poor networks and desktop computing: China, India, and Russia, for instance. The reason is that as slow and poor as the service is in those countries, thanks to the networks and to the availability of desktop computing, it's better than waiting for the mail, which sometimes never gets there.

Control of access. This study uncovered an instance in which one participant did not prefer increased access to their research data. That researcher wanted to control both access and use of the data because so much effort went into creating it. It was important that these findings fully displayed the unique data that illuminated the complex issues surrounding access, some of which may appear simple at the first glance. Educationist F scholar stated:

> Well, let's see, I guess I don't anticipate or wouldn't immediately be in favor of making data available just across the board. Because I think there is an issue about who owns it after you've gone to the trouble of collecting it. I don't think it's just immaterial who analyzes it next because at some point you know there is an issue about how many times would we revisit this with every single data set. So if you collected data and published findings from it, I don't think it means it's now in the public arena and anyone else who wants to do that way. . . . So that's a huge intellectual and labor proposition to take seriously the idea of making my data available to others.

A contradiction to restricting access to original data was stated by a researcher, Educationist G, from a large Research One university:

> Access to their [someone else's] data is certainly something that is viewed as a professional courtesy within the print publication field, it historically has been. But calling attention to problems, contradictory findings and that sort with traditional print publication, time enters into the mix, the amount of turn around time in identifying and publishing contradictory findings, those types of issues would be eliminated in the electronic realm.

Many of the hard discipline scientists stated that they made their methods and data available in order to allow all others to recreate their studies. The hard scientists also

mentioned that editors often required them to provide more information in their articles for reproduction purposes. The soft disciplines never referred to this type of disclosure.

Serendipitous discovery. The majority of the scholars, librarians, society members, and publishers raved about the searching potential of the online scholarly journals versus paper-based stacks. However, one astute scholar stated a disadvantage to online searching: the inability to serendipitously search, like walking the bookshelves. This interviewee, Educationist F, explained,

> Searching online is obviously easier to get the [article or book] you want, it's more amenable to search online. However, it's more amenable to just get that one article, not all the articles that are relevant. Sometimes you want to know what adjacent articles look like. You even what it see all the articles together in the journal let alone and the journals together in the library. I mean some people don't like it that they can't go into a library, having looked up the book they want, and see what other books are next to it on the shelf. It's really quite interesting if you only have an electronic search where you miss the experience of always learn something more if you can go see what's sitting next to the books in the library.

Proponent motives and beliefs about access were represented best by the words of Physicist C when he stated:

> What we're trying to do is optimize our ability to do research, which is maximum access and ease of access to our own literature, which we'd like to think of ourselves as autonomous, and also to minimize the amount of hassle it takes to communicate to our colleagues.

Papyrophiles

Glass (1994) noted how his faculty friends would sermonize fondly on the pleasures of caressing paper, the heft of a weighty volume of good writing in one's hands, and the smell of fresh paper when the shrink wrapped is removed. Those who have a love for paper and can see no substitution for paper are referred to as Papyrophiles. Four years later, in 1998, the love for paper continued.

One professor of computer science confessed his fondness for paper during the September Forum. His testimony represented the views of many scholars who spoke of their dislike of online text, described their fondness for paper, and continued their praise of print journals. Forum Participant E, a professor and director of the Minds & Machines Lab and Program in the Department of Computer Science Portability, stated during the forum:

> I'm online a lot, and I like it just fine, but paper is special for aesthetic reasons that make me somewhat skeptical about predictions that it will die. I even confess to spending fairly large amounts of money to place myself in positions where paper fits, and computer screens don't. Machines in my lab of every variety, machines throughout my house, my laptops with CDPD modems so that a TCP/IP connection can be maintained wirelessly, inverters in my cars for power . . . and so on: this is my life. But because I guess I've written a thing or two, I have some money to burn—and I burn it sometimes for peace and isolation where print journals and books rule. It's brisk on the Atlantic now, even this close to the mainland, and a fire is burning out here in my house on Block Island. The last thing in the world I want to do right now, paradoxically, is read stuff on this bloody screen. I can pick up this issue of the journal BBS, drop it on the floor. I can even hit it with a hammer and no damage results, toss it over to the couch, stroll outside with it, stroll back inside and curl up with it beside the fire, and so on. These joys will not die, nor will the search for them. I'm not just reporting idiosyncrasies here. Ergo, either paperless scholarship must somehow to some degree take the form of hard copy—electronic books, for example, that are wirelessly updated . . . or paper will survive.

Replace. Olson's (1992) study of scholars' preferences for electronic text design and its associated barriers were reinforced by these findings. However, since Olson's study, the interface and the ease of using the World Wide Web has created a new threshold for scholarly publishing in which technology is no longer the chief barrier. This section explores the paper centric reaction that occurred when people thought of replacing one technology (print journals) with another (electronic journals). This was a crucial issue because it was rooted in the strong and well-established history of

academia. The paper centrists held fast to its advantages, and proponents of electronic scholarly journals glossed over the issue by commenting, "Just print it out!" if you love paper (Harnad, 1998). Numerous physicists, asked whether or not they foresaw electronic journals replacing paper, answered with a resounding "Yes!" An experienced physicist, Physicist B, from a large Research One university described his view of the timetable for the transition as follows:

> It's already happening! An important set of journals for us [of the physics reviews] . . . and those are now available online so you can download the articles.

Asked the same question, another younger chemist from a smaller comprehensive university, Chemist A, responded:

> Yes, almost all of our journals now have gone to online versions, but still 90% of the people just use it for convenience of searching and then they print it out onto a hard copy.

Readability and portability. Although much progress has been made toward the development of better computer monitors for reading ease, as well as portable computers, and personal digital assistants for storing email and schedules, additional strides must be taken to satisfy the traditionalists. Many issues concerning the removal of paper were disclosed in the interview transcript analysis. However, two issues emerged as imperatives. A publisher (Publisher B) who performed numerous focus groups, reader demographic studies, and market predictions for electronic journals, summarized these two factors:

> Portability and readability, I think are the big two. I can't think of another one more important.

Another publisher (Publisher D), from a scholarly society whose 29 journals in the hard sciences were in both electronic and paper format, explained the publisher's perspective regarding the full transition to electronic files:

> I mean we've been doing this now for what, three or four years. And we still consider the print version the authority file. And I don't think that there's really been any time frame for when we're going to shift over. Now the one thing that struck me about a year or so ago was being in a meeting with a lot of the print people here that I never thought would just in casual conversation foresee the time that print was not the authority file. But they did. They just kind of said, "When we get to the point that the electronic gets the authority file blah, blah, blah." That was how the conversation went. I didn't really hear it after that because I just heard them casually says [this]. So I mean there will be a transition over to electronic but it's real hard to say [when].

Printing problems. Generally, the hard science scholars and associations did not tell horror stories about technical issues and problems reading text online, or printing articles to hard copy for portability. On the other hand, the majority of educational scholars, society officers, and publishers complained about technological problems with formats, prints, and computer monitors. One educational scholar, Educationist D, at a prestigious school of education on the West Coast, stated:

> If I have something electronic, what I most typically would do would be to print out the article, or whatever, and then just read the hard copy that I generated, which is nothing but an extra step for me. It's just a lot more hassle. And the technology is imperfect. I've had trouble interfacing different printers with different computers. Adobe Acrobat format documents don't always work for me. They print funny. The margins come out bizarre. Something is wrong. I am sure that all things are solvable, but it's just a lot more hassle than simply opening, you know, looking up a journal, taking it off the shelf, and reading what I want to read. I guess those would be the major reasons [journals will not go electronic].

Cultural artifact. The interviewees' responses to this issue reflected deep frustration. When the researcher probed further, participants acknowledged that, in some

cases, the desktop paper was not the issue. For example, another educational scholar, Educationist I, stated,

> I like the bound [copy]. I like a *book*. I can't print it out in the same way that the organization thinks that it ought to look. I like receiving this complete set of ideas in a bound format.

Summarily, based on these interviews, paper journals articles were considered by many participants as cultural artifacts that were not going to mildly disappear in many fields, especially education. Educationist G, an educational researcher in technology support and development, noted:

> I don't see them replacing print journals. I see it as an alternative means of publication. But the tactile nature of holding a journal in one's hand has a history and an appeal that won't diminish.

Due to these heartfelt pleas to keep the paper alive, many of the strongest proponents of electronic scholarly journals predicted that most publications would parallel a print and paper copy with an electronic journal during the transition to an all-electronic scholarly publication (Harnad, 1998).

Archives

This section deals with many complex issues that were not completely recognized by the prominent scholars nor many of the scholarly society officers. The majority of the interview quotations used in this section were from librarians and publishers, as well as proponents and opponents of scholarly electronic journals. Lynch, in *Scholarly Publishing: The Electronic Frontier*, noted that issues like authentication and archival were more important to electronic publishing than technical issues (Peek, 1996). Comments regarding the past, present, and future of archives and collections centered on

a continuing attention to the six issues that emerged from the interviews. Those six issues, discussed in this section, are preservation, collection, indexing, aggregation, centralization, and space.

Preservation. Preservation concerns appeared to be simplistic. However, investigation using knowledgeable informants revealed that concerns were actually quite complex. Forum Participant F best explained some of the archival issues:

> Traditional journals were archived, in part, by printing numerous paper copies and sending them many different places. Except for the early part of the present century, paper has proven to be a wonderful storage medium. I have read paper documents 2,000 years old. Have you successfully read any 20-year-old electronic documents? My point is that we face an urgent need to develop and finance enduring archival preservation for at least the modest share of our scholarly output that is still worth reading after a decade. . . . The basic principles are that any new approach to journal distribution must be part of a systematic effort that attends to all of the functions and systemic relationships in the current approach; and that payment streams roughly match required functions.

Publishers and librarians struggled with the questions raised by forum participants. Participants noted that financial as well as collaborative models needed to be in place so that all actors might collaborate to better serve readers and scholars using electronic journals in the future. An expert in the field of network information pointed out essential issues that were beginning to get the attention of those concerned with archiving. The official of one professional library association, Scholarly Society Officer K, stated:

> I see that the major thing that will hold back the move to the all electronic are the issues surrounding preservation. And that includes licensing issues into the long-term. Most libraries are very concerned about how they will provide access to journals that are only in electronic form in 50 years or 100 years time. The technology may have changed; platforms may have changed 5-10 times. In the meantime, what are the economics? What's the infrastructure that they'll need to migrate or emulate or whatever those resources into the future. This is an issue that's getting a lot of attention in ARL.

Collection. Preservation issues were complex, but the librarian's role in collection was even more complex. The challenge of collecting electronic scholarly material from thousands of sources with an ever-decreasing budget was an issue for modern research librarians. One research librarian, Librarian B, highly regarded by her peers, displayed the complexities of the task:

> Well, we're doing both [collecting and preserving]. I mean we're licensing databases. We're evaluating free things on the web. We're buying things that are accessible through the web. We're mounting databases, and we're digitizing [hard copy] files of journals with societies, and we're working with two faculty members in anthropology who have a three-year old journal [and putting it up on the web]. We're also part of the SPARC initiative, which is the Association for Research Libraries' initiative to create competition in the marketplace while at the same time helping to transform scholarly communication in the form of science and technology journals.

As discerned by the participants, librarians needed to be skilled in areas ranging from million dollar negotiations to the cataloging of faculty members' electronic journals. They were required to monitor the events that were happening globally, while acting appropriately at the local level.

Indexing. Prior to this time, indexing was not seriously considered by scholars, societies, or librarians. However, it has gained the attention of the entire field of electronic scholarly journals. The indexing task from the librarians' perspective was two-fold–one either was paying for indexing services or building indexing services. Many in the bibliographic records field were perplexed by the issue of indexing electronic journals. Indexing hardships associated with an all electronic journal surfaced throughout the interviews with librarians. For example, Librarian B shared her problems with indexing:

> The *Index Medicus* will not index our biology journal because they don't index any new journal until it's four or five year's old—electronic or not. And you talk to faculty members. When a faculty member found out an article was submitted to this journal, which is going to be both print and electronic, but wasn't going to be indexed, [he] pulled his article saying that he had to have it indexed by January. He had to have it pulled even though this was an excellent editorial board; that he had to have it in a journal that was [indexed for reference]

Many scholars talked about the difficulty of finding articles on the web. Numerous proponents of electronic journals sought a more centralized database model, while the publishers wanted to start their own indexes. In essence, it appeared as though everyone was working in different directions.

Aggregation. All scholars would like "one stop shopping at a scholarly journal store" that had every conceivable good and service available for free. Journal aggregation appeared to be essential in achieving this type of utopian database. Indexes and aggregators hold all scholarly journals together. Aggregation is the glue that binds different disciplines and multidisciplinary studies. Librarian A stated:

> The other thing that's in there about organizing that's sort of hard, and we see our vendors, our index vendors, now want to almost be aggregators. And they want to point from the index to the electronic piece. This makes a whole lot of sense, but this works if the user is coming through an index and doing a subject search and trying to figure out what material meets the user's criteria. Often users know exactly what they want when they come in the building. They know the name of the title, and then what's the best way to do the title search. If you go out and work on the net, you will see there are a wide variety of ways of doing it. Some are alphabetical listings; some are grouped by subject. I mean there are a variety of ways to browse or search for something. There is no professional decision about how we're going to organize these things.

Librarian A mentioned the challenge of aggregation and for library patrons with different styles of working with Internet databases. This issue was a serious concern of librarians, and publishers mentioned they wanted to provide assistance.

Centralization. The Los Alamos electronic preprint archive referred to as XXX was not only a model for electronic scholarly activities, but also appeared to be the best example, according to electronic scholarly journal proponents, for centralizing data and distributing it to various locations for preservation. The unique aspect of XXX was its centralized nature, as indicated by Forum Participate B's reply:

> XXX is mirrored in 12 countries, upgraded, and updated on a ongoing basis . . . but the virtue of making XXX the locus of more and more of the literature in all disciplines is that many eggs can be collectively tended in one basket.

Space. As described by these participants, the virtual library really was not "virtual." Space issues were not considered easily resolved, even though online scholarly journals required only disk space. Research Librarian B shares her designs for increased space:

> I mean we're going to add to this building, and we're going to redesign space. We're seriously underconfigured. When you look at the new environment and how people are going to work in groups and the technology. Actually, in a library, a person sitting down with a book, the standard space that you need is like about 25 square feet a person. When you look at the workstations and group work and so on, you're really talking 45 and 55 square feet a workstation. And so it's not going to take away the library's place, an intellectual common ground. I call it the point of intersection for the campus, intellectual intersection.

Many scholars were pleased with the trend toward library reconfiguration. They valued the perceived convenience of having the library at their fingertips, rather than having to visit it in person.

Throughout the discussions, many participants described their beliefs that despite the complex issues, problems would be solved by professional librarians working with key publishers through scholarly societies. However, Publisher H gives a different opinion:

> So the key, in my mind, is if you unified a global set of archives that everybody in the world uses as equal access to and is comprehensive, in a sense, if you can't find it there it's because it doesn't exist, not because it's poorly indexed or because it's part of some partitioned database somewhere else. That state of affairs, we certainly wouldn't have gotten to by now, and it's not obvious to me that we would get there even 10 to 15 years from now.

Publisher Profits

Although the scholarly world wished to reward good work with fair compensation, the situation escalated to the level where the ARL organization was investigating the existing practices and exploring the viability of antitrust lawsuits against a few giant commercial publishers. This section exclusively addresses issues of publisher profits, competition, library-led initiatives, and methods to remove vested economic interests from publisher control.

STM serials crisis. Publisher profits have been at the center of the debates about scholarly journal pricing. The small publishers' depiction of the for-profit publishers as "Euro bad guys" was best put forth by Publisher B:

> The bad guys, or at least the perceived bad guys, are what we call STM publishers: science, technology, and medicine. And for the most part, those are huge megalithic European publishing houses. And I don't know whether I should name names here, but they are mostly overseas. We know them. We know who they are. . . . What's happening is those European STM publishers are charging huge, huge prices for their journals. For instance, one journal that I know of from one prominent STM publisher is a medical journal; it's $2,000 a year for that journal, a library subscription. Our highest prices for our journals to an academic library, and we're a commercial publisher, our highest price is $199.00.

Furthermore, she suggested that the influence was directly connected to prolific scholars.

> So when librarians and scholars and people in academia complain about this, they mean European STM publishers. But I don't mean to bring up this venal point, but I have to go back to the medical and some science journals, commercial publishers will come in and you're a professor, and they'll say, "We'll give you a $100,000 a year to be the editor of this journal in addition to what you're

> making." But somebody has got to pay for that. And, of course, the publisher, you know, charges a lot of money. They make a big profit too. But as long as you have the researchers within the university community who are benefiting from this STM expensive journal system, how are you going to change that? And if the university goes to them and says, "Okay, you can't do this anymore; this is a conflict of interest; you're a researcher for us; this is work for hire; you can't do this," they'll go to another university, and the top researchers, the top names, the people that you want will go somewhere else. I don't see any way around that at the moment.

This example of for-profit publishers playing the status game with academic research in exchange for scholars' money did not infuriate scholars with both pockets empty, then they did not possess either a temper or any value of money. These examples of "highway robbery" were mentioned by those who were informed proponents of electronic scholarly journals—publishers as well as librarians.

Culture and Economics. "Academia," as defined by faculty, librarians, and scholarly associations, was unaware that established behaviors were being "rewarded" with more restrictions on scholarly publishing, less scholarly materials in libraries, and less access to published work. A highly-placed librarian and technical policy analyst best described the existing culture as the "nemesis." Scholarly Society Officer K stated:

> One is that the key operator is faculty culture and that includes promotion, rank, and tenure. There will not be a quick break from the existing use of high level and high priced scholarly journals in sciences, because some of the very high priced journals [also] have a very high prestige factor that is not to be easily dismissed. There is certainly a value of having high level editorial boards and competition would be great in certain journals. It's just that there's no reason that it has to be limited to high priced or print environment, etc. So I believe it will be actually quite a slow transition period. I don't think there will be a revolution because faculty culture is generally not amenable to it.

Competition. The volume of publisher profits and the increasingly aggressive behaviors of publishers created a new sense of competition in the noncompetitive activity of publishing scholarly works for one's self, one's colleagues, and one's field.

An official of a hard science scholarly association, Scholarly Society Officer J, best described the new competitive culture that he personally had experienced:

> I think part of the changing environment over the last five years has seen us go from more of a collegial organization where we do our thing, we do it well but there isn't a lot of rush or pressure or tension to one that. I really sort of envision the publications division, even though we're of a not-for-profit, we are a for-profit in this division. And that has got to have sort of a different philosophical bent or otherwise you're just not going to make it. Like it or not we're out there competing with for-profit big time publishers like Elsevier.

Unlike the hard sciences, the soft disciplines had no comments or concerns about competition.

High Wire Press and SPARC. Throughout the interviews, librarians and scholarly society members commented on increased proactive responsibilities. Many not only worked to educate senior administrators and faculty, but began initiatives to become publishers in attempts to lessen their dependency on for-profit publishers. One interviewee actually established High Wire Press, located at Stanford University. It serves to assist scholarly societies in bringing their journals into the electronic medium while keeping prices low for the libraries. Stanford's librarian also was the publisher of the High Wire Press. In another initiative action, ARL had recently decided to become a publisher of online scholarly journals in an attempt to block high-priced, high-margin publishers from overcharging for journals for campus collections. Librarian C best described the situation by stating:

> What the journals provide are copy editors and typesetters basically. The editing is done gratis by the journal editor. The reviewing is done gratis by the reviewers. The writing is done gratis by the writers. And it's not inconceivable to me that we could, say as an organization, hire our own copy editors and own typesetters. In this case, it wouldn't be typesetters, it would just be someone to make sure it gets online, and save money by having things published electronically. But it's not to

> say that the prices they charge individuals are all that outrageous, except for a few.

Profit margins. This research attempted to glean economic data through face-to-face interviews and an online forum. This researcher was able to gather additional, secondary economic information from the forum participants. However, more analysis is needed to draw any conclusions beyond those designed to enlighten the reader about the existing issues regarding electronic scholarly journals. Librarians who seemed passive became animated and livid when quoting profit margins of their major for-profit publishers. For example, Librarian B stated:

> The big commercial STM publishers have created the economic crisis. They created almost a monopoly-like environment. There is a saying among librarians that Elsevier is the only company in the world that can raise its prices and drive its competitors out of business. She (Karen Hunter, Vice President of *Elsevier Science*) would tell you that they have all these costs, you know, they're not charging anymore than they have to. But when you look at their profits, in 1995, 39%; 1996, 40%, and almost 41%; in 1997. . . . And they raise their prices in anticipation of us dropping. That's a self-fulfilling prophecy. So if they say, "Well, next year, let's figure 10 libraries will drop, so let's set our price [to] the 10% we would [have], and another 5% or 6% on top of it to make that up [the dropped subscriptions]. They make sure that some of us have to drop. And then those of us that don't, we just increase their profits.

In conclusion, many participants believed that the system was a house of cards that had to collapse (Harnad, 1997). Faculty, it appeared from the study, seemed ignorant of the economic realities and culturally passive about the prominent and influential scholarly publishing arena in which they worked every day. As a result of the efforts of many proponents of electronic scholarly journals and others, debates continue within electronic bulletin boards, presidential boardrooms—even the local copy shop that markets for-profit CoursePaks to students. Analysis of the data revealed that highly profitable publishers become defensive when confronted with their allegedly stealthy

tactics. A young faculty member, Chemist A, described his enlightenment on the issue and alluded to the future:

> I would say, in general, you know the few little things in your area and you know if they're pricey or not. I would say though that it's kind of been something in the past that we've always just lived with. Everything was in paper and so you just lived with it—the rising costs of library things—but you just had to have them because these were important journals in your field. You just knew that you had to have them. Now, you're right, with things coming online, I think the issue is really resurfaced on why are we paying so much for this, etc. It's interesting to look at my field.

Comparison and Contrast of the Disciplines

This section contains the secondary analysis that explores differences and similarities that exist between disciplines. The analysis of qualitative data combines art with science (Guba, 1981). This analysis focused on emergent categories that enlightened and informed the study of the growth of electronic scholarly journals. In addition, the analysis identified concerns that must be addressed in order to satisfy all disciplines, ranging from physics to education. These comparisons and contrasts illustrated areas in which disciplines were working in a similar fashion, as well as those areas, in which work was unique.

Factors Considered

This analysis explored the predictions that the participants offered regarding when, or if, paper publications would be replaced by electronic scholarly journals. Similarities and contrasts of technology use and computer literacy were identified. Analysis of other similarities and contrasts explored the falsifiablity of knowledge claims, the policies and procedures implemented by publishers, and the features that scholarly societies requested for online journals.

Differences in journal cost and competition were described. The phenomenon of preprints on each discipline's culture were investigated to better understand the importance of speed, peer review, and standards in scholarly communications. This section concludes with the marketplace differences and similarities of the hard and soft science scholarly journal as seen through the eyes of publishers, scholarly societies, and librarians.

The study emphasized the education field as a soft discipline when compared to the four other disciplines. Psychology was considered as a second soft discipline. The three hard disciplines included in the study were physics, math, and chemistry. Of the 31 interviewees, 16 were classified as soft disciplines and 15 were hard disciplines.

The psychology of scientific communication combined with the specific circumstances in the field provided the researcher with perspective of the complexity and diversity of the study. Of each of these four disciplines, education was the most diverse. As Educationist A explained below,

> One of the things that you have to realize is that education, as a field, differs from most in that it's much broader and more encompassing. AERA has Divisions A through L. And as you look at them, they include history, administration, learning and instruction. AERA, in and of itself, is as diverse as any college of letters and science. And a school of Education is often as diverse as the entire college of letters and science. What that means is there are a lot of subspecialties.

A recurrent theme during this analysis was the interactive nature of electronic and paper journal writing. Interactive style was based on the discipline, social systems, subjectivity, bias, and methodology. Despite the numerous differences among the disciplines, the findings showed that many scholars, librarians, and officers of scholarly societies were united in regard to many of the concerns and issues associated with

electronic journals. Even with the most informed interviewee, it appeared that the issues were complex and not thought-out to great lengths but, instead, were accepted as part of the scholarly research process. Using the beliefs and meanings as described in the words of the participants, this section defines the differences and similarities in the following as listed in Table 9.

Table 9

Themes Discovered By Comparing and Constrasting the Disciplines

	Themes
1.	Predictions
2.	Technical uses
3.	Speed
4.	Cost
5.	Market
6.	Falsifiability
7.	Preprints and eprints
8.	Peer review

Predictions: Hard, "Yes!" Soft, "No!" Every interviewee was asked the same question: "Do you see electronic journals replacing paper journals?" Many of the replies, surprisingly, suggested that paper publications would not be replaced, but rather would be used as parallels to electronic journals. Those who believed electronic journals would replace print journals were exclusively in the hard disciplines of physics, chemistry, and math. In fact, two of the informants, both physicists, believed it had already happened.

All of the interview participants were categorized as hard discipline scholars (physics, math, and chemistry) who believed replacing paper would happen. When the follow-up question, "When do you think this will happen?" was asked, the majority of the hard discipline scholars stated that the full transition would occur in five to ten years. As gathered from the data analysis, the responses from this collection of hard and soft librarians, scholarly society officers, publishers, and prominent scholars reflected the additional differences toward the potential for electronic journals to replace paper publications. The two exemplars, one from a soft discipline and the second from a hard discipline, emphasized the confidence level (or the lack thereof) of the probability that paper will be replaced by electronic dissemination. A senior educational researcher, Educationist C, offered this perspective:

> No, I guess I'm somewhat dubious about that. I've been on the editorial board and so on and so forth. I think people like to have hard copies of things... You know, you'd like to be able to slip a journal to a student. I just am not convinced they are going to replace paper.

A renown librarian and information technology dean, Librarian C, whose focus was on science technology and medical journals, predicted:

> I would say five years for the life sciences. And that fast for physics, if it's not already there. Maybe longer in the softer sciences and we're years and years away from the humanities and the softer social sciences.

These two different examples were found as exclusive differences in the hard and soft disciplines. Many of the scholars understood the comparative advantages of the ejournal, yet did not feel that academia, in general, or their respective disciplines, in particular, were apt to change due to paper publisher inertia, paper prestige, and cultural factors. Altering the system was viewed as a matter of changing the entire social structure of the discipline. For example, in the soft sciences, interviewees viewed

alterations in communication behavior as a potential accomplishment if done in such a way that distinct features of the discipline and its journal were not destroyed. Those unique features that have been established to reward progress and integrity in sub-fields and sub-disciplines, rather than in general categories (i.e., outstanding educational scholar and outstanding physicist) must be preserved (Garvey, 1979). Scholarly behaviors were rewarded in the sub-fields of the disciplines or across disciplines. For example, education was viewed as quite diverse and comprehensive. On the other hand, sub-fields of chemistry were perceived as similarly diverse, and the rewards that happened in those sub-fields often were unknown to other scientists.

Technical use. Implications for electronic journals for scholars affected the scholars' ability to use computers and computer technology effectively enough that a new medium like ejournals did not hold them back in their respective fields. As indicated in this section, many of the barriers to electronic journal success in the soft disciplines appeared to be related directly to computer use. The contrast was illustrated when a more technical physicist stated that barriers to success were cultural, and an educational scholar stated that the barriers to success were technical. The data provided self-descriptions of technical ability and the findings ranked technical ability from high to low. The data showed that the technical skills of physicists were at the highest end of the range, while educational scholars had the lowest degree of technical proficiency. Educationist D, when asked about technical ability of his field versus the hard sciences, replied,

> Two reactions: First of all, I think physicists are hard scientists; they're much more likely to gravitate to the technology. We can speculate about all kinds of reasons for that. There are gender differences in the distribution of professionals.

> I think males are more likely to gravitate to electronic media than females, and females are relatively heavily represented in the social sciences. The humanities and social sciences are less likely to be attracted to that area.

When asked the same question, this former department chair of one of the hard science disciplines, Mathematician A, stated,

> Certainly technical computer literacy is much higher in those first three fields [physics, chemistry, math] than the last two [psychology, education] but... Social sciences probably don't know what an operating system is and wouldn't understand different operating systems, but on the other hand, they certainly can sit down in front of a machine and do the end user stuff whereas the physicist may, in fact, be writing assembly code to make something run faster. They've [soft disciplines] got big experiments, and work in the field. They [soft disciplines] will have a lower level of comfort with machines and the technology.

Collectively, the interviewees explained that computer skills or computer literacy were required only at a minimal level to work with electronic scholarly journals in the current World Wide Web system. However, publishing on web sites appeared to be something the soft disciplines were not doing, primarily when technical assistance was required. Not only were there differences between the two major categories that arose from the data, but also, as one scholar explained, there could be a technical ability and use rank order among the disciplines that yielded different online journal growth patterns. This interviewee noted the differences in computer literacy because he worked across two of the hard science disciplines. Chemist A stated:

> A lot of chemists don't use computers much since half of the chemical community is synthesis people. They make things and they're not really even computer literate. So I would say they just fall behind because most physicists, you know, whether astronomy or physics, half of their life is spent interpreting data and they need computers for that and the same with mathematicians.

Computer literacy and technical use might be factors that influence faster or slower growth of electronic scholarly journals. Economics may also play a role. The interview

data, although not as substantial in this area, showed that the technical skill level of scholars was related directly to the amount of technology available in their disciplines. If a scholar did not have a computer, it was difficult to become computer literate. Scholar Physicist B revealed:

> So I would say, in general, the social sciences and the humanities have had less access to the technology, and there's less money for them to experiment, to create servers. They tend to write longer articles, so preprints and so on would be longer. I mean the nature of what they do, not that it's soft or hard, but it's simply the kind of research they do does not have much money that's available, the kind of dollars for computers are not there. So the technology dollars that are available are small. Whether or not faculty are moving technology into their own teaching and research, probably has a lot to do with how fast or not fast the ideas [like electronic journals] will take hold in those fields. So, I think that may be the answer.

Speed. Most of the scholars understood the value of speed as it related to the publication time frame of scholarly communication. For example, an immense amount of time is consumed from writing, to submission, to the completion of peer review. More time then passes from the submission stage through typesetting, and until final publication.

All scholars had developed some type of informal network through which zero drafts, first drafts, and even outlines were distributed in order to generate scholarly feedback. Many of these groups were formed to ensure timely feedback in the scholarly journal writing process. Some networks were quite formal; others were ad hoc connections.

The differences that were exposed in this study were significant. For example, many interviewees perceived that the hard sciences needed faster dissemination than other areas. By contrast, the soft sciences, according to some participants, benefited from

a slower dissemination process. The recurrent themes concerned competition, discoveries, and breakthroughs. Educationist D stated,

> I think there's a more intense competition. Perhaps, more concern with speed of publication and rights to ideas, the structure of knowledge in the hard sciences is perhaps more cumulative. In education, we're more likely to have a large number of articles on the same topic. And one article is less likely to be critical. We don't typically have situations in education where we've got teams at several institutions working on the same problem, racing to see who is going to be quoted first or something. That kind of thing happens more in the hard sciences. I think that press for timeliness and preoccupation with order of publication makes a difference.

Breakthroughs and discoveries were identified more frequently by the hard sciences than the soft:

> No, I mean I think the disciplines are somewhat different. I mean if you are working on DNA replication or cloning or something like that, then if someone at Cambridge in United Kingdom makes a really major breakthrough, then that maybe is going to save me hundreds of thousands of dollars here at Stanford. I really need to find out about that as soon as possible. If I make a breakthrough in thinking about some philosophical issue in education, you know, it seems to me it's hardly in the same category. (Educationist C)

An expert who has studied information dissemination and has a background in the social sciences felt that neither sufficient competition nor timely discoveries were attributable to the soft discipline fields in such a way that faster dissemination or preprint service was required. Scholarly Society Officer K revealed:

> In other words, in some of the humanities—let's take literature. There's not necessarily a rush to publication. And so, even in physics, people are generally still wishing to have the peer review as part of the ultimate process. I don't know that there's a particular value in let's say in literature to having a preprint that would appear a year before the journal article. There may be and there may not be. But it's not as pressing a need as in the sciences where usually timeliness is a very important factor.

The data supported the perception that hard sciences needed speedy dissemination and soft disciplines did not. Two soft disciplines scholars even mentioned that a slow

publication process allows things to settle and to, quote, "get grounded" better. Hard scientists almost unanimously agreed that fast access to scholarly journal articles kept them sharp, up-to-date, and creative in order not to duplicate someone else's work. It appeared that the desire for speedy dissemination was directly related to the hard sciences' demand for eprints, ejournals, and society journals to be online.

Cost and market. This section explores issues of cost and the scholarly journal market that exists in the hard and soft disciplines. The data illustrated differences in the pricing of journals and the existing markets, along with publisher profits.

Issues of cost appeared as the force behind many of the ongoing debates about scholarly journals that have appeared in *Nature*, *Science*, and *The Chronicle of Higher Education*. According to the interview data, scholars understood prices of their own specialty journals, but not of others. On the other hand, the *American Scientist* forum participants spent the majority of their time discussing the economic issues revealed in recent studies. Journal costs were a definitive factor if not the primary factor in decisions regarding subscriptions to existing journals and purchases of new journals. The majority of participants did not push for modifications or changes in a discipline that had low cost journals. On the other hand, disciplines that had very high-priced journals found themselves engaged in serious conversations about mandates for change designed to relieve the cost implications of scholarly communications. They moved towards cost-efficient eprints and ejournals. This section discloses differences between fields in the cost category. The following scholar, Forum Participant G, informed the study regarding the price differential between his educational journals and his APA journals. Price structures of the soft sciences were also identified:

> Humanities journals are really cheap in price in comparison to some other fields, and so are quite often subscribed to by individuals and not only libraries. Scholars are much more accustomed to reading them at home, on the bus or train, and so the low cost and ease of use of paper journals will make for some resistance to going electronic completely, at least in the immediate term. Again, in the humanities it isn't so much the financial constraint upon access, but more the financial constraint upon publication itself.

The scholarly journal market, according to librarians and publishers, is divided between the science, technology, and medical market (the market where most of the hard science journals are published) and a second market for the social sciences and fields such as psychology and education. Many similarities exist in the markets, but the differences better illustrated the development of the scholarly journals phenomenon. Similarities in the markets consisted of the prestige of a journal as related to its age and editorial board membership, the publishing process of typesetting and copy editing, and the copyright issues. Another similarity was that scholarly societies and not-for-profit publishers held lower profit margins and appeared to partner better with librarians and scholarly societies.

The market differences were illustrated through the two main market phenomena of price structure and profit margins. One of the not-for-profit publishers revealed the low price structure, yet large market, of education journals. Scholarly Society Officer A stated:

> Education certainly has its share in terms of quantity of journals. I think it would probably be number one in terms of numbers of titles. In terms of revenue, probably not in the top twenty. You could look at, not that we're the only education publisher by far, but you look at the price structure for AERA publications, not only to members but to non-members or libraries, in comparison with what physicists charge for their subscriptions . . . tremendously different. The more . . . the libraries have to cut their budgets-which I understand that pressure very much-education wouldn't have a major impact. It's the big-ticket items that they have to concentrate on. There's an adequate, a very healthy

> reserve fund that can afford virtually anything that we may want to do without having to cut something or get dues increased. We haven't increased our dues once in 19 years. That's kind of strange or unusual! I guess the challenge is the foci of our mission are one to promote quality research and to communicate that research. I think we're very successful in disseminating research to our own folks.

Another not-for-profit publisher who focused on the hard sciences market believed there was no opportunity, profit, nor demand for electronic scholarly journals in the humanities and social sciences. The market and the soft sciences as seen through the eyes of this publisher appeared so weak that he would not choose to do business with the soft science publishing market. Publisher C's quick response was as follows:

> We have worked on science technology and medicine because of the threat that communications world offered, and still offers, and makes to universities and research libraries. The same cannot be said of journals in the soft sciences, mostly, and certainly not in most journals in the humanities. Interestingly because there is not that threat, there is also not the opportunity, because there's not enough money to play, given the current state of our services, the costs of those services, and the functions that we offer. So what I would say to a journal in the softer sciences in humanities and social sciences is that we're probably not going to respond to a request for a proposal, because we have serious doubts that they would be able to afford our services, number one.

Publishers' language was very similar when talking about the soft disciplines: one, there was no market; and two, the profits were slim. The other publishers followed the same business rules that governed the one quoted above. The publishers looked to find profits that fit their business model, and wanted to maintain or improve their cash flow while improving their profitability on an annual basis. This soft discipline Publisher B asserted,

> So if we go and offer the electronic license, which a lot of people are thinking is a replacement for print, in our case we're not replacing print, we're adding new customers.

Falsifiability. This study also focused on the issue of knowledge claims. Interviewees were requested to provide feedback about the potential for falsifiability of knowledge claims in either the hard sciences or the soft sciences. For example, they were queried about the extent to which it was possible to falsify the knowledge claims of cold fusion in physics versus falsifying the information about charter schools in education. An assumption was confirmed that falsifiability was easier in the hard disciplines. That ease created a desire to evaluate the work more readily and, therefore, hard disciplines required less peer review prior to placement on an eprint archive or electronic journal.

In the hard sciences, there can be only one truth. Concerns about the nature of reality are not important, and the justifications for knowledge claims are regarded as secondary. For example, causality concerns (i.e., whether A caused B—a causal inference) and how it happened (cause mediation) are the methods used in the hard sciences (Shadish, 1991). If Scientist A is right, then Scientist B must be wrong. There are no two sets of truth in the hard disciplines. Hard scientists viewed answers as "yes" and "no" or in terms of what some refer to as "black or white." Education and psychology (soft sciences) work in what is often referred to as the "gray areas" between black or white and true or false. The hard scientist, Mathematician A, described his thoughts on the differences:

> Well, I don't know whether it's a reason but I try to take a very broad view as to what constitutes research and scholarship. And there are certainly areas out there where you have two well-dressed well-educated obviously intelligent people, one gets up and says A, and the other one gets up and says not A, B and they're both applied. Now that doesn't happen that much. If it does, I mean, people make mistakes and so legitimate mistakes happen in science all the time and they certainly happen in mathematics. So people that publish results that turn out to be wrong, it can happen but it doesn't happen in the same setting as two economists getting up and arguing about what's the better course of action to deal with the

> Asian financial crisis. People in mathematics can argue and say this is more important than that, but they don't argue correctness. So we can't all operate like mathematicians, we can't all operate like physicists. These other areas do require certain intellectual expertise; it's not mathematics. Whether or not it's lesser or greater, I'll let someone else worry about that.

Another hard scientist referred to the gray areas as "slippery" when describing them:

> It's easier to look at something and make a judgment as to whether it's crazy or essentially interesting or physically consistent, right compared too much more slippery issues in education. Things are pretty slippery in physics too when you get right down to it when you're working on the edge. But still, she's [his wife in Education] probably right. It's much less slippery than it is in a field such as education. I also think, I mean there are just way more people doing education, lots more people writing education papers. (Physicist B)

In concluding thoughts, a few of the interviewees did not believe that the difference in knowledge claims was significant enough to lead to slower growth and development of electronic journals, or that preprint archives suffered from any potential falsifiability of knowledge claims. Informants spoke of other ways of judging journal articles such as methodology, authority in the field, creativity in subject matter, or discovery. A proponent of electronic scholarly journals noted,

> You said the problem may be falsifiability. Well, they're still using some criteria in their published journals, and there's no reason why those same criteria couldn't be used to construct these quality overlays for a raw database [eprint archives] in what you call a soft disciplines. (Physicist C)

Preprints and eprints. Everyday, in the hard sciences and especially physics, tens of thousands of scholars point their web browsers to a vast repository of physics preprints or eprints. Almost overnight, this form of scholarly communication changed the loci of publishing into the electronic media. This occurred in one discipline but not in others.

This study attempted to illuminate the reason(s) for the difference. The site (http:\\xxx.lanl.gov) served as a model for electronic scholarly communications where other disciplines were encouraged to send their paper-based preprints and articles to the Los Alamos repository. Some disciplines had a longer history of preprints that made the move easier than others did. The experiences with preprints in each of the disciplines might be predictive factors affecting the time at which a specific hard or soft discipline will change its respective scholarly communication system to include eprints. The interview data illustrated not only the status of each discipline in the formation of their e-eprint archives, but also their feelings toward the development. According to scientific Librarian B, preprints had been available for quite awhile in the physics discipline.

> Physics had a strong tradition of preprints in paper far before it did electronically. And so it was kind of a natural thing that worked there. I think it will work it other disciplines. Other disciplines are just much more slowly coming to it. But probably something of that type will be much more heavily in play in a variety of disciplines in the next few years.

A chemist who revealed in the interview that he preferred to receive materials electronically noted the following:

> I would say chemistry lags behind many other fields like physics and mathematics where they really are; everything comes up as preprints first. Chemistry is a little worse about that for some reason. . . . There's hardly any, nothing compared to physics or mathematics as far as the preprint community. It's a shame. I mean you write, all you have to do is spend much time with math or physics and you've really spoiled, if you like online things, you start to love their society because half my work is in physics and I can get everything online without ever worrying about it. (Chemist A)

A senior scholar in psychology favored the idea of eprints. He was less inclined to believe it would occur immediately in psychology due to the diverse sub-fields and specialties. He also mentioned that his field, like education, had as many professionals in

the field and in the lab, and therefore away from computers quite a bit. According to participants, this hindered the development of preprints since those located in the field appeared less likely to use computers in their practice. Psychologist B stated,

> Oh, I don't know, people get preprints of stuff that's related to them. But there's nothing organized in the preprint area in psychology, no. Not that I know of.

Educators, on the other hand, had a history of a form of eprint/preprint known as ERIC (Educational Research Information Center). The majority of the educational researchers interviewed did not view ERIC very highly. This perspective could be a factor that prevented or slowed the growth and prestige of a preprint archive in the education field. A prominent Educationist D talked about ERIC:

> Another factor in education, in particular I think is that the electronic media may be a bit tainted by the experience we've had with ERIC. ERIC doesn't really have a very good reputation. It's a tremendous resource and we use it, but the first thing anybody is told about ERIC is, you know, anybody who wants to can send a bunch of term papers in there, and they'll stick them in ERIC. There's no quality control at all. Things end up in ERIC and are sent as ERIC documents, only if the author has been unable to place them in a more prestigious format. So I can submit something to ERIC and I'll try to publish it, but if I don't manage to publish it, then it will end up being an ERIC citation someplace. So ERIC has a reputation, I'm afraid, as being more like the leavings. And I think that probably may have very well created some prejudice against the electronic media. I don't know that. Again, it's speculation. I'm not even sure how you go about tracking it down.

On the whole, most of the scholars considered using eprints to post and get feedback without going through the laborious paper publishing process. However, many scholars completed a form of preprint dissemination using their informal network of peers and subject specialists, and believed that they knew everyone who might influence their articles. Because many of the interviewees were senior, prominent scholars, the majority of them thought the preprint archive was a great location for those younger scholars, who

usually did not have an established network. Younger scholars also would be able to see and refer to their articles in a preprint rather than from the hard drive of an office computer. The differences in the disciplines emphasized in the eprint analysis section might be a telling sign about the culture of the disciplines and their acceptance of electronic scholarly journal articles dissemination.

Peer review. When asked about peer review, scholars did not speak of differences directly. Some differences were revealed in the transcripts and, indirectly, during the forum. In this section, differences in the beliefs each discipline had toward peer review and the characteristics of their journal literature are noted. Librarian B, a senior science librarian and member of many electronic publishing initiatives, was queried regarding the move of soft disciplines toward electronic publishing and dissemination.

> I think they will move, and the products may look a little different eventually. I mean, again, if you look at the social sciences and the entities, 30 to 40% of articles submitted ever get accepted. If you look at the sciences, 70% of what's submitted gets published. How do you explain that?

When hard scientists were asked what prompted difference in rejection rates, many stated that they knew in advance which journal wanted their work so they sent articles there rather than taking time to work through the cascade of referring and reviewing mechanisms that slow down timely dissemination. Garvey (1979) stated that the hard scientists judged their findings and interpretations based upon the work's novelty or pioneering characteristics.

Hard scientists believed they differed from soft sciences scholars in that some core journals were pressuring for quicker reviews. Chemist A, a hard scientist,

mentioned that his journals were concerned with speed, and he was published much faster due to restrictions placed on peer review turnaround time:

> You can find some things that accept electronic versions, you know, where they promise to publish in two months . . . because they're typically . . . worried about getting it out. In a lot of fields, it's just extremely competitive.

This competitive drive and the resultant acceleration of all processes were not found in the analysis of data from the soft disciplines. One educational scholar, Educationist K, revealed that there was an advantage to the process being slower. She noted,

> I think the dust settles more in waiting.

In contrast, Psychologist B, coded as a hard scientist since he was a neuroscientist, stated,

> I never let reviews sit. If I agree to do it I do it immediately!

Garvey (1979) suggested the following in his research of peer review and scholarly communication:

> That eclectic ("soft") nature of the social scientist's subject matter probably contributes to this situation. For example, social science authors and editors disagree more often that physical science authors and editors do on the appropriateness of the required revisions; the editorial process in the social sciences focuses more on the mechanics of the work, such as statistical procedures and methodology, than on the controversiality of research findings; and whereas "core" journals in physical sciences receive few manuscripts previously rejected elsewhere, social science authors repeatedly recycle manuscripts rejected by "core" journals and resubmit them to other "core" journals. (p. 297)

According to participants in this study, hard scientists attempted to use new, unique techniques or pioneering discoveries to assure acceptance. Not nearly as many hard

scientists mentioned sending their articles out again if they were rejected by a core journal. For example, the neuroscientist Psychologist B stated,

If you think they're [editors] reasonable, you say thank you and bury the paper. Finally, many of the soft scientists interviewed for the study mentioned recirculating articles; that most rejections were due to "fit" and subject area appropriateness for the publication's preferences at the time.

Summary

The analysis of data revealed that big differences existed between the hard and soft disciplines. At first glance, the differences among scholars, librarians, and officials of scholarly societies did not appear as significant as expected. However, upon closer analysis they differed not only in the words they spoke, but also in the actions they took. Through this data the differences were clarified. In general, the similarities were too numerous to note, and held no significance due to their broad nature.

The differences, when discovered and expanded, supported the findings of previous studies. For example, Garvey (1979) stated,

> The results in his studies in the 1970s suggest that the scientific communication in the social sciences is in an early state of development relative to that in the physical sciences: the elements of the social sciences' communication structure are relatively non-cohesive; the flow of scientific information through the communications systems follows less predictable sequences; and the processing of information for the archives appears less efficient, more time consuming, more haphazard, and more diffuse. Because of this state of affairs in the social sciences, social scientists appear to communicate more randomly that do physical scientists, whose communication system is more highly development. (p. 297)

This study did not disprove Garvey's findings, but added examples and meanings to his findings through the more recent commentary of scholars concerning scholarly electronic

journals. This section described, in the words of the scholars, their beliefs about and meanings of (a) the predictions of when electronic journals will replace paper, (b) the scholars' technical ability, and (c) the rate of publication speed they wished to see applied to scholarly materials. Moreover, the study enlightened the differences in journal costs as well as the differences between the scientific and social science markets. The falsifiability of knowledge claims also was explored and although it proved to identify some differences, the greatest difference between the two was the organized nature of preprints and eprints. Differences in peer review also were exposed. This educational researcher best summarized the differences in the disciplines and how they affected the development of scholarly journals:

> I imagine if it's really going to go there [hard sciences], it's going to spread, because we like to take our cues from people we think are higher up in the ladder than we are. If it happens at Stanford and Harvard, then it's good for the rest of the universities. If it happens in physics and chemistry, then maybe it ought to happen in some other fields. Pretty soon, it will get down to us. If it happens in psychology, we think, "Yeah, why not follow suit? " (Educationist B)

A summarizing statement, mentioned by both disciplines, was stated succinctly by Librarian B who also represented a scholarly society:

> It was interesting to me to hear that journals that are available both ways, none of the organizations are reporting loss of sales, loss of revenue for electronics. So, that suggested there's a better chance that it will move faster for electronic journals.

Roles of the Actors

The last framework discussed in this section explores how the four major actors viewed the issue of electronic scholarly communications and the roles they have taken (or wish to take) in establishing electronic scholarly journals. The roles that these four actors choose will shape scholarly communication for the next decade and, perhaps,

beyond. This section addresses the key issues, as identified by each actor, that are related to electronic scholarly communication, especially as it affects electronic scholarly publishing. The study used the words of the actors to describe what its role was and what it should be. At the same time, the researcher confirmed those roles by assessing them against the perceptions of the other actors. The actors under investigation were librarians, scholarly societies, scholars, and publishers.

Librarians

By history and culture, librarians are trained to archive and retrieve paper text. The librarian wishes to maintain a central management of scholarly communications. Not all organizations believe libraries can handle all of the functions and roles necessary to take scholarly communications into the electronic era. The four main roles that librarians can fulfill are those of leaders, collectors and archivist, publishers, and lastly, indexers and organizers. In this study, many of the librarian interviewees spoke of their role as trainer, archivist, and faculty research assistant. None of these roles were confirmed as roles that librarians and the library community should focus on concerning scholarly journals. Other interviewees and responses from the *American Scientist* forum confirmed the four roles that emerged from the data. The four actors stated that librarians play six roles: leaders, archivists, accessors, publishers, electronic journal pioneers, and indexers and organizers.

Librarians, because of the serials crisis in the 1990s, were forced into electronic publishing. The most knowledgeable group of actors about all issues concerning electronic publishing were the librarians. The interviewed librarians passively noted the

exponential growth. Yet, education about the issues of scholarly journals had not surfaced at the presidential and chancellor levels until recently. Librarian B's response displayed the emerging leadership roles of librarians:

> It's only recently that libraries are beginning to take leadership roles on the campus or in the scholarly communication process. In fact, in the past, faculty would have been fairly insulted if the library played too aggressive a role when that's sort of the faculty's role. I think that libraries haven't, in the past, shown enough leadership; you know there could be lots of reasons for that. I think that we were too passive in the last 20 or 25 years in dealing with scholarly communication problems, with the cost problems.

As leaders. As university librarians watched their budgets shrink and their collections dwindle, they managed to start getting the attention of more senior administrators and faculty members. A few forward-thinking librarians even made visits to each of the university departments and faculty assemblies to explain the serials crisis and how it affected the faculty. An expert in electronic scholarly communications, Librarian D explained the rapid emergence of leadership and the evangelism that librarians have conducted:

> I think that it took many years of persistent effort particularly of ARL working with (AAU), the American Association of Universities, to bring these issues to the attention of people like presidents and provosts and faculty. I think that's what's made the big difference—that presidents and provosts are now tuned in to these issues because the librarians were not effective at solely carrying the banner for this problem.

As archivist. Libraries, as we now know them, must restructure and reorganize to handle collections and ensure equity of access to everyone on campus. Many of the participants believed that fulfillment of the collector/archivist role of the library required help from many other organizations. According to most, however, the traditional role of

the library would not change in the near future. Furthermore, they believed the library role would take many forms during the transition. Librarian D stated:

> Well, I think that it relates to my previous comment about a library as the traditional place in the university that provides a quality of access. So, for subscriptions to information or even pay-per-view to information that is not published within the university, I would like to see the library maintain a central role in that kind of arena.

As accessors. Many believed that the collector role and accessor role were linked; collections were built with the widest possible access. Concerns about access were paramount according to librarians and scholars. Librarian D asserted:

> I certainly, would say I do feel strongly that they [librarians] should provide access to electronic journals. I think that it's important in a university environment for some institution to play the role of providing equality of access to information. The library has done that through centrally paying for information for all the constituencies in the university.

The scholars believed that librarians could handle the role of collector and accessor, although many proponents of online scholarly journals believed librarians had too many responsibility areas. Central figures within these issues were the powerful library associations, conferences, and leaders. New librarians, fully trained in electronic resources, were assisting with electronic dissemination training and research.

As publishers. Librarians and library associations were taking the initiative to be not only leaders in electronic scholarly communications, but also to become electronic publishers. Many of the publishers were not pleased that librarians were competing for business against them, but did not want to acknowledge this competition. Publisher A, when asked about the librarians' role as publishers, stated:

> I think High Wire Press has been very clever in how they tried to position themselves and their leader has done a very nice job. He is not a publisher, though. He is a service bureau. He's an electronic service bureau for other

> people's publications where High Wire Press is offering a very nice set of services at a high price to those who don't want to do it themselves.

Except for a few scholarly societies, non-librarians did not confirm that the publisher role was one that librarians should perform. Despite this doubt, individual librarians and library associations continued leading major initiatives and supporting online publishing houses.

Electronic journal pioneers. A prominent large library organization during the past few years developed and expanded the High Wire Press (online publisher) from a small operation to one with more than successfully publishing many of the hard science journals on the Internet. Forward-thinking Librarian C, who was also a publisher, stated:

> Well, we focus on STM because our mission is to do two things. The church mission is to enhance scholarly communication by smart Internet publishing as a service to the scholarly community, principally through not-for-profit and responsible scholarly publishers. And, second, the state mission is to begin to effect or to contribute to the effect of market-place correction in the STM journal world. So from the start, we were focusing on STM because that's where the biggest attack on our purchasing power has come over these last 15, 20 years.

Librarians and ARL, their professional association, also started an independent organization committed to creating online access for electronic journals. This newly formed alliance of libraries aims to foster and expand competition in scholarly communications. Called SPARC (The Scholarly Publishing Academic Resource Coalition), the alliance is determined to influence the market place by reducing the price of journals by aiding new publications to get online with sustainable high quality. Librarians were beyond planning and into the implementation stage. Librarian D revealed:

> I think SPARC is a very important project for creating new venues for scholarly communication, particularly in electronic journals. We have a very good working

> relationship. We exchange ideas and strategies. We're also a program of the Association of Research Libraries as SPARC is. SPARC is really an electronic publisher or will be an electronic publisher.

Researchers and societies, as well as publishing partners, are expected to join SPARC and work in a more collaborative environment. This collaboration should foster more dialogue and educate the academic audience about online publishing.

Many scholars felt the library community was not ready to become electronic publishers. The scholars primarily conceived the librarian in the collector role. Publishers did not state outright their disdain for the new competition from libraries, but they alluded to it many times. Scholarly societies were welcoming the new role of libraries as publishers by partnering with them (rather than for-profit publishers) to do their electronic journals.

Indexers and organizers. Scholars believed that libraries needed to be assistants in organizing online resources. Moreover, they believed that libraries needed to provide tables of contents and search engines to help scholars get what they wanted, when they wanted it, and how they wanted it. Librarians identified this expectation (of organizing and indexing) as challenging. Despite the challenges, many librarians were actively building indexes and formally organized web bibliographies; purchasing indexing services; and collaborating on major informational organization projects with other universities. A senior scholar, Physicist A, stated:

> I think that the libraries are metamorphosing to a much greater utility in organizing and finding and assisting people with information rather than storing. The classic definition of the library is a storehouse of knowledge. Well, that has a whole new meaning today. So I expect them to be more facilitators than storage devices.

The archival role of libraries was diminishing in the minds of many scholars. The proponents of ejournals predicted that archiving electronic data would be handled by those trained in information technology or by off-site vendors outside of the libraries.

Scholars and senior administrators on campuses did not view librarians as the prominent leaders on campus. In fact, they believed that librarians were in the best position to work on ejournals but had the least training to do so. Many proponents of ejournals constantly battled the same challenges that concerned librarians. Scholarly Society Officer H, also an electronic publisher, said:

> I have just today come back from an eLib [electronic library] preservation meeting in London, and, as usual, librarians' hearts are in the right place, but their heads are full of needless and misplaced worries, motivated, I now believe, by a very simple, paper-based "intuition pump." They think of the "preservation" problem as requiring some analogue of paper, some undying object, multiplied many times all over the world, to fend off a Library of Alexandria calamity.

In conclusion, traditional roles both in the publishing process and in the libraries must undergo transformation. The optimism of librarians in light of all of their responsibilities was commendable. The study found that the present and future of scholarly communication was in the hands of the librarians. Many scholars believed that if library leadership does not become swift and forward thinking, libraries may be left behind in the transition to electronic scholarly communication.

Scholarly Societies

Scholarly societies play the most essential role in facilitating scholarly exchanges between scientists, librarians, and members. When unpacking the data specifically concerning scholarly societies, three roles emerged. Scholarly association officers as well as the members defined these roles. The central role of societies has been to produce

many of the elite scholarly publications. If societies were not successful in keeping journal literature up to date, accessible, and well formatted, the dissemination of scientific knowledge would be hampered and stalled.

The three emerging roles of scholarly societies, as identified by the participants, were as follows: insuring the sharing and dissemination of ideas; the preservation of the society (central office); and the development and growth of publications. Many scholars felt confident in allowing the scholarly society to act in their best interests. This peer-based society, as revealed through the interviewees, was very conservative and slow to move. Despite their conservative nature, those members interviewed spoke highly of scholarly societies. Scholarly Society Officer K reported:

> I would start with the scholarly societies. I would say that they could, in some cases are, or should be, very significant players in this world. And their members should pressure them to produce timely, high quality electronic products and keep the prices as reasonable as possible. I think that they could be test beds for innovation. Not that they aren't or can't be but I think they should take that on more as a role. I think that it's likely that as more and more researchers and scholars who have grown up in the digital environment become the members of these associations that they will press for changes and emphasis and role.

Dissemination and sharing. Scholarly information exchanged through meetings, committees, and publications are central to these societies. Many interviewees had a vested interest in their specific scholarly society. The interviewees participated in numerous roles within the scholarly society (editors, committee members, conference speakers). Scholarly Society Officer B said:

> Scholarly societies should be leaders in doing stuff right, and that means figuring out how to make sure things [journals] run scholarly and appropriately while getting the widest distribution they possibly can. I really believe at least in the academic market place that the most important thing is the sharing of ideas.

Numerous scholars were pleased with their association's products, meetings, and personnel. Most of the complaints about scholarly societies focused on what they were *not* doing, rather than what they *were* doing. The majority of the scholars did not want their meetings with peers and opportunities for exchange, such as national conferences, eliminated. An exemplar was offered by a senior scholar, Educationist D:

> Well, the goal of the organization—NCF has a variety of different goals. So far as most of the members are concerned, the most important thing we do is have our annual meeting. And that provides an opportunity for face-to-face interaction and exchange of information, which is I thinking qualitatively different from either print or electronic communication. It's unlikely to disappear. People really want to get together and hear what one another has to say and meet informally and make contacts and make friends. I think that's fundamental. I don't think that professional meetings are likely to disappear.

Survival. Society officers expressed goals of maintaining a strong central office—financially, organizationally, and managerially—through outstanding leadership. Activities that reduced the society's power structure normally were suppressed or subsumed by the society. A senior society member, Mathematician A, reported:

> Now in fairness to AMS (American Mathematical Society), these are good guys or girls. They have societies' best interests, they have sciences' best interests at heart and yet, they are also human. They like to preserve their leadership role that AMS has historically played. And so, when it comes to issues of how major national initiatives or trends are going, any trend that threatens or diminishes the role of AMS is not good.

On the whole, societies maintained a strong central office that acted as a facilitator, as a partner, and as a provider of basic infrastructure needs. Society directors commonly were responsible for ensuring that mistakes were not repeated, that the office maintained the day-to-day functions, and that growth of new publication sub-fields and new innovations continued. When asked about electronic publications, Scholarly Society Officer A revealed:

> I see us thinking about that. The short-term issue is getting the infrastructure in place. Okay, that's what we will be dealing with over the next couple of months. And I would like to think that the January council meeting will be in a good position to say, "Here's what we need to have the right facilities and have the right expertise in the central office."

All five society officers, when given the choice between coherent policy and normal procedures, chose preservation of the central office (survival) as their most pressing duty. Different societies handled threats against the central office in different ways. All but one society, education, viewed themselves in a competitive marketplace where threats occurred not just yearly, but daily.

Publication development and growth. All the scholarly societies included in the study were concerned not with increasing membership but, instead, with maintaining services for a growing society. All the scholarly societies dealt with increasing demands for additional journals and articles. Scholarly Society Officer H, a hard science publisher explained:

> Well, first of all, we're not trying to grow the organization at all! We're trying to keep up with all the articles that authors are sending us. Larger and larger numbers of papers every year have forced the growth on us.

Another scholarly publications committee member, Educationist I, asserted:

> I don't see [that] it's AERA's role to provide a wider range of publication opportunities. The discipline itself provides those.

Another role of the society was to ensure quality control. One mechanism of quality control was controlling growth. A few of the societies had started new, exciting electronic journals to keep up with the competition and to test new forms of scholarly communication. The no-growth policy of new publications was not formally stated, but every senior officer mentioned that he/she received a request for a new journal nearly every day. They attempted to encourage members to maintain quality control and keep

costs down. However, societies educated members that starting new journals was very difficult.

These organizations never were referred to by scholars as innovators or risk takers. Each organization had noted and demonstrated the desire to follow other societies and to learn how to publish electronically. Finally, both proponents and opponents of electronic journals believed that scholarly societies were best qualified to become the most prominent players in electronic scholarly journals.

Scholars

This section investigated the scholar's view of and role in electronic publishing. Electronic publishing could not exist without the scholars and their desire for the widest possible distribution of their work, the new knowledge found in publications, and a belief in peer review. Scholars were familiar with and accustomed to paper-based scholarly publishing. The scholar's role in his own publishing process was enlarged and empowered with the introduction of electronic publishing. If the reward system for faculty allowed for it, individual scholars, acting as publishers, could ensure a successful electronic scholarly publishing process. The three roles explored in this section included the scholars' role in providing access to individual work, in promoting the ability of individuals to self-publish, and in generating participation in the peer review process.

Access. Historically, the scholars' desire to publish for knowledge and growth of the field, rather than to achieve royalties, was the lynch pin that allowed scholarly communication to exist. It was the scholars' dynamic process of writing, networking, and peer editing that produced order in the scholarly publishing system. Scholarly

communication was largely a matter of interaction among scientists. The major elements of the scholarly publishing process were social institutions and dissemination activities. Forum Participant B, in the *American Scientist* forum, explained:

> The authors of the refereed journal literature, not writing for fee, wish only to maximize the visibility and accessibility of their work.

It was this desire that led authors to the preprint and eprint world. The preprint in the hard sciences functioned as a form of date stamping and the marking of a new area. A preprint or draft for the soft sciences was used for peer dissemination and the generation of informal scholarly networks designed to facilitate feedback. All five disciplines used some form of preprint, whether organized as a peer list or as a formal preprint archive. Forum Participant B asserted:

> To hasten the optimal and inevitable, authors should publicly archive their unrefereed preprints and their refereed reprints on their home servers as well as in a global archive such as the Los Alamos Eprint Archive [http://xxx.lanl.gov]. XXX already has at least 35,000 users daily and archives at least 14,000 papers annually. Once this is generalized to the other disciplines, library subscription cancellations will place pressure on finding an alternative-funding model, publishers will switch to online-only and page charges, and the windfall savings from subscriptions, site licenses, and pay-per-view will become available to fund them.

The traditional role of scholars obviously is the production of scientific and scholarly knowledge. However, without access to this knowledge through journals, societies, and meetings, there is no communication system to keep it moving forward. Because the scholars' concern with access was paramount, the eprint archive was developed by a researcher to get his research out to his scholarly world as rapidly as it was produced.

This faculty member's ability to perform all publishing tasks via his access to technology and the Internet made other assistance unnecessary. A hard science scholar, Physicist B, when asked, "Do we need publishers?" summarized as follows:

> There's no typesetting, of course, because everyone sends it in as a text file or something else. Almost invariably it is a text file. So they go through and make sure that certain conventions are adhered to. And I suppose there's some value in [copy-editing] that but it's pretty minuscule. It's sort of nice to have the complete volume in paper grouped together but that's becoming less and less important. So I think the thing is that they're rapidly becoming obsolete. So the only service that they're really performing as nearly as I can see that they're coordinating the review process by which XXX doesn't touch.

Recently, scholars began to perform not only the research and the writing, but also the typesetting, the peer review, and the html coding for web publishing. Scholars understood that this powerful, new position could be the pivotal role that allowed them to challenge commercial publisher pricing, procedures, and copyright policies. An expert in network information believed that heightened faculty awareness of the electronic publishing issues, combined with the spiraling costs of commercial publications, might lead faculty into more subversive activities. For example, Librarian D suggested publishing all of the articles on a specialized web site:

> I think if faculty begin to do more self-publishing on the web and start maintaining their own individual archives of their published materials, they control their own access. They should work with societies to preserve the rights to do that.

Peer review process. Lastly, scholars controlled the quality of their own research through the peer review process. In most instances, the peer reviewers were unpaid volunteers who considered it an honor to review for a scholarly publication. Scholars, usually unpaid or nominally paid, also served as editors who administered the peer review process. A few scholars thought that they could do without things like libraries,

scholarly societies, and commercial publishers; but that they could not do without peer review. The majority of the interviewees believed peer review not only was accelerated in ejournals, but also was medium-independent, meaning peer review could occur in a paper journal as well as in an electronic journal. Many soft science scholars interviewed did not understand the difference between a preprint and a refereed publication, often because they were not familiar with the language and terms as defined by the interviewer and the forum participants. Forum Participant B explained:

> So everyone should be clear on the fact that unrefereed preprints are not refereed publications. Refereeing and editing are medium-independent. There will continue to be a hierarchy of journals, based on the rigor of their peer review and the quality of their authors and articles. This too is medium-independent. Promotion Committees will continue to put greater weight on publications in APA journals than on publications in other journals. It is just that the medium in which people will be accessing and retrieving the refereed literature will change.

Scholars in this study were neither knowledgeable nor experienced in the issues of the scholarly communications process. It appeared those closest to the issues continued to work out of habit and tradition. One interviewee mentioned that scholars only think about their particular areas, and that their scope of knowledge was so refined that they could not attain the encompassing perspective of scholarly communication as a whole.

Despite the shortfalls they noted, all but one of the participants believed that scholarly journals could not exist without peer review. Many of them echoed what was summarized best by Psychologist A, who participated in the *American Scientist* forum:

> Refereed journals are simply implementers of peer review. They should continue to do that; there is no alternative we know of. And there should continue to be a hierarchical spectrum of peer-reviewed journals, varying in their subject matter as well as their quality and rigor and the archive is just the means of access.

Peer review appears to be a virtual sacred cow, though not plausibly superior to open commentary on unreviewed publications.

Publishers

Regardless of the discipline, the processes that publishers followed for scholarly journals fell into the categories of editorial, production, marketing, fulfillment, subsidiary rights, and financial oversight (Peek, 1996). In the world of scholarly publishing, there were two kinds of publishers: not-for-profit and for-profit. According to Graham (cited in Peek, 1996), most for-profit publishers were involved in scientific and professional publishing due to the profitability and competitive nature. In the past, publishers had the resources, the stature, and the motivation to change the vision of electronic scholarly publishing.

This section discusses the role of the scholarly commercial publisher. First, the negative sentiment expressed by scholars and librarians toward publishers was stated. Second, the role of maintaining revenue-based economic models and suppressing others was explored. Thirdly, the role of growing a small market was discussed. Lastly, the role of the publisher was detailed through peer review and copyright. Other areas concerning publisher roles were described fully within the two previous frameworks. The roles and themes that emerged from the data were: publishers as the enemy; publishers as economic models; publisher as scavengers and survivors; and publishers as purveyors of value-added services.

Publishers as the enemy. Many new visions of scholarly publishing concern the elimination of for-profit publishers. The move to electronic scholarly publishing has

caused great anticipation and anxiety. Changing the existing scholarly publishing system relied upon by all scholars might require that those actors give up something: paper, stereotypes, traditions, or perhaps profits. The interviewees considered publishers as antagonists in the movement toward electronic journals. Publishers were bashed and belittled repeatedly throughout the data. During the forum, rarely did any participant stand up for the publishers. Had publishers been more visible in the interactive forum, additional hostilities might have arisen. The lengthy forum reply demonstrated the nearly palpable frustration with publishers. Forum Participant B exhibited at length his disdain of the largest for-profit publisher in the world, Elsevier, and its latest policy. First the Elsevier policy, then the incoherence. The policy states,

> A paper may be posted to the author's Web site but may not be updated to include the results of refereeing and editing, which reflects the value we have added in the publication process and that the textual integrity of this final paper is best preserved by reference to the published article.

Now the incoherence.

> (1) I write a paper. It consists of the following:
> "The ratiometer reading for Clintonite-21 it 4.072."
>
> (2) I submit it to the (top, Elsevier) Journal of Ratiometry (JOR) for peer review, and simultaneously archive it on my home-server and xxx.
>
> (3) JOR sends it to referees, who reply "brilliant finding, but failed to make the Starrken correction: the reading should be 3.972."
>
> (3) I revise and resubmit the paper, which is now:
>
> "The Starrken-corrected reading for Clintonite-21 it 3.972."
>
> (4) The paper is now accepted and edited and takes the final form:
>
> "The Starrken-corrected reading for Clintonite-21 is 3.972."
>
> (5) The paper goes to press.

> According to Elsevier policy, it is in something's/someone's interest that my home-server and xxx either contain:
>
> "The ratiometer reading for Clintonite-21 it 4.072."
>
> or nothing at all.
>
> Do I need to spell out the incoherence, tortuousness, ludicrousness and blatant conflict of interest coursing through all this more explicitly?
>
> Is it coherent to declare that "you may publicly archive your work, but not the correct, final version?" (Will you shoot me if I just fix the "it"?)
>
> Is there an apter word than "tortuous" to describe the attempt to justify this constraint as being in the service of "preserving textual integrity"?
>
> Does "ludicrous" not quite capture portraying such a self-serving restriction as "adding value"?
>
> Is the conflict of interest with which this is all but exploding blatant only to my ears?
>
> And here is the last step of the *reductio ad absurdum*: Both the author and the referees have "added their value" to the product for absolutely nothing, not a penny!
>
> The publishers of paper journals are (understandably) worried about their revenue flow if people make their work available for free on the Net. But the reality is that there is a huge conflict of interest here: What's best for the publisher is definitely not best for the author (not to mention the reader).

Publishers as economic models. According to Peek (1996), scholarly publishing maintained the usual economic model. Although the authors were never paid and the editors were often not paid, the scholars' libraries "bought back" (p. 11) the works from the publishers. This took place although the articles had been paid for by the subsidized amount that the academic institution already allocated for the author's salary.

Some interviewees noted that publishers were developing new economic models to ensure their profitability in the newly emerging electronic publishing world. An example of this occurred when an employee of a large publisher, Scholarly Society Officer E, informed the researcher about his organization's publishing strategies for the online world:

> What we're actually working on right now is just kind of seeing more than anything else how the economics of the whole situation will play itself out, because it is possible that we will go to an all electronic format. I don't think it's guaranteed that we will but it's quite possible as I said that maybe in ten years or so that we would do that. But obviously we publish a lot of journals and that's a sizable portion of our revenue base. We have to look out for the bottom line as well as everything else.

This publisher referred to the bottom-line as maintenance of the revenue base. The scholars or academics did not object to paying for value-added. They objected to not seeing value-added or understanding the publisher's model and increased costs. In the traditional system, the stature of the press and its recouping of costs was either understood or dismissed. The feelings held by scholars about the economic models that publishers protected was waning.

The expertise that scholarly publishers added was superceded by their vested economic interests. Physicist C described how the commercial publishers were treating the Los Alamos E-print Archive:

> The current publisher response is that, in fact, we can no longer scoff at these systems. They do challenge us; they do threaten us. And their response momentarily has been to throw up this big wall. Okay, we can't compete with these systems; we'll try to suppress them.

Furthermore, many of the *American Scientist* forum participants believed that commercial publishers were trying to suppress efforts for electronic dissemination and

electronic journals. But during the interviews, the commercial publishers argued that academicians did not understand what publishers did for them and what their publishing costs were.

Publishers as scavengers and survivors. The third role of publishers, according to these participants, was that of survivors. They demonstrated the ability to grow in very small markets and to "stay the course" in light of new actors or technological discoveries in publishing. The commercial publishers were able to do this in the past using the leverage of prestige, power, and money. Respected Publisher C and librarian stated:

> What you did see was the societies continuing with their fairly conservative definition of coverage, growing their coverage conservatively. Physics grew their coverage conservatively, and eventually covers quite a bit, I think, the whole waterfront. But they got some serious competition from Elsevier and others as well on other fronts they did not wish to grow at the time. And then you see them [societies] preserving elements of their publishing program and their business relationships in a way to avoid competing directly with Elsevier in that subject area. This was a by-product of some of the conservative decisions they've [societies] made.

The conservative nature of scholarly societies gave commercial publishers a foothold for growth in sub-fields and with journals that were rejected by the formal society structure. Many of the core developers of new journals wanted to see their journal flourish. However, if the society did not help, the aid of a commercial publisher was welcome. In this way traditional publishers generated and enhanced the growth of scholarly journals.

Keeping the same structure and processes was in the best interest of the commercial publisher. The scholarly journal was quite rigid in its requirements. Thus, all publishers, both non-profits and for-profits, wished to keep things at the status quo or change as little of the current process as possible. Many proponents of electronic

scholarly journals believed that, rather than restructuring the current publication organization, they would maintain similarities. Forum Participant B stated:

> Meanwhile, of course, the publishers turned quite naturally instead to the offer I've called the "Trojan Horse" Hybrid publication, both paper and online, offering the paper edition for the usual price, the online edition for a bit lower, and both editions for a bit higher, and then letting demand shift to online-only whenever its time comes, but always supported by [subscriptions, site licenses, and paper-per-view] S/SL/PPV (and its attendant tollbooths and firewalls blocking free access).

The proponent and scholar of electronic scholarly journals, Forum Participant B, continued in his summary:

> It's not just commercial publishers who will want to cling to the S/SL/PPV status quo for as long as possible; most big publishers will, including learned society and university presses. It's only natural. They will fail, of course, because they will be fighting against the optimal and the inevitable for scholars and scholarship, research and researchers, but it is, I suppose, natural in the Darwinian marketplace to try to prevail along the old lines as long as possible. But the conflict of interest is a great vulnerability: their constituency, after all, is us, the authors and readers. We acquiesced in the Faustian Bargain of bartering copyright for publication while there was no option, but now that there is an option, we will realize it sooner or later helped by subversion.

The findings were not surprising considering the strategies of for-profit organizations trying to manage operational cash flow. They achieved this goal by doing the following: maintaining revenues (i.e., thwarting all changes to the journal market); generating product growth (i.e., adopting journals that societies do not want); and maintaining low capital costs (i.e., not building new electronic journals until the market is competitive). While these business skills would be rewarded in any other market, forum and interview participants contended that those skills no longer would be rewarded within the scholarly journal market.

Publishers as purveyors of value-added services. Providing the services of peer review, validation, and editing for the research community was a role that most of the

participants believed was a beneficial quality-control function of the publisher. The editorial role was one of leadership as much as an editorial position. Publishers supported journal editors who agreed to oversee the peer-review process by assembling editorial boards. Many performed these duties for the honor and prestige. Staff and support were provided in the form of editorial assistants, equipment, office space, postage, and supplies. The editor reviewed articles, generated submissions, nominated potential reviewers, analyzed reviews and made the final decision to accept or reject articles. Many interviewees noted that it was these functions that comprised the main intellectual work of a scholarly publisher.

The most prominent function that scholars, librarians, and scholarly societies wanted the publisher to fulfill was to provide peer review and hold copyright. The issue of copyright was discussed in the findings numerous times, but its relationship to the role of the publisher needs to be reiterated. The forum data, as expressed by Scholarly Society Officer H, reinforced the relationship:

> As [the publisher of APS] points out, there are two possible clear intellectual owners of a scholarly work; the author who writes it, or the author's employer, and the editor, employed by a journal, owned by a publisher, who evaluates, places, and in many cases helps shape it. The contributions of both are inextricably intertwined in the final product. The publisher spends up to $1000 on the editing process for each scholarly article published--this is in many cases more than the author has spent in time on the actual article, although the research reported in the article could have cost tens, hundreds, or thousands of times more.

Many of the functions that the publisher performed were not mentioned, and others were viewed as functions that would be eliminated in the move to electronic publishing. Some of the functions, such as fulfillment and subsidiary rights, never were discussed due to their uninteresting nature and behind-the-scenes functions.

In conclusion, many of the actors wanted to take roles and functions away from the publishers rather than support them in the roles they performed well. The publishers, on the other hand, argued that their removal from the scholarly publishing process would create system-wide chaos. Publishers believed that no other party was capable of taking on their many responsibilities and roles.

Scholars and authors who were genuinely interested in and supportive of electronic scholarly journals believed the reformation of the roles and relationships needed to include them. A hard scientist, Physicist C, stated:

> There's something wrong with the preexisting system in the way that publishing companies and librarians have gone off in their own direction without direct input from researchers; that this split had occurred, and they were blindly going on their ballistic trajectory without really understanding what it was that researchers wanted and could use from the new electronic format. And I don't think that publishers and librarians really understand the way that researchers work; that they had happily developed the status quo, and were not getting a lot of input from researchers. Consequently, a system like this could only have happened from within the research community.

Despite the communication breakdowns mentioned by scholars, and the problems voiced by other actors, publishers were credited with enhancing the quality of the material through the editorial review and revision process (Peek, 1996). The publisher inherently communicated its imprint to the readers, libraries, and the other personal communities through the high quality that came to be expected. Furthermore, publishers viewed themselves as demonstrating to the community of scholars that they were ready and able to boost their articles to the next electronic publication level by implementing a controlled transition from paper to eprint. Librarians were supporting some of the publishers while trying to level the playing field for others.

The responses about the roles that each actor should or should not undertake were predicated on the position espoused by the interviewees and forum participants. After discussing eprints in physics, one hard scientist who worked throughout his life on editorial boards revealed:

> You must understand my bias, but I've spent a significant amount of time working with scientific societies and their publication efforts. It's my hope that they survive. (Physicist A)

Conclusion

The roles that these four actors choose will shape scholarly communication for the next decade and, perhaps, beyond. This section addresses the key issues as identified by each actor classification: librarians, scholarly societies, scholars, and publishers. Despite the differences between the actors, they were for the most part attempting to complement each other in the scholarly electronic journal process. However, librarians, scholarly societies, and scholars were collaborating to reduce the dependence of scholarly communications on the publisher, primarily the for-profit publisher.

CHAPTER 5

SUMMARY AND CONCLUSION

In this chapter, the research questions methods and findings are briefly summarized. The findings are further organized into four major conclusions.

Summary

Research Questions

These analyses were undertaken to discover the existence of the development of electronic scholarly journals and the concerns and issues that surround the transition from paper to electronic. Seven factors, thought to influence how quickly people adopt this technological innovation, were explored in this study:

1. The "paper culture" of libraries, ERIC, and other document archiving institutions;
2. The "technological comfort" felt by scholars in some disciplines in comparison to others;
3. The unseen costs of production or conversion from paper to electronic media;
4. The vested political or economic interests that are threatened by the eventual transition;
5. The conflicting claims of research fields about what each has established as constituted knowledge based upon the distribution timing of its research findings (what constitutes knowledge claims in one field over another as it concerns itself to electronic journal dissemination);

6. The speed at which knowledge production is required or preferred in the discipline; and
7. The absence of any incentives to dismantle the current system.

In addition to the seven factors above, the following six questions formed an interpretive research framework:

1. To what extent are scholars, libraries, publishers, and scholarly societies aware of, influenced by, using, or building their own work on research published in paper and electronic scholarly journals?
2. What obstacles, resistance, and impediments do the publishers of ejournals face, given the existing process of scholarship, research, and the advancement of knowledge?

Subsequently, the study addressed the following research questions about future developments in the field:

3. What is the role of scholars, librarians, publishers, and scholarly societies in the transition from paper to electronic?
4. What is the relationship between the type of publication and the authority of the scholarly text and the nature of the discipline?
5. What keeps the current paper-based system in place when the technological developments and costs suggest a change?
6. What issues and concerns arise among the actors before, during, and after a transition of scholarly communication has taken place?

These research questions were used for exploratory purposes to more closely investigate the electronic scholarly journal phenomenon.

Methods

The analytic induction methodology consisted of qualitative face-to face interviews with 31 participants and a documentation analysis of an electronic forum with 114 participants and more than 160 documents. The volume of data collected consisted of more than 800 pages of transcribed field notes and forum documents.

The face-to-face interviews were conducted in natural environments in the field in order to elicit informal and spontaneous information. The researcher recorded each interview in addition to taking copious notes. Each interview was semi-structured and followed the four respective interview protocols for each actor. The actors were classified as scholars, librarians, scholarly society officers, and publishers. The four actor classifications were studied within five disciplines, three in the hard sciences (physics, chemistry, and math) and two in the soft sciences (psychology and education). Immediately following the interviews, the researcher recorded detailed narratives concerning the information exchanged with reference to initial issues and themes. The tapes were then transcribed verbatim. Within days of each interview, the tape was listened to again and the transcript was then coded for themes, patterns, and clusters. A reflexive analytic induction methodology was used to take the informant's responses and information to update the interview protocol. The interview transcripts were listened to for a third time and the transcripts were coded and placed into the qualitative data analysis software.

The electronic forum data was received and read first via email, and then on a threaded web-based archive. After the second reading of the forum data, the coded process began. This data was merged into a database with the original interview transcripts and then placed into the qualitative research analysis software. A third analysis grouped the emerging categories, compared experiences and observations between the hard and soft disciplines, and studied the actors' roles in the development of electronic scholarly journals. This analysis developed the three frameworks with which to view the electronic scholarly journal phenomenon. Two peer review interviews were performed to attempt to disconfirm the relevant findings and to establish general conclusions.

Major Categories

The study yielded nine major concerns, issues, and themes according to the 31 interviews and the 114 forum participants. The major categories concerning the slow development of electronic scholarly communication were as follows: (a) economic issues, (b) speed and convenience, (c) peer review, (d) reward structure, (e) access, (f) Papyrophiles, (g) archives, and (h) publisher profits.

Of the nine issues and concerns expressed by the interviewees and the forum participants, the top issues were economics, access, and peer review. Many believed the economic model put forth and maintained by the publishers will not last since publishers and scholars have incompatible goals; scholars want to disseminate knowledge and publishers just want to maximize profits. Access was another priority. Most scholars want the widest possible access to their work and technology, whereas publishers place

little emphasis on the access issue, presumably because they have not discovered a way to make money in that arena. The majority of the participants still felt that peer review and quality control, despite their shortfalls and problems, were necessary. In total, the nine major categories will enable readers to see the issue from more than one perspective.

Results of Compare and Contrast

The research unveiled how complex the reality was. The findings discovered and explored eight major differences between the hard and soft disciplines as defined by Labaree (1998). The eight major differences were prediction, technical uses, speed, cost, market, falsifiability, preprints and eprints, and peer review. At a first glance, the differences between the disciplines did not appear significant, but a lucid, closer inspection revealed numerous issues. Although the study could not validate Garvey's (1979) work, it went a long way in providing examples of what was meant by the differences in cultures, status quo, dissemination speed, and relationship with their journal articles. The largest differentials between hard and soft were the technical use, speed required by the scholar, cost, and the feelings toward preprints and eprints.

Actors' Roles

The study inspected the roles that each of the different actors (scholars, librarians, scholarly societies, and publishers) played and how they viewed their roles in the evolution of scholarly electronic communications. Librarians, and the other actors, saw librarians as leaders, archivists, accessors, publishers, electronic journal pioneers, and indexers and organizers. Scholarly societies perceived themselves as facilitators of the

sharing and dissemination of ideas, survivalists preserving the society and its central office, and gatekeepers and managers of the development and growth of publications. The scholars' functions were providing access to individual work, promoting the ability of individuals to self publish, and generating participation in the peer review process. Publishers were viewed as enemies, the dominate actors dictating the economic models. They were also perceived as scavengers and survivors, due to their niche marketing efforts, and as purveyors of value-added services.

Conclusions

Economics Will Prevail

One participant who had written on the forum stated it would take time before the paper house of cards would fall, meaning publishing "houses" would fall based on their inability to maintain their old economic model during the transition from paper to ejournals. The findings of this study illuminated the economics of the scholarly journal process. Through this enlightenment, each of the three actors were seen as engaging the publishers on issues of value-added and profit margins. The majority of the scholars viewed publisher-profit margins as obscenely high for their value added. The fact that the scholars gave away their articles for free did not help the for-profit commercial publishers. For example, biologist Rosenwig abandoned the thriving scholarly journal he founded a dozen years ago because the publisher made it so expensive, many libraries and colleagues could no longer afford his journal. He related that price increases on his journal, averaging 19% annually, have harmed the scientific community–the very group

that supplies articles to the journal at no cost (Rick Johnson, Personal Communication, November 24, 1998).

Another economically driven situation in scholarly publishing is the absence and presence of competition. The hard science journal literature has a considerable amount of competition, as confirmed by all the hard scholarly society journal publishers. Many of these publishers feel competition has pushed them to develop and grow online ejournals at a much faster rate in order to stave off competition and assist in keeping the scholarly society the centralized authority in the field. The soft discipline society feels no sense of competition and no rush to move publications online. Scholarly society publications, due to their conservative nature and contentment with status quo (as a result of the absence of competition), dictate very slow ejournal growth.

Structure of a Discipline

The basic structure of a discipline (hard vs. soft) governed the speed of the transformation from paper to electronic technologies. The culture and history of the discipline in the hard sciences, as asserted by the participants, assisted in speeding this transformation due to a history of preprints, as well as the advent of eprints needed for speedy dissemination to mark discoveries. The technical ability of members of the hard sciences led to a faster technical diffusion into the scholarly journal process. The soft disciplines spoke of a history of unreliable data archives such as ERIC; no apparent urgent need for discovery and dissemination; and lower technical ability and familiarity in working on computers, which according to Olsen (1994) led to pulling articles off the web and publishing articles for the web.

Labaree (1998) argued that education lives with a lesser form of knowledge than physics due to the kinds of knowledge produced. Soft applied knowledge production was the "rural" and "divergent"; the researchers can not build towers on the foundation laid by others since education is always altering the foundation. On the other hand, hard pure knowledge production is "urban" and "convergent," allowing the field to build upon towers of knowledge. Labaree's assertions were visible in the fast growth of electronic journals in the hard disciplines and its eprint cumulative nature. Soft disciplines, according to Labaree, place senior educators in less control over the intellectual knowledge due to the ease of challenging theories and hypotheses. On several occasions very senior educators did not wish to relinquish their data to other scientists unless they were deemed qualified to review their work. On the other hand, the majority of the hard scientists mentioned the time and effort that each of them contribute to making the data or the information available to all other colleagues and researchers for immediate replication of the experiment. Many of the consequences of the soft disciplines have been negative in terms of ushering in a new form of scholarly communications–the ejournal.

The Technology is Transforming Libraries

Just now surfacing on campus is the active role of libraries as partners, entrepreneurs, leaders, and technologists, focused on the reduction of publisher-profit margins by building competitive journals and/or online publishing. The data reveal the key role of the library in its transformation from passive collector/archivist to aggressive publisher/aggregator. The rapid emergence of electronic journals has retooled and

reinforced the library to remain the central management of scholarly communication, but through new and radically different means of organizing collections and services. The new forms of exchanging ideas are scholarly electronic journals; their acceptance into each discipline is dependent on the discipline's ability to transform. Librarians are now the loci for dialogue about these complex issues. The technology is available and the economics deem it necessary to begin publishing many core journals online.

Peer Review and Quality Control

The irony discovered through comparing and contrasting the disciplines is that those scholars and researchers most at risk of being misled by "errors" in communications were least inclined to support the institution of peer review to protect themselves from error. Those scholars who had least to fear from such "error" were the most intent on controlling access to publication outlets. Physicists said, "Don't slow things down by tying them up in the peer review process; give me the data and I'll decide whether it is right or not." Psychologist, educationists and other practitioners of the soft disciplines emphasized the risk to their disciplines of allowing "errors" to enter the literature. One becomes suspicious that this reliance on the peer review process in the soft disciplines (e.g., rejection rates in the soft sciences often approach 80%-90% while remaining extremely low--5% to10%)--in the hard sciences) has more to do with controlling whose message and what message is disseminated than it has to do with protecting the discipline from error. In the soft disciplines, it is difficult to discern "error" or distinguish it from ideology or methodological disputes.

Peer review, quality control, and the higher education culture constitute a combination of three issues that could lead to faster, online-scholarly journal growth. Many hard scientists feel the peer review could either be delayed or dealt with it separately as an independent medium that suits electronic journals as well as paper. Hard discipline stances towards ejournals are encouraging. Quality control must be ensured to break the paper-based traditions and create incentives for the ejournal evolution, particularly in the soft disciplines. Human nature will stay with the status quo and will only make technical change substitutions (ejournal for paper journal) when the quality control and certification traditionally provided by paper journals are safeguarded in the electronic scholarly journal world.

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APPENDIX A

INTERVIEWEE AND INFORMANT LIST

Interview And Informant List

Scholars

Education

Alan Schoenfeld
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College of Education
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Professor and chair of
the program area of
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Professor of Education
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University of Southern
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XXX
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Department of
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Jeff Yarger
Assistant Professor
Department of
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Scholarly Societies

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AERA President and
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University of California
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Lorrie Shepard
President elect of AERA
Professor of Education
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Hilda Borko
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Professor and chair of
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APA

Forrest Harvey
Electronic Publications
APA Organization
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Joan Lippencott
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Librarians

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Carla Stoffle
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Publisher

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Physicist and Creator of
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Proponents for
Electronic Scholarly
Journals

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Forum Participants

Forum Participant A
(Mark Doyle, APS
August 26, 1998)

Forum Participant B
(Stephen Harnad, 1998)

Forum Participant C
(Steve Koonin, Cal Tech
September 19, 1998)

Forum Participant D
(Greg Youngen
September 27, 1998)

Forum Participant E
(Selmer Bringsjord,
September 30, 1998)

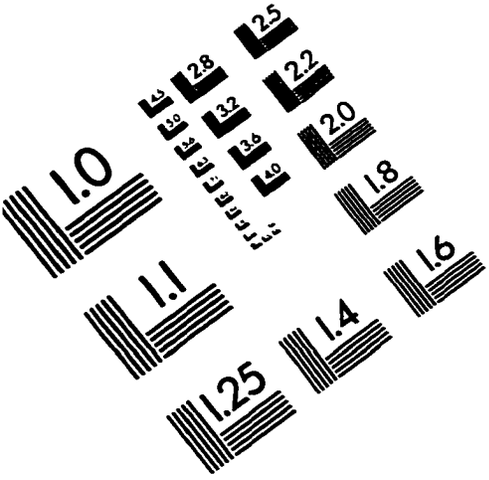
Forum Participant F
(Alan M. Lesgold,
August 25, 1998)

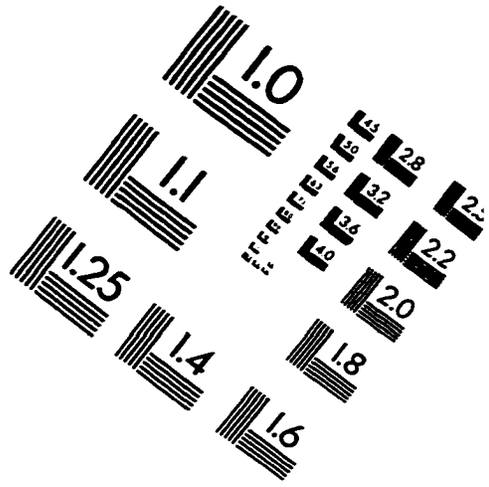
Forum Participant G
(L. W. Hurtado August
28, 1998)

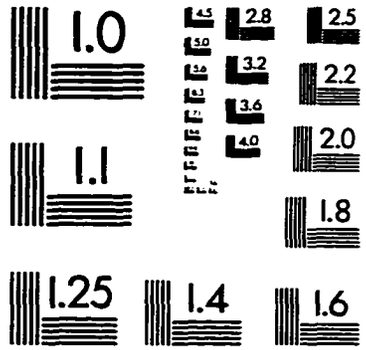
BIOGRAPHICAL SKETCH

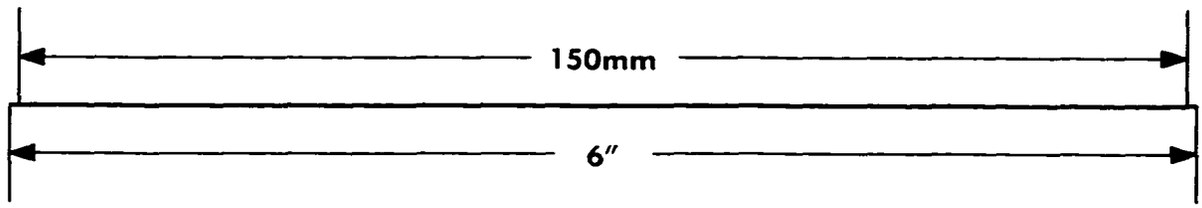
William (Skip) Brand was born and grew up in Red Bud, Illinois. His undergraduate education at Arizona State University included a major in political science and a minor in business administration, which triggered his career in the business of Arizona and National politics. In 1989, he came back to Arizona State University with an interest in computers and information management. During the Internet revolution, Skip began working for the Vice President for Information Technology William Lewis at Arizona State University campus in the Information Technology organization where he was involved with grant writing, research, and presenting at Internet conferences. Form 1990 to 1995, Skip Brand served as Executive Director for Arizona State Public Information Network (ASPIN), which consisted of 200+ consortium members and a statewide Internet network with over 500 connections. He managed over $5 million dollars of grant funds from major organizations: National Science Foundation, Government Services Agency (GSA), and Cox Communications. His interest in teaching particularly within computer science and technology policy stimulated the pursuit of Ph.D. degree in educational leadership and policy studies. During the last three years, he started a web development company (Rhino Productions), served as Internet Product Marketing Manager at Cox Communications, and as an Industry Analyst (Kinetic Strategies) for the High Speed Internet Category. He has conducted a number of research projects exploring the use of Internet technology and content. As a technology policy analyst, he is concerned with the state of online free electronic scholarly journals. Skip and his wife Holly have been married for two years.

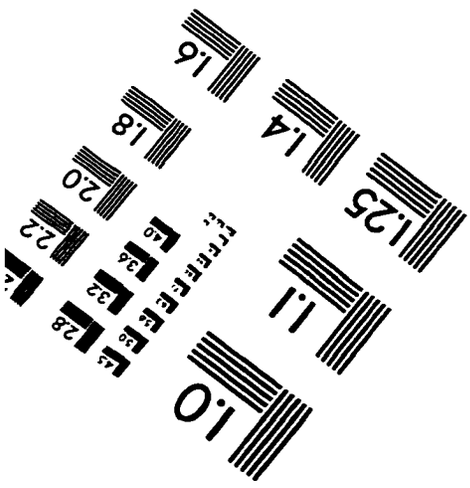
IMAGE EVALUATION TEST TARGET (QA-3)

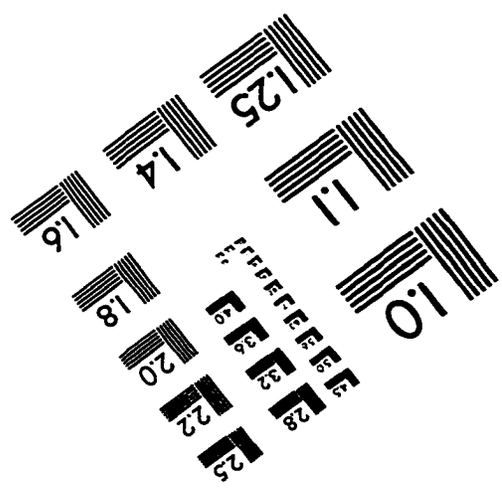












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