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THE DEVELOPMENT OF THE ELECTRONIC JOURNAL IN THE MEDICAL SCIENCES

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Presented for the
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Thomas O. G. Tallant

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Any errors that remain in this thesis are solely my own responsibility.

ABSTRACT

Since the early 1900s, the traditional system of scientific and technical journals has been unable to handle the increasing amounts of information researchers and science professionals generate and use. The electronic journal has developed in response to this information overload. It is especially useful in the medical sciences, where doctors and researchers must publish and access large amounts of data as quickly as possible.

The advantages of the electronic journal are that 1) information becomes dynamic and interactive once captured digitally, 2) users gain quick access to information in a variety of forms selected according to the users' needs, and 3) electronic journals relieve the overburdened publishing system by storing more information in less space and at less cost.

The disadvantages are that 1) hardware and software user problems exist and must be solved, 2) graphics capabilities must be improved, 3) international distribution of electronic journals must be established, and 4) telecommunications costs must fall to affordable levels.

Electronic publishing is here to stay, but the role of the electronic journal in this new system has yet to be clearly established. More than likely, a balance will be achieved between the advantages of the traditional publishing system and the electronic medium.

PREFACE

Context

The first scientific journals appeared during the second half of the 17th century. From this time, the ability of these journals to successfully report scientific and technical information has become hampered by the growing amount of information scientists and other professionals produce. During the 1960s and 1970s, information specialists (ranging from librarians to scientists) saw the potential of the computer to provide a way to help in the producing, collecting, publishing, storing, and distributing of scientific information. Thus, the concept of the electronic journal (or virtual journal) was born.

The growing need for information has put great stress on the traditional journal system. These journals publish more pages every year, but they find it impossible to keep up with readers' needs. In some cases, summary journals (abstract and review journals) have lessened the pressure on the journal system. However, the need to publish and store full-text articles has not been adequately met. The electronic journal may in certain cases relieve the strain on the traditional journal system by providing a way to store large amounts of information and make that information available in a variety of forms to users.

Purpose

This thesis will examine the growth of scientific and technical journals and the appearance of the electronic journal. It will focus on medical journals and the special information needs of the medical community. The thesis will show how publishers and information specialists are trying to understand the way scientists communicate and how they are attempting to change the traditional journal system to better suit the communication needs of these scientists. Finally, the thesis will explore the implications of electronic journals, highlighting problems and looking to the future.

One problem this thesis does not delve into in adequate length is that which the user faces when dealing with information processed electronically. User problems are a central issue within the study of applying electronics to publishing and managing scientific and technical information. These problems present formidable challenges to everone who must use information in the scientific community. This topic deserves a separate thesis in itself. The reader, however, will learn what an electronic journal is, where it came from, and where it might be going.

Organization

Chapter 1 discusses the growth and history of journals since the Scientific Revolution. Chapter 2 continues this discussion by exploring the current situation facing scientifc journals. In Chapter 3, the reader learns what an electronic journal (its hardware and software) is. Chapter 4 focuses on a pressing problem facing electronic journals: how to create and establish a standard way of describing and coding documents for electronic publication. Chapter 5 sums up the thesis by discussing the implications of the electronic journal.

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CHAPTER 1

THE GROWTH AND HISTORY OF SCIENTIFIC AND TECHNICAL JOURNALS

The purpose of this chapter is to acquaint the reader with the historical background to the current system of scientific and technical journals in Europe and the United States. The chapter opens with a discussion of two important concepts necessary to an understanding of the growth of journals in science: the Scientific Revolution and the Invisible Colleges. The chapter next looks at how the structure of the journal system came about, how exponential growth is an important factor in understanding the implications of the massive number of articles scientists must deal with, and how the early journals influenced the reasons scientists write. This chapter covers the history of journals from about 1550 to the early 1900s. The more recent history is discussed in Chapter 2.

1.1 The Scientific Revolution

Scientific and technical journals are a product of the Scientific Revolution; they are a product of the need by men and women to tell what they know and to find out what others know. The term "Scientific Revolution" is controversial and difficult to define, but anyone interested in the history of science and intellectual growth must attempt to understand the term, to make some sense of the conflicting and at times chaotic definitions applied to it.

As one historian of science states, "The Scientific Revolution did not arise suddenly and out of nowhere .... It is rather the rebirth of the scientific knowledge of antiquity" (Price, Science Since Babylon 47, 49). Most of this rebirth occurred during the Renaissance, after the scientific texts of the ancients had been translated during the Middle Ages and after the decline of the great Medieval universities (between the 12th and 15th centuries). To the modern reader, the Scientific Revolution appears to be dominated by individuals such as Copernicus, Kepler, Bacon, and Newton; however, much of the work done by these individuals was anticipated by men who are largely unknown or whose lives remain unresearched.

The works of the major and some minor scientists are preserved because of the revolution in publishing that occurred in close proximity of time with the Scientific Revolution. This growth in printing is credited with giving science the push it needed to escape from the scientific vacuum of the Middle Ages into the active and vibrant arena of the late Renaissance of the 1470s (Price, Science 50-51).

The historian must defuse the word "Revolution" because it usually implies premeditated acts designed to overthrow an established order and replace it with a new system of thought or order. With very few exceptions, such acts do not occur in science. Over the past four or five centuries, the conception of the universe held by intellectuals who study the world (natural scientists) has changed from a view dominated by Aristotelian mechanics and The Great Chain of Being to a view dominated by quantum mechanics and secularism. Clearly, a change in thought has occurred, but the substance and direction of the change cannot be adequately pinpointed, in spite of the efforts of historians like Thomas Kuhn.

Kuhn's historical work, The Structure of Scientific Revolutions (1962), has received much critical attention for its attempt to deliniate neatly the progress of science since the Middle Ages. In fact, Kuhn recognizes this problem of progress in science, and in later books and articles (see the second edition of The Structure of Scientific Revolutions, 1970 and The Essential Tension, 1971) has changed his position on the nature of growth in science. Still, Kuhn's early views do add much to an understanding of evolution in science and cannot be entirely dismissed.

Perhaps the major terms Kuhn employs are "paradigm" and "normal science." Kuhn's definition of paradigm is complex; he does not have one definition but instead seeds his text with shifting meanings of the term. In essence, a paradigm is an established model of scientific study that excludes other competing forms and sets up a basis for research by a community of scientists. The confusion surrounding the term comes in part from the use of the word in linguistics, where it means some kind of a template or object of replication. Kuhn tries to differentiate his use from the linguistic use by stating that a paradigm is "an object for further articulation and specification under new or more stringent conditions" (Kuhn, Structure 23). The scientific paradigm is thus a structure that shelters and guides accepted scientific thought, or "normal science."

"Normal science" is easier to grasp. It is the normal problem-solving activity that scientists engage in. In such activity, the scientific community faces no crisis, no threat to the accepted way of undertaking work. However, this normal situation can change to one of dissension and upheaval, and this is when the time is ripe for revolution, for establishing a new order or paradigm. Kuhn uses many examples of such revolutions. They include the Copernican revolution (which had much more to do with theology than science), Priestly's discovery of oxygen (which replaced phlogiston), and the acceptance of quantum mechanics (which replaced the Newtonian system of mechanics). Common to each of these revolutions is the existence of a state of normal scientific activity that went on before the upheaval occurred. This normal activity goes through a period of crisis and eventually became forgotten or practiced by a minority of scientists. The majority of scientists accept the new way of thinking, which becomes the new normality.

The problem with the term Scientific Revolution is that there was no single indentifiable Scientific Revolution; rather, scientific activity is characterized by many smaller (and, less often, larger) revolutions. Kuhn agrees that this is the case and that it often occurs within "a single community, consisting perhaps of fewer than twenty-five people" (Kuhn, Structure 180-181). It is, in fact, within these small scientific communities that the need for journals was felt. What Kuhn shows the reader is the ever-changing world of science, from large- to small-scale, and the need for scientists to communicate on many levels, from personal and informal to highly formal. Kuhn, however, does not explore the workings of these small groups of scientists. To understand how these groups work and how scientific journals are related to them, the reader must turn to studies of scientific communities, in particular the phenomenon of the invisible colleges.

1.2 The Invisible Colleges

"Invisible Colleges" is a term used to describe the highly collaborative network of scientists who communicate informally in order to transmit information as quickly as possible. The term (first used by the informal gathering of intellectuals that became the Royal Society of London) is based on the assumption put forward by Diane Crane in Invisible Colleges (1972) that scientific activity occurs among groups of scientists that remain open (and not closed) to ideas from outside the group's domain (Crane 100). The first sign that such groups are communicating is a conference or informal gathering to organize and promote ideas. Few records exist of the earliest gatherings, but by the mid-1600s the first scientific societies were created, indicating that scientists were trying to open channels of communication to all who were interested. The official organs of these new societies were the first scientific journals, such as The Philosophical Transactions of the Royal Society of London (1665).

In his book Science Since Babylon (1961), Derek de Solla Price states that invisible colleges are the result of the "not wholly pleasant necessities of the scientific life in its new state of saturation" or overload of information (Price 99). By the middle of the seventeenth century, science had reached high levels of saturation. Increasingly, scientists found it difficult to tell everyone interested what they were doing. They also found it difficult to learn what other scientists were doing. The response to this communications problem was to establish a repository of news and information, one that would appear periodically and satisfy the needs of people within and without the group.

Crane and Price go on to show that the invisible colleges have continued to evolve and are vitally important to current scientific communication. In fact, the invisible colleges undermine the traditional journal process by providing personal contact instead of the slower forms of formal publication.

The invisible colleges represent a state of informal communication which not only evolved along with the formal publication system which grew up during the early stages of the Scientific Revolution but also played a crucial role in its development. The scientists involved in these informal groups realized the need for formal communication and saw that journals provided one means of such communication. The same individuals, however, realized the need to collaborate informally on related work and to communicate without the restraints the journal system placed on communication, mainly the need to evaluate information as completely as possible before reporting it.

Thus, as we explore the growth and history of journals in science, we must remember that journals and periodicals play a vital role in a broad system of scientific communication. At one end of the spectrum stands the formal communication system that is a product of the Scientific Revolution and the growth of the printing presses. At the other end stands the informal system of communication that helped create the formal system of journals in order to cope with the growing need of scientists to learn more thoroughly new developments in special and related fields.

1.3 The History of Scientific Journals

The history of scientific journals began officially 320 years ago in Europe with the publication of two different journals, the Journal des Scavans (which appeared in France in 1665) and the Philosophical Transactions (which appeared in London in 1665). Since this time, the number of scientific periodicals has steadily increased. During the 19th century, the number of scientific periodicals grew at a sharp rate, but the steepest rate of growth has occurred since the Second

World War. Today, an estimated 57,400 scientific periodicals are published worldwide; approximately 13,300 journals and periodicals are published in the United States alone (King, Scientific Journals in the United States 23). These numbers are expected to rise as science becomes more widespread and diversified.

1.3.1 Scientific Information Before Journals

Long before the rapid growth of science in the 16th and 17th centuries, scientists communicated their thoughts, theories, and results of experiments to each other. They used letters mostly, but newspapers and newsletters provided an outlet for much of their communication. Also, scientists contributed to almanacs and wrote treatises.

Perhaps the most characteristic method of communication was the letter. The advantage of personal communication is its informality: the scientist feels free to expand on ideas untried in experiments as well as to report findings accurately. The drawback, of course, is the limited audience of a letter. The content can be shared by no more than a handful of interested readers.

A more formal attempt to provide information is the newspaper. With the invention of moveable type by Gutenberg, printers could expand their publishing facilities, and by 1635 the first newpapers appeared. In this year, a French physician founded that nation's first newpaper. However, in order to meet the special needs of scientifically oriented audiences, more specialized newsletters were published, which soon led to publications like the Conferences of Thephraste Renaudot. This newsletter provided information to the growing number of people interested in science and medicine and was a precursor to France's first scientific journal (Kronick, A History of Scientific and Technical Periodicals 37).

During the time that newspapers and newsletters were not feasible or were still in their infancy, scientists published much information in almanacs. Most almanacs contained two types of information, medical and agricultural. For example, the Almanach Jehande Lespne, Docteur en Medecine, Calcule sous le Meredional de la Cite et Ville du Mans appeared in Paris in 1534. It contained instructions in the vernacular telling the reader when to bleed patients, when to bathe, and when to purge a patient. Also, the typical almanac stressed hygiene. Such books, compiled by many physicians, were popular because (aside from helping to heal people) they provided valuable information and satisfied the needs of early scientific enthusiasts. They contained medical, agricultural, and astrological information, news, and treatises written in a language the educated layman could understand.

So far, we have examined scientific publications outside of academia. However, universities contributed a steady flow of scientific literature that gained importance during the 17th and 18th centuries. Because such a high number of scholars were trained in medicine, a large proportion of academic literature is to some degree medical in nature. Scholars relied heavily upon personal correspondence, but a more formal means of communication, the dissertation, established itself during the Middle Ages as a preeminent means of scientific communication.

The dissertation marked a change from the classical model of the thesis, an important part of scholastic training during the Middle Ages. In medicine, dissertations reflected changing attitudes: classical doctrines and methods of research and application were no longer acceptable; dissertations stressed observation, investigation, experimentation, and proof. As such, they mark an important part of the scientific revolution because they represented the intention of scientists to challenge scientific conduct and method as practiced for hundreds of years under the Aristotelian system (Kronick 222-225).

Although dissertations contributed to scientific literature, the value of this contribution is in many cases doubtful. Kronick remarks that the universities contributed little that was original to science. He reminds us that academic scientific literature (not exclusively dissertations) can be called "ceremonial" (Kronick 222). The scientific dissertations of the 16th through 18th centuries are thus largely documents that satisfy the formal conferral of a degree; they were a display of academic ability and not necessarily a contribution of scientific originality.

1.3.2 The Early Journals

Although correspondence, newsletters, newspapers, almanacs, and dissertations provided means of communicating scientific information, early scientists soon realized that the growing body of scientific data needed a faster path to the growing readership. As scientific societies proliferated, society secretaries (such as Denis de Sallo and Henry Oldenburg, who became the first editors of the Journal des Scavans and of the Philosophical Transactions, respectively) handled more and more letters, articles, and treatises. The pressure to transfer this information quickly to society members led these secretaries to establish periodical publications.

The two earliest scientific journals appeared for different reasons, but these reasons influenced the appearance of journals for years to come. The Journal des Scavans was less technical than its English counterpart; it mostly sought to meet the needs of amateurs who wanted to keep abreast of developments in a broad range of scientific matters. The Journal included news, letters, accounts of proceedings of the Academie Royale des Sciences, and reviews of books and articles (Senders et al., Scientific Publication Systems 10). This journal would be typical of journals for about 100 years to come in that it presented a wide variety of information for readers of varying levels of expertise in science. Some readers were here-today-gone-tomorrow followers of intellectual fashion; others were skilled amateurs; still others were scientists of the highest order, members of the Academie and of other scientific societies which were so popular during the 17th century.

In England, scientists and amateurs created a more technical and focused journal, the Philosophical Transactions. The Philosophical Transactions represents the need of scientists of the time to step beyond personal correspondence in communicating scientific information, and toward a more formal and systematic method of recording information. This journal was to serve three functions which have continued until this day to exert influence over the journal publishing system:

1. It provided an archive of scientific information that scientists would be able to use in the future.

2. It provided a means of transmitting experimental and other scientific information quickly--faster than books, although slower than personal correspondence.

3. It provided a means of acquiring prestige, of staking out a claim to a particular territory, of establishing priority in specific areas of study.

The Philosophical Transactions played such an important role in the progress of scientific communication because it established a new process and medium for transferring knowledge: a scientist could now make his work known by publishing it in a periodical publication. His colleagues could read and comment on articles as a group; they could, by consensus, give certain articles priority over others, an activity which soon evolved into the referee system we are familiar with today.

1.3.3 Journals Between 1665 and 1750

Soon after the appearance of the first two scientific journals, other societies throughout Europe began to publish their own periodicals. Most of these journals followed the form of the Journal des Scavans and to some extent the Philosophical Transactions, but it was not until after 1750 that specialized journals appeared with any regularity.

Many of these new journals contained much information on medicine, but they were not specialized journals in the true sense of the word. The Acta Medica et Philosophica (1671), Giornal dei Litterati (1668), and Acta Eurditorum (the first German periodical, which appeared in 1682), are important examples of the earliest journals that published medical material (Kronick, History 214 and McKie 10).

Most of the medical material in these journals was taken from books and other lengthy works (treatises, monographs, and so forth). The earliest medical journals, thus, are hybrids like the Observationes Chymico-Physico-Medicae Curiosae, Mensibus Singulis Continuande (1697), which included many extracts from books. These journals have much in common with the earlier Consilia or collections. These later medical journals, however, differ by containing articles that were translated from Latin (to reach more readers) and by containing a wide variety of medical subjects and not focusing on a single topic in the manner of the Consilia. The Agonismata Medica Marpurgensis in Academia

Marpurgensis Habita (1618) is an example of the prejournal medical collection which influenced the earliest medical journals (Kronick 100, 202-203).

We have seen that journals flourished and grew at a steady rate during the century after the appearance of the first two periodicals. Most of these journals contained a wide variety of information, from philosophy and natural history to agriculture and medicine. After 1750, however, a new type of journal appeared, one devoted to a more narrow subject. These journals did not appear out of thin air: they are a product of the social, economic, and intellectual tension that characterizes the years before and during the great revolutions of the 18th and 19th centuries. Not only were changes occurring in social and economic thought, but the Industrial Revolution was producing changes in scientific communication. Advances in chemistry and physics led to an increased need for specialized communication, and the journals of this time reflect the attempt to satisfy this need.

1.3.4 Journals After 1750

After 1750, the number of scientific and technical journals rose steeply: about 74 journals were created between 1750 and 1800, with 45 appearing between 1780 and 1798. Many of these new journals were published in

Germany, testimony to that country's rise as a dominant influence in science and academics (McKie 11-12). By the middle of the 19th century, the number of journals rose dramatically, from about 90 in 1800 to 10,000 in 1900. From 1900 to the present, journals have increased to more than 57,000, and the world number rises every year (King 7, 23).

What do these numbers imply? Since the beginning of the scientific revolution, our culture has come to rely increasingly on information. As readers' needs became more specific and specialized, the scientific and technical periodicals multiplied and specialized. For example, as early as 1788 a medical journal appeared which was devoted to a specialized topic: <u>Ausgesuchte Betraege feur die Entbindungskunst</u>, a journal devoted to obstretrics only. Two other important specialized journals appearing at this time were <u>Observations sur la Physique</u> (1771) and the <u>Chemisches Journal</u> (1771). From this time onward, journals became more specialized and were read by fewer amateurs (who found it increasingly difficult to keep pace with advances in science) and by more specialists.

Also, the nature of publication was changing. Societies continued to publish journals, but commercial concerns became a growing force in scientific publication. The United States was slow to follow this trend, but after the Second World War, the number of commercial scientific publishers grew until they comprised about one half of the number of journals in the United States. The earliest publishers responded to scientists' need for information, but they seldom realized profits from their endeavor. Today, the phrase "big science is big business" is not far from the truth, with major scientific publishers controlling worldwide networks of scientific periodicals and deriving considerable profit.

We have seen that the number of scientific journals has grown from two in 1668 to fifty-seven thousand in 1975. Journals became more specialized, and the demand for information rose. The next chapter will discuss the changes that have occurred in the journal system since the 19th century, exploring the effects of the rapid growth of the scientific literature.

CHAPTER 2

THE CURRENT SITUATION OF SCIENTIFIC AND TECHNICAL JOURNALS WITH AN EMPHASIS ON MEDICAL JOURNALS

The purpose of this chapter is to trace the growth of scientific and technical journals over the last 20 years, with an emphasis on medical journals. Medical journals are chosen because they must handle particularly large amounts of information and because many of the innovative changes in publishing have made their presence felt first in the field of medicine. This chapter will discuss the number of scientific and technical journals, overspecialization among these journals, and costs involved in important functions of journals. Next, the chapter discusses current electronic journals in medicine, with emphasis on journals, newsletters, mail systems, and databanks. The chapter concludes with comments on the implications of the current situation.

2.1 **The Number Of Journals**

Before discussing the growth in the number of journals over the past 20 years, it is important to mention that counting journals is a tricky business. The most thorough counters (including Donald King and the late Fritz Machlup) have been the first to admit that the numbers do not tell the whole story. Looking at the list of medical journals listed in Ulrich's International Periodicals Directory, a reader would assume that the number of journals in medicine is indeed large. But upon closer examination the reader finds that many of these publications are not refereed journals; many are newsletters and bulletins. Furthermore, even determining the number of refereed journals is not satisfactory. Of the hundreds of refereed journals in medicine, only a few (somewhere between a dozen and two dozen) journals actually publish articles of great importance. The rest serve to publish important but still relatively minor work. The number of journals is important here only insofar as it indicates the level of scientific communication (or activity) and how that level has increased in recent years. We can use these figures to understand the ways scientific communication is changing, but extrapolating from the numbers to the change in the nature of scientific communication is a difficult and suspect job. Still, the statistics worked out by Machlup and King (and presented in the next section) are important indicators of the activity occurring within the scientific community.

2.1.1 Tracing the Number of Journals

A handful of researchers has attempted over the past two decades co report the number of scientific journals published in the United States and the rest of the world. Perhaps the most comprehensive attempts were made by Fritz

Machlup (Information Through the Printed Word 1978) and Donald King (Scientific Journals In the United States 1980). King found that 4,447 scientific journals are published in the United States annually, along with 8,915 other periodicals (such as newsletters, synopsis journals, review journals and so forth). Worldwide, 57,400 scientific periodicals were published. These numbers, however, are based on 1977 statistics (King 23). Machlup found that in 1973 (the most recent year for his statistics) 348 medical journals were published, which represented 14.2% of the total number of scientific journals published in the United States in that year (Machlup 22). King does not report any numbers specifically for medical journals, but he states that in 1977 the Life Sciences supported 1,318 journals, a number that had risen from 856 in 1965 and that was expected to rise to 1,648 by 1985 (King 84-85).

2.1.2 Tracing the Number of Medical Journals

Another way of looking at the rise in medical publishing is to examine the growing number of journals indexed by the National Library of Medicine's massive database, Medlars (Medical Literature Analysis and Retrieval System). MEDLINE, the online access to the database, currently selects articles from 3,200 biomedical journals per year. This number is chosen from about 20,000 biomedical journals worldwide because the indexing service simply cannot index every journal in the medical field and because of the overlap of subject matter among most journals. From these 3,200 journals, MEDLINE extracts 250,000 articles and provides full-text indexing for each article.

Stepping back in time, we see in Figure 2.1 (see Appendix) that in 1910 there were 1,000 biomedical journals published, a number that rose to 1,500 in 1930, 4,000 in 1950, 14,000 in 1970, and finally to 20,000 in 1980 (Warren, Coping With the Biomedical Literature 20).It is to be expected that as the number of journals rises, so too does the number of authors. King reports that the number of authors publishing in a field rises just as dramatically as the number of journals. For the Life Sciences, this number was 212,000 in 1965 and 388,000 in 1985.

These figures show that scientists are writing more. But do the same figures prove that scientists are reading more and that the information they publish is of increasing value? And to what use is the growing mass of information put? The studies undertaken to explore these questions prove that the world of scientific information is much more complex than researchers previously thought. The problem is to describe what kinds of worlds scientific and technical information is created in, lives in, and finally dies in. One of the strongest models (the Epidemic Model) used to describe the infomation world is based on a mathematical model used to describe the spread of epidemics. The other model (a Cultural-Ecosystem Model) is somewhat related but attempts to understand scientific information in terms of its ecosystem, a term used broadly to show that information and culture (economics, politics, social pressures, philosophical biases, technologies) are entwined in a Gordian knot that cannot be rigorously unraveled.

2.2 The Mathematical Model

A mathematical model for the spread of scientific and technical information was first proposed in 1966 by two researchers (Kermack and McKendrick) who saw similarities between the spread of information through the publishing system and the spread of disease through an organism. The basic view (as shown in Figure 2.2--see Appendix) states that information is spread to a host (a journal) that in turn breeds many more copies of itself (articles). Other hosts (readers) receptive to the information will become infected and pass on the information (Warren, Selectivity In Information Systems 5).

It is, no doubt, easy for a scientist to think of information as an infection, and with a little practice someone with an education more firmly grounded in the Humanities can also acquire this dynamic perspective without its negative overtones. I will make no attempt to discuss the mathematics behind the assumptions. However, the scientific community has for the most part accepted the view of information as a kind of infection that spreads throughout a living body. This view does not apply to just one segment of the literature. As one study states: "Preliminary studies have already shown that laws governing the dispersion of papers among journals apply to exceedingly diverse literatures such as schistosomiasis and the mast cell" (Warren, Schistosomiasis xiv). Thus, the disparate kinds (lives) of information in science and technology seem to be governed by a unified law that controls the effect information has on the body of scientific researchers.

2.3 **The Cultural-Ecosystem Model**

The Cultural-Ecosystem Model began as an attempt by researchers to understand the processes of clustering and selection in the world of scientific and technical information. This view, as proposed by Warren (1981, 1985), leads to deep insights about the dynamics of information.

Although it is clear that the body of information grows daily, it has been more difficult to prove that the core of viable, usable information remains relatively stable and at a small number. Two important studies have shown that even though more information is generated, scientists and researchers have their own informal means of selecting information that is useful to their work. Furthermore, certain journals seem to attract the major articles in a given field, keeping the small number of important articles restricted to a small number of periodicals.

Warren's monumental study of the entire literature of schistosomiasis over a 110-year period provides perhaps the most important example of how scientific information is grouped and selected by other scientists and doctors. Warren found that the entire body of 10,286 citations relating to schistosomiasis was contained in 1,738 periodicals. To his surprise, Warren discovered that 19 journals contained one-third of the literature relating to schistosomiasis and that a mere 50 journals contained one-half of the literature. For the first time, here was proof how a few journals dominate the collection and publishing of scientific information. Thus, a large number of articles was clustered (or captured) by a small number of journals. This fact (and the results of research by citation analyst Eugene Garfield) seems to support a statement by Samuel Bradford in 1946 that "500 to 1000 journals are required to obtain 95 percent of the significant literature in any given field" (Warren, Coping 21). Bradford's estimates do not apply specifically to the core journals in schistosomiasis, but the figures do comply with Bradford's claim about a small number of journals dominating a given scientific field.

A less lengthy study provides a second example. Scientists studied the literature in transplant immunology in Index Medicus over a 4-year period. A total of 1,120 articles had been published in 272 journals. One half of this number of articles, however, was contained in 15 journals. Again, a few journals were found to provide outlets for most of the articles (Warren, Coping 20-21). Warren's interpretation of these studies is summed up in his view that "a clustering process occurs in the literature and that a selective system is constantly operating" (Coping 20).

Clustering and selection can best be seen as a defensive action by researchers, engineers, and other professionals in science who must manage a body of information that grows larger and more chaotic every day. Warren remarks that "working within the ecosystem of scientific information and using a selective mode, one does not have to be overwhelmed by a vast and undifferentiated mass of information" (Warren, Selectivity 7-8). Clustering keeps a small number of the truly important articles within a small number of journals. Therefore, readers who use computers can access information easily and select what they wish to read. The computer allows the reader to manage the growing body of information by using its search and data manipulating capabilities to focus the reader's attention on relevant information. Thus, by providing a "technological fix" the computer becomes both the friend and foe of the scientist. On the one hand, it makes possible the generation of huge amounts of information; on the other hand, it gives the reader the means to search that body of information and to select what is needed.

2.4 The Current Situation in Medical Publishing

The medical publishing industry currently faces important changes brought on by the establishment of electronic databases. These databases give publishers of journals, manuals, textbooks, and so forth access to massive amounts of information; they also give the same publishers the option to bypass paper format for an electronic alternative. Many of these publishers have decided to publish both paper and electronic versions of the same material. Also, they publish information exclusively electronically.

Colleague, a joint medical publishing effort by Bibliographic Retrieval Services (BRS) and Saunders Publishing, is a leading example of an attempt to consolidate publishing and data storage facilities in a package of medical information sources such as journals, books, and databases. Subscribers to Colleague can search databases such as MEDLINE for current citations to articles; they may search other indexes (Medical and Psychological Previews services) that contain information taken from 200 journals not yet found in MEDLINE. They have access to full-text storage of more than 20 major medical texts (for example: Gray's Anatomy, Brain Failure and Resuscitation, Birch's Emergencies in Medical Practice, and Manual of Antimicrobial Therapy and Infectious Diseases). Subscribers also have access to online versions of leading international medical journals such as Annals of Internal Medicine, The British Medical Journal, The Lancet, The Medical Letter, and The New England Journal of Medicine.

For these services (and more), subscribers pay a registration fee of $50 and access fees of $20 per hour for non-prime time use (after 6 p.m., weekends, and holidays) and $32 per hour for prime time use (6 a.m. to 6 p.m., Monday through Friday). Users receive discounts for high-volume use; they pay extra for special services such as extra passwords and printouts from Colleague.

Although no one has determined the average time doctors and researchers spend using these services, the prices health professionals pay for Colleague service are not prohibitive. In general, the databases with broader applications usually cost less than the more specialized online services. BIONET, an online resource for molecular biologists established by the National Institutes of Health (NIH), charges a $400 subscription fee plus telecommunications costs. The Telenet Medical Information Network, a joint online service established by the American Medical Association and GTE Telecommunications, provides a much broader range of services ranging from Med/Mail (an electronic medical mail service) to the Associated Press

Medical News Service, to the Medical Procedure Coding and Nomenclature service--a much-used database of "medical services and procedures" (AMA/GTE Manual). Charges for this service start at $100 for the one-time registration and tutorial fee and include hourly connect-time charges ranging from $7/h to $39/h, depending on the type of service and the time spent online.

2.5 Effects of Medical Publishing Services

We have seen so far that online information services have been created in response to increased needs for information by readers and by the need to store the growing body of information economically and efficiently. What has been the effect of this change in information storage and retrieval in the medical community?

Kay Goldberg, the Program Administrator for the AMA's Medical Information Network, states that it is too soon to know for certain how online services affect the medical community. She does know, however, that a "core of consistent users" has grown up around the AMA online services. About half of the subscribers are doctors, and they customize the services (by means of programming utilities provided by AMA/GTE) to serve their particular needs (Personal Letter, June 7, 1985).

Brook Manville, of BRS/Saunders Colleague, has attempted do define the effects Colleague and other electronic publishing ventures have had during the past months. Based on discussions he has had with the publishers of paper versions of the Colleague journals, he states that "it is still premature to draw any definitive conclusions; since Colleague's material has been available to subscribers for a year or less, publishers are reluctant to assign any particular weight to events that may be related to online distribution" (Manville, preprint 1).

In attempting to learn if electronic publishing causes paper subscriptions to diminish, Manville found that no publisher experienced any drop in circulation of paper subscriptions as a result of increased use of online subscriptions of the same publication. He found that users turn to Colleague online services because they need to search through large amounts of information for a specific answer or fact. The online information in no way takes the place of the paper journal or index. A paper journal is fine for browsing and relaxed reading, or for close reading. The online version is useful as a source for data retrieval, such as key words, condensed articles (abstracts, abbreviated versions of articles), and selected passages of information (Manville 2).

According to Manville, publishers have not been hurt financially by electronic publication. In fact, some publishers have actually seen revenues increase because of their electronic publications. For example, Grolier

Publishing, which marketed its online version of the _Academic American Encyclopedia_ during the past year, has seen sales increase. The American Chemical Society, which publishes 19 electronic journals, has seen no threat to the paper versions of its journals. More important, some electronic journals are reaching readers who would not normally read these specialized texts. An example is two journals of the American Mathematical Association (_Mathematical Review_ and _Contents of Mathematical Papers_), which because of their distribution by BRS and Dialogue are reaching a base of readers not strictly associated with these journals (Manville 4).

The current situation in scientific publishing can be summarized in the following way:)

> Food and energy challenge because they are in short supply in major areas of the world. In both cases the challenge seems to be, How do you manage shortage? Information is quite different. It is in quantitative surplus.... Indeed there seems to be more information around--good and bad--than anyone can use. I have heard it said that we are living in a world of information junk....
>
> (Warren, _Coping_ 27)

Scientists, doctors, engineers, and others who use advanced information are faced with an information glut. Currently, journals cannot handle the amount of knowledge specialists must share; libraries cannot afford to keep up the subscriptions they once supported. Most of the information published is of marginal use, and studies show that "25 to 50 percent of scientific papers published are never cited even once" (Goffman, Coping 43). Too much scientific information is not only unimportant, but it goes unnoticed, increasing the chance that important works may also remain hidden in the mass of unread work.

The problem of an increasing mass of information in the biomedical literature is not decreasing; it increases by 6 to 7 percent every year, thus straining the already overburdened medical publishing system. The solution to this problem is in part the creation of online information retrieval systems like BRS, Dialogue, MEDLINE, and BIONET. The solution also lies in the success of online journals such as The New England Journal of Medicine and others published by Colleague, AMA/GTE, and The American Chemical Society.

Too many scientific and technical journals exist; they are too expensive to maintain and support; much of what they publish is unread and in part not worth reading; they cannot provide the services of archiving and publishing current information they once could. But we must not abandon this system of publishing, for it is accepted by too many readers and it is part of an ecosystem of information creation and communication that is far more complex than we imagine. As one researcher has said:

> If we are to improve an evolving man-made ecosystem that is beset with uncertainty, we would be well advised to strengthen what we can and take care not to destroy the food chain of journals that has nourished science for three centuries.
>
> (*Selectivity* 5)

The means to strengthen this system of communication are in great part the electronic journal. Electronic publication systems are becoming more popular, but their effect (as Brook Manville and Kay Goldberg state) is still to be discerned. Future studies must examine the impact of electronic publishing, but for now it is enough to know that a assistance to the problem of scientific publishing may become available.

CHAPTER 3

THE ELECTRONIC JOURNAL

The purpose of this chapter is to describe the hardware and software of the electronic journal. The chapter begins with a discussion of the publishing process and the role of the electronic journal in that process. Next follows a description of hardware and software. The chapter concludes with a discussion of the advantages and disadvantages of the virtual journal.

3.1 The Publishing Process: An Overview

Publishing a journal involves the use of technology that has remained relatively unchanged for many years. The exception is the computerized phototypesetter and the advent of electronic delivery systems, but this technology is new and is still making itself known. Before taking an in-depth look at the hardware and software of an electronic journal, we must study the old system of publishing to understand how the electronic journal fits into this system.

In a general sense, to publish a scientific or technical article, the author must send his work through the following channels (see Figure 3.1 in the Appendix):

1. He submits the article to an editor, who decides whether or not to send the article as is to chosen referees or to send it back for further changes. If the editor sends

the article back, the author makes changes and resubmits the work.

2. The editor sends the article to chosen referees, who either accept or reject the work or suggest further changes. These referees often uncover mistakes or problems the editor may have missed or may not be qualified to pinpoint. The referees often send detailed comments about the quality of the article back to the editor.

3. Based on the referees' comments, the editor will send the paper back to the author for changes, reject the paper, or accept it for publication.

4. The editor sends the document to a qualified technical editor who begins the process of technical editing. This editor bases his changes on the audience and purpose of the document, keeping in mind the publication deadline and other constraints. He edits for consistency (especially making sure that SI units are correct and that chemical and mathematical notation is correct), clarity, correct in-house style, and grammar.

5. The technical editor merges the text and visuals and begins to copyedit the material. The article is then sent to a compositor, who codes the document for typesetting. This process of coding is usually performed on a terminal connected to a computerized phototypesetter.

6. Galley proofs of the article are proofread by the author (who may make last minute changes) and by the editor.

7. The galley proofs are revised (if necessary) and sent to makeup, where the page proofs are created. The visuals are placed in the text exactly as they will appear in the final version of the article. It may still be possible for the author to make changes, but they are very expensive, time-consuming, and rare.

8. The page proofs are reviewed and sent to the printer. The article, along with the other articles of this issue, are printed. The pages are collated (that is, sorted into proper order), bound into whatever physical form the journal takes, wrapped (if necessary), and finally mailed to individuals or institutions.

Writing the article may take about 5 months, depending on circumstances as the number of authors and updates of information (King, Scientific Journals 200). From submission to publication may take as much as 10 months on the average. The author, thus, can expect to wait a year and a half on the average before his or her work is read in final form by the scientific community. This time span is an average figure, and some authors may wait two years or more to see their articles published.

The above is a generalization of the journal publication process; the process may take different forms depending on the journal, publisher, and other circumstances. However, we can observe a number of obvious problems with this manual system. First, the process takes time, with authors waiting one or more years for their work to appear in print. Second, the author has relatively little control over the text once it is in the editor's hands. Changes in the text are expensive and time-consuming, so the author is discouraged from making changes. Third, the publishing process is expensive: On the average, a journal article cost $1,540 to publish in 1977; in 1985, this cost is expected to reach $2,720, a rise of 77 percent (King 289).

3.2 The Role of the Electronic Journal in the Publishing Process

We have seen that scientific and technical journals serve two main purposes: 1) They are an archive of past information, and 2) they are a medium for presenting information to other scientists and engineers. Furthermore, journals allow scientists to establish who came up with ideas, discoveries, or data first. Keeping up with this double role has severely taxed the ability of the journal system to do its job. While authors wait many months to publish, researchers (including authors themselves) find it increasingly difficult to search past literature without the aid of abstract journals, citation indexes, and other means.

The proliferation of journals in science has added to the difficulty authors face when attempting to gather information. Historians know that journals have grown at an exponential rate. That is, as the quantity of journals increases, the rate of growth of journals also increases. Thus, journals breed more journals; articles breed more articles; and the scientist searching for information or seeking to contact journals for publication quickly becomes lost in a maze of reference obstacles.

For example, in one journal, Physics Abstracts, the rate of articles published has doubled about every 15 years since 1900. By 1960, more than 180,000 articles had been recorded in this journal. Such discoveries have led historians such as Derek de Solla Price to claim that "the density of science in our culture is quadrupling during each generation" (Price, Science Since Babylon 108). Each generation, there are more scientists and engineers, more authors, more journals, and finally more articles and reports to be read.

The role of the electronic journal is as follows:

*First, to allow the author to publish more quickly;
*Second, to give researchers quicker and easier access to bibliographic searches; and
*Third, to improve the quality of the information that finally sees publication.

The article is a body of text (excluding graphics) that is "captured" by the computer, a process called capturing the keystrokes. During this act, the author keyboards the text, capturing its content in its earliest form, ensuring that later revisions will not have to be retyped. Instead, the author can bring the text online and make revisions without having to retype (rekeyboard) the entire document. Usually, the author inputs this information herself, working from a terminal. In its earliest form, the article that has been written and stored online now becomes the potential property of three groups of people who share electronic access to the online article: the editor, the referees, and the members of the scientific community who use comptuters to access databases.

This kind of access by the editors and the scientific community is possible if the proper communications equipment is available to allow the interested readers to call up the text on their own computers. Such an electronic bridge may often be a Local Area Network (LAN) or it may be an extended telecommunications link involving many communications nodes or transfer points. LANs are becoming popular because their limited range allows smaller scientific communities to keep contact electronically without paying exorbitant prices. A Local Area Network is a combination of software and hardware used to connect computers so that users can share information and communicate quickly. Users may wish to tie in to a common database (for management or scientific purposes), or they may wish to start a mail or message system. The greatest expenses may only involve the communications software and the price of optical fiber transmission lines or satellite links. The result is a group of information users who share common needs and the ability to use their computing power to its fullest by pooling their resources.

The creation of an article thus becomes a dynamic process. Three vital sectors of the communication process have direct access and input to the text of the article. Editors, referees, and interested colleagues all serve as gatekeepers in the publication process, ensuring that the quality of the article is the best possible. The article is published more quickly because the keystrokes are captured just once: retyping is limited to editorial corrections done online and does not waste the time of a secretary who would normally have to retype the entire document if changes were made. Furthermore, the article can be published quickly if the author has coded the manuscript using Standard Generalized Markup Language (see Chapter 4). Changes in the text are easily made and coded, and the text can be quickly sent to a computerized phototypesetter that interprets the codes.

One of the more important functions of the electronic journal is to act as a source of bibliographic information. Its computerized nature gives it powerful filing and indexing capabilities. As we can see in Figure 3.2 (see

Appendix), the electronic journal can be made to operate with a two-part file structure. The index file is the gateway to the information, and the anchor files are the various levels of text available to the searcher.

The user should be able to search by title, abstract, author, institution, date--facts that are all stored within an electronic database. From this file, the user should be able to access the anchor files, which contain the full citation, title, and abstract, as well as the full text and visuals of the articles.

Furthermore, articles can be stored according to the frequency of their use. The computer keeps track of how many times the article is retrieved, keeping articles with high retrievals within high speed online memory. As retrievals drop, the articles are placed in memory that is less expensive and slower to use (Senders et al., Scientific Publications Systems 111-118). An added benefit to this system is that readers may append their own comments to the articles, stating whether or not the article is effective or if the current reader should be referred to other articles on the subject at hand. Thus, even after an article is written it retains its dynamic characteristics. Later readers can see how well the article was received by the scientific community, and they can benefit from recent additions and emendations to the text.

3.3 The Electronic Journal: Hardware and Software

Until recently, the high costs of computer hardware and the relatively primitive state of sophisticated, user-friendly text management software have hindered the evolution of the electronic journal. However, recent breakthroughs in equipment and software development have made online journals more feasible than they were in the past. The following section will describe the tools needed to support an electronic journal, the current state of the art, and the costs involved in maintaining an online journal.

3.3.1 Tools needed to support an online journal

These tools address four basic needs: input, transmission, storage, and output. Availability, cost, and reliability of hardware in these areas have fluctuated and have not been the same for each need. That is, while input technology has made steady and fairly cost-effective advances, storage and output technology have been slower to advance until recently.

The main method of inputing information is a typewriter style keyboard connected to a video display terminal (VDT). Sophisticated keyboards contain advanced character sets that are able to produce the most used mathematical and scientific symbols (such as differential, integral, summation, and Greek symbols and special notation used in physics and chemistry). They must also be able to provide high-resolution graphics and displays that do not strain the user's eyes. Most important, the keyboard must be human engineered and easy to use, at least as easy as a standard typewriter keyboard (such as the IBM Selectric). This makes sense, although until recently keyboard manufacturers seem to have forgotten that the user will spend most of her time staring at a screen that must be well-lit and will be typing on a keyboard that must provide proper tactile response. Users simply will not put up with shoddy input equipment: too much of their time is spent inputting text.

Efficient and affordable methods of transmitting text have begun appearing recently. ETHERNET and TYMNET are examples of two widely-used telecommunications networks. Using special equipment (a modem), the user can transmit the text by telephone. Text can be transmitted at speeds of 300 or 1200 baud or more (at 1200 baud, roughly 120 characters per second are transmitted). Telecommunications nodes (centers where equipment is gathered to pickup and transmit signals) are appearing in cities throughout the nation, creating an extensive series of communications links. As these nodes proliferate, costs are expected to reach affordable levels.

Storing information electronically has been and remains a challenge for electronic information developers. The main methods of storing text have been on hard disks and tape media. Hard disks can store large amounts of information (30, 80, or more Megabytes of information) and provide fast retrieval rates. But such storage is expensive; thus it is suitable for articles and reports that have higher usage. Tape storage is a much slower method of storing text, but it is cheaper to use, better suited for less-used texts.

The brightest star on the storage horizon seems to be laser memory. Such memory involves the use of a plastic-coated aluminum disk encoded by pits that are optically scanned by a laser. Currently, laser memory has entered the audio field (compact disks) and the movie industry (video disks). It has been noted that "sometime within the next five years optical disks may offer dramatically larger storage devices with the same read/write capabilities of today's hard disks" (Fersko-Weiss 71). Thus, the new technology will soon extend to text storage and will provide a means for changing the material on the disk: Currently, it is possible to write to the disk (that is, to fix the information onto the disk magnetically), but it is not possible to modify that text without damaging the disk. However, both methods (disks that can be changed and disks that cannot be altered) offer advantages.

The changeable disks will be useful for updating and altering texts, while the nonchange disks will be useful for collecting information over long periods of time. This latter method strengthens the electronic journal's ability to perform a valuabe archival function. Both types of laser disks can store from 100 to 620 Megabytes of information (or roughly 6,250 to 38,750 pages of text, excluding graphics).

Output, or printer, technology has made strong advances during the past three years. The state-of-the-art IBM line printers are capable of producing 2,000 lines of text a minute (roughly 37 pages per minute) in dot matrix form. Laser printers have recently entered the market place and are priced in the $3,000 to 8,000 range. Although such printers are slower than line printers, they produce letter and graphics quality that approaches that of phototypesetters. The line printers produce a print quality that is better-suited for drafts and not final copy.

Authors and researchers who need hardcopy of texts can thus receive printouts (less visuals) quickly and cheaply. Large journals can use the more expensive printers to send high quality text, and smaller journals and individuals and send and receive hardcopy printed on Near Letter Quality (NLQ) dot matrix printers that cost from $170 to 1,000.

3.4 **Advantages and Disadvantages of Electronic Journals**

The qualities that make an electronic journal effective would seem to involve just technology. However, we must also remember that the skills and expectations that people bring to the electronic workstation also play an important role in determining the electronic journal's success. The following paragraphs will explore the advantages and disadvantages of online journals as they relate to the technology (the equipment people use) and to the user (the editor, author, and so forth).

First, it is necessary to understand what makes the electronic method of publishing a scientific journal different from its traditional counterpart. Figure 3.3 (see Appendix) will help us see these differences.

The first obvious difference is that a traditional journal's end product is paper. The electronic journal's end product, on the other hand, is electronically stored information (text and visuals). Of course, paper is used if the reader wants a hardcopy of the article in a short period of time, but print on paper plays a relatively minor role. Thus, the electronic journal places emphasis on <u>sharing</u> information and not merely on packaging the information in a usable form. Of course, the information seeker must pay for online time, but she is buying a service (the database search or online subscription) and not a commodity (the journal).

The next major difference is how the reader reads the journal output. A traditional user will read paper copy or perhaps a microform copy, but an online user will most likely read at a terminal (unless she wants a paper copy). This fact means that an online user reads differently than a paper reader. The former is bound to the number of windows a screen can support in order to view different parts of the article at the same time, while the latter may flip back and forth between pages. Also, it is not possible to make notes on an online article: The user must either request a hardcopy she can mark on, or she must create a window to a personal note file. Another way around this problem is for the user to copy the article into her own file, where she may make notes easily.

This difference in the way paper and computer users read documents has led to criticism of the electronic journal's usefulness. Critics of the electronic journal say "If you can't take it (the journal) into the bathroom or read it in bed, what good is it?" Such comments miss the point. A reader is usually attracted to an electronic journal not because she wants to browse (although browsing is fast and easy online) but because she has specific information needs that the computer's speed and flexibility can provide more quickly than a hand search through a database or bibliography.

The next difference is complicated and demands much space for explanation, but it can be summarized as follows. Information in the traditional scientific and technical journal system is communicated via a network of professional societies, commercial publishers, and libraries. The communication may be informal or formal: It may be generated in one area (at a conference,for example); processed in a second area (an editorial office and printing house); and stored in another (a library or a databank). The electronic journal seems to level this process somewhat, mainly because the information is communicated directly via a computer controlled network. Once the keystrokes are captured, the information cannot easily escape the system; it can be easily channeled to different parts of the publishing system, yet everyone involved in producing the information still has access to it through the computer. The computer, then, plays a major role in generating, processing, and storing the communication. And once the information is stored, thousands of individuals with computers have access to articles and data stored centrally online.

One of the most important differences is cost per page. King estimates that electronic processing of scientific articles (including composition, telecommunication, and text editing) can save the scientific and technical journal system about $61 million (out of a total cost of the scientific publishing system of $4.5 billion). Thus, an article that is published electronically will cost about $371 less than an article published by traditional means. Prepublication costs can be sharply reduced by electronic means, but King goes on to say cautiously that "the (electronic) processes have some cost advantage but not an appreciable one" (King 295, 293, 221). Lancaster has shown, however, that with hidden costs considered the price of publishing an electronic journal equaled its paper counterpart in 1971 and has decreased in cost every year since then as computer technology has become more affordable (Lancaster, Toward Paperless Information Systems 53-55).

It is clear, then, that electronic publishing is cheaper than paper printing, but no one knows exactly how much money can be saved. The difference seen in the chart is a good example. The electronic journal's short publication lag will save money, but how much it will save is difficult to uncover. If a scientist can save six months of his time by using electronically published information (time that may have been wasted had he not had access to a quickly published article), then surely his employer has profited by using electronic journals.

For example, researchers in genetics can share online information almost immediately, as is the case with the Yale Human Gene Laboratory. This laboratory's database has been converted into an informal electronic journal. Scientists from around the world who are working with this laboratory have access to the database and can publish their findings and progress for immediate review and comment (Ruddle 944-953).

After examining the differences between paper and electronic publishing systems, it is possible to gain a fuller understanding of the advantages and disadvantages of the online journal. The following discussion is not comprehensive--that would take many more pages--but rather is meant to highlight the major points for and against the electronic journal.

3.4.1 Advantages

1. We have seen that the electronic journal allows captured information to become interactive and dynamic. An example of this advantage is seen in the experimental electronic journal Mental Workload, based at the New Jersey Institute of Technology. Although the users of this journal found that much needs to be done to make the electronic journal feasible (see the section on solutions and the future of electronic journals in Chapter 5), they did agree that the potential to interact with electronically captured information is one of the online journal's strongest advantages.

Contributors to the journal had access to three separate files: one of the edited version of the article, one of informal discussions among contributors of the articles about the articles and the journal, and another of formal comments about papers submitted to the journal. Thus, journal users could work with the texts on three levels, giving those texts a truly dynamic character (Moray 17).

2. Because a text is stored electronically, an author can use the computer's advanced text editing functions to manipulate data. Sections of the text can be coded by

subject, and the author can sort through the coded sections, reorganizing or reexamining the text at will. These functions also apply to readers in general, who may need only to look at selected parts of the article(s) of interest to them. For example, a reader who has selected 15 articles for research purposes can scan the parts of those articles that contain relevant information. Perhaps the reader wishes only to read the conclusions--these can be called up easily--or perhaps the reader is only interested in references to a specific drug or therapy or disease; the computer can be instructed to search for these references. Skimming through selections is a definite advantage. A reader may decide to skim through abstracts or to look at references. A reader may even pull out the headings and look for relevant material.

Also, the author can update articles according to need. If new information becomes available, the author can easily insert the changes or add comments to the article updating current readers. Thus, the article keeps its dynamic characteristics even when it serves archival functions.

3. Electronic journals provide automatic bibliographic routines. A reader can review selections of articles (as mentioned above). She can list and sort bibliographic references as her own research demands. And she can automatically cross reference pertinent information.

4. A little-studied advantage is the ability for an author to receive a translation of a text. This is becoming increasingly important as the international scientific community becomes more reliant upon foreign papers. This feature of electronic journals is one of the goals of researchers in the field of Artificial Intelligence (AI), who hope to create software that can accurately translate one language to another.

3.4.2 Disadvantages

We must not ignore the problems facing users and designers of electronic journals. Problems are many, but solutions are also clear. The following paragraphs will present the major problems of electronic journals; the final chapter of this report will present solutions to the main problems as well as comments about the future of online journals.

1. Perhaps the main disadvantage is the interface between machine and operator. This problem involves hardware and software.

Hardware. The computer screen has limitations that must be addressed. Until recently, screens have lacked portablility. They were large, heavy, and fragile. While strides were made in other areas of computer technology, the VDT remained in the dark ages. Also, VDTs are hard to read. The printed page is of higher quality than the displayed page. And without appropriate software, the reader cannot annotate the displayed page.

The keyboard remains a problem. It must offer an extended character set, rugged and yet responsive keys, ergonomic design, and standardization. Until these needs are met, users will balk at committing themselves wholeheartedly to electronic publication.

Software. Text management software (such as the UNIX-driven Interactive Textediting System) is not in its infancy, but users of such software will agree that designers have a long way to go before flexible, standardized, and user-friendly text management systems see the light of day. One of the originators of the Mental Workload experiment sums up the failure of the journal's text management system: "It was too hard to do things so they were not done" (Senders, Eurim 4 15).

If an author experiences any difficulty with the system, she must have access to extensive and easily understandable instructions showing her how to use the system. Error statements like "Syntax Error" must be replaced by statements like "Please try again with a different document name. Hit Escape H for help." Everything to help the user must be contained online in a subroutine.

Of major importance is the development of a standard method of coding a document for composition and typesetting. Current codes in use are complex and difficult to use. See Chapter 4 for a discussion of this problem.

It cannot be stressed enough how important the human interface is. Human engineering must not be forgotten when software is designed.

2. Connect time between user and editor (or storage facilities) must be cheaper. Current rates range from $15 per hour to $60 per hour of connect time, which for many users is prohibitive, especially if transmission is international.

3. International distribution of electronic journals is vital. This is mainly a telecommunications problem, and it must be solved by providing scientific communities in all nations access to communications links. If this does not happen, then much of the scientific world will be left without the electronic advantages enjoyed by a handful of countries.

4. Electronic information systems lack sophisticated graphics capabilities. Currently, a user receives visuals to an article by mail, while the article can be transmitted electronically in a few minutes. Electronic journals must provide high-quality graphics as well as text online.

Although the problem of how to store and transmit visuals is serious, progress is being made in the area of digitizing visual or graphic information. This process involves converting the video image to digital form and then reconverting it at the desired time and place. This technology is becoming available as a result of advances in high-resolution video screens, expanded microprocessor capabilities (true 16-bit processors with custom designs that allow advanced graphics to be processed without overloading the Central Processing Unit), and video technology. Computers made today are capable of digitizing visuals. One example is the Amiga (manufactured by Commodore), a 16-bit machine with advanced graphics capabilities that sells for under $2400.

CHAPTER 4

THE STANDARD GENERALIZED MARKUP LANGUAGE

The following chapter describes the purpose and history of the Standard Generalized Markup Language (SGML). It gives a definition of SGML and a description of its evolution. It describes what SGML is supposed to do. This chapter provides the reader with definitions of the major parts and concepts of SGML and closes by presenting before and after examples of document markup. The reader will become aware of the difficulties facing editors, writers, and text management specialists as they work toward a standardized and coherent method of preparing a document for online publication. I would like to thank Jim Mason of Oak Ridge National Laboratory (Oak Ridge, Tennessee) for his guidance in writing this chapter.

So far, this thesis has described the history and growth of journals in science, leading up to the formation of the electronic journal. Also, this thesis has explored the problems faced by researchers who must publish within an increasingly overburdened system of scientific communication. This chapter on the Standard Generalized Markup Language is an extension of that exploration. Electronic publication forces people who use information to reassess their understanding of information--what it is, how it should be used, how in fact it should be described. An outgrowth of this need to review our concepts of information is the need to create a standard system of describing and labeling documents for electronic storage. To this end, publishers and information specialists around the world have embarked on an electronic manuscript preparation project, a part of which is the development of the Standard Generalized Markup Language (SGML).

As anyone who has written for publication knows, marking up an article, book, or other work for printing is a difficult and time-consuming task. A document will pass through many hands before it is properly configured for its final stage in the publication process--printing. One of the great advantages of electronic publication is that with the proper facilities an online document can be marked up for publication quickly and with relative ease. Furthermore, online markup and formatting allows the author and publisher the flexibility to change the document's final form to meet changing needs and demands.

4.1 Defining the Problems

The main problem facing authors, editors, and other professionals has been that a text marked up on one electronic system could not be handled by a different system: Codes recognizable by one formatter were unrecognizable on a different formatter. Lately, however, large and influential publishing organizations have begun the process of creating a markup language that all publishers will accept and use as the standard for publication. This effort involves persons and organizations from the United States, the United Kingdom, and Continental Europe. Professional societies, publishing houses, universities, and research and development centers are currently assembling guidelines and testing systems for standardized text coding and document description. To better understand these efforts, it is necessary to follow the evolution of the standardized markup language and to show how solutions to the problems of document markup have led step by step to the current guidelines.

The attempt to create a standard markup language is a central part of a larger project called Computer Languages for the Processing of Text (CLPT). It was started in the United States by the American National Standards Institute (ANSI) and consists of the following ten parts:

Part 1 A general description of the entire project;

Part 2 A section dealing with the vocabulary, both general and specialized;

Part 3 A section on the programming languages used in text management and other applications in the project;

Part 4 A section on the text entry and editing funtions;

Part 5 A section on text formatting and composition;

Part 6 A document markup metalanguage that "describes the structure and attributes of documents generically without respect to the processing they will undergo";

Part 7 A section on markup support functions;

Part 8 A section that provides for merging of graphics with the text;

Part 9 A section on WYSIWYG or "What You See Is What You Get";

Part 10 A method of registering document design procedures.

(Smith, Computer Languages 1-2)

Clearly, the CLPT project is extensive, too much so to be covered in this chapter. However, Part 6 (the document markup metalanguage, or SGML) is considered one of the most important parts of the CLPT effort and plays a crucial role in making the processing of information more efficient.

4.2 Early Solutions To Document Markup

One of the first attempts at devising a markup language involved the macro call, or formatting call. A macro call signified that certain sections of the text were to be processed in a specific way by codes that were kept out of the document and placed in a formatting subroutine. Each code indentified the kind of text formatting to occur, such as a paragraph break, a numbered list, a heading, and so forth. The macro call usually appeared as a combination of letters and numbers placed in the text where the change was to occur. For instance, the macro call "format-12" might mark a numbered list.

The next development was the use of generic names in place of code names. Thus, "format-12" was replaced by "numbered list." The actual formatting routine was still separate from the generic name, but understanding how the document was to be formatted became a less intimidating process.

A major step toward a standard markup language came in the early 1970s when publishers accepted the concept of a generalized markup language. Such a language would provide a "formal base for general coding" (Standard 101-1983, 1) built upon the following principles:

1. Descriptive Markup--markup is descriptive and separate from the processing instructions;
2. Procedural Markup--"markup is formally defined for each type of document" (2). Thus you use formatting definitions specific to a certain document type.

From this two-part heirarchy soon developed a thorough set of document type definitions that apply to all conceivable kinds of documents. Developing this extended heirarchy and making it work has been the goal of groups such as the Association of American Publishers (AAP), the Council of Biology Editors (CBE), the Council on Library Resources, and many others.

Descriptive markup involves using tags to define the kinds of information that occur within a document. Tags will be discussed in greater detail below, but for now it is enough to say that a tag is used to identify part of a document for processing by formatting routines that are external to the document. A descriptive tag simply indicates what formatting is to be done at a certain part of the document.

Procedural markup, on the other hand, involves the use of codes that are actively involved in formatting the text. For instance, a popular word processing program may specify a sequence of keystrokes that embed a code the printer can interpret when the document is finally printed. In the word processor used to write this chapter, pressing the "clear" key and the number 3 embeds a command to begin italic script; pressing "clear" and 4 embeds the command to stop the italic mode. Any number of commands can be embedded to print boldfaced characters, to center text, to use super- and subscripts, or to underline text, and so forth.

Obviously, such a method is handicapped because it is specific to one software system. Most likely one method of coding will not work on a different computer or a different version of the same computer. In order to code the document for another system, a search and replace function must be used to replace old codes with new ones, a time-consuming process.

4.3 **SGML--How It Works**

Working from the two-part heirarchy described above, publishers, software designers, and text management specialists have developed descriptive markup into a rigorously defined system of preparing a document for publishing. This system is based on two ideas, manuscript preparation and manuscript creation (Electronic Manuscript Project 3).

4.3.1 Manuscript Preparation

This involves activities that do not include writing but rather that include preparing outlines, defining the type of document being written (article, technical report, book chapter, and so forth), and then deciding which tags can be appropriately used to code the document.

What the author is really doing here is deciding how best to merge the structure of his or her document with the proper descriptive tags to ensure smooth processing of the document. For instance, will the document contain many equations? If so, the author needs to prepare a list of approved tags for coding mathematics. Does the document contain graphics? Special tags are necessary here. Does the document contain references, index, and table of contents? Once again, special codes are needed.

To find the proper tags, the author must consult lists of tags prepared by the AAP. These lists contain the most common tags used to prepare all of the types of documents described by the AAP guidelines for manuscript preparation. The lists include document types such as monographs, textbooks, theses or dissertations, serial articles, magazine articles, journal articles, conference proceedings, and technical reports (for examples, see Appendixes 1 and 2).

4.3.2 Manuscript Creation

This step involves writing the document, inserting the tags, and revising. Because the author is actively using tags at this stage, it is appropriate now to describe in detail what a tag is and how it is used.

The AAP's Electronic Manuscript Project defines the tag as a "label or code used to identify a document element. A tag, under the AAP Standard, has a special structure which distinguishes it from the text of a manuscript" (3). The structure is as follows. First, a symbol is used to start the tag sequence. A "less than" symbol (<) is the preferred delimiter. Next, a series of letters and numbers marks the tag name. Any combination of letters and numbers may be used, but the first element must be a letter. Finally, a terminating symbol is used. The "greater than" symbol (>) is the standard delimiter. In a technical report, the beginning of the title is thus indicated by the following tag: <TI>. The table of contents is marked by <TOC>; a first level heading is marked by <H1>; a paragraph is marked by <P>; an appendix is marked by <APP>; and so on.

To mark the end of a tag sequence, a slash is used with the < and > signs: </TOC>. Thus, the entire tag sequence for a table of contents would include <TOC> followed by the information contained in the table followed by the terminating sequence </TOC>. A chapter would begin with <C> followed by the coded material in that chapter and ending with </C>. The glossary would begin <GLY> followed by the glossary to end with </GLY>.

The following list contains some of the more important tags one would find in a journal article. For a comprehensive list of these tags, see Appendix 3.

Element Name	**Tag**
Abstract	<ABS>
Acknowledgements	<ACK>
Article Identifier	<AID>

Author Group	<AGP>
Date of Publication	<PDT>
Figure	<FIG>
Figure Reference	<FRF>
Footnote	<FN>
Footnote Reference	<FRF>
Front Matter	<FRT>
Full Text Group	<FTX>
Head, Level 1	<H1>
Index	<IX>
Introduction	<INT>
Issue Number	<INO>
Language	<LNG>
List	<LT>
List Item	<L>
LC Card Number	<LCD>
Matrix/Table	<MT>
Paragraph	<P>
Repeating Identifier 1	<REP1>
Reprint Source	<RPT>
Text, Level 1	<TX1>
Title Group	<TIG>
Volume Identification Data	<VID>

This list, which is incomplete, gives one an idea of how specific a tag may be. Furthermore, the reader sees how simple tags are, a simplicity that aids in memorizing tags and putting them to use in a document. For an example of text marked up using SGML, see Appendix 1. Appendix 2 contains the printed version of the same text.

4.3.3 Markup Minimization

Markup minimization allows the author and editor to save time and space by deleting or abbreviating symbols used to terminate tag sequences. One way to do this is to allow the beginning of one tag to act as the terminator of the preceding tag. In this way, <TI> followed by the title may be effectively ended by the tag signalling the next element in the report--<ABS>, for abstract. <ABS> may also be ended by the beginning tag for the next element--<H1>, or the first first-level heading. Such a method of chaining tags may go on as long as feasible. It may be easier, however, to end a tag by simply including the terminator symbol, the slash, as follows: </>.

The concept of markup minimization, thus, allows one to cut back on keyboarding, saving time and money. The author and editor have a flexible means of cutting back on keyboarding, but they must still abide by minimum rules. The proper symbols must be used (such as <, /, and >), or the proper sequence of tags must be followed--that is, ending one tag sequence by beginning the next logical tag sequence.

4.4 The Implications of SGML

One of the goals of this thesis is to make clear the obstacles editors and publishers have overcome to make the electronic journal a reality. Every day, we read news of the latest advancement in computer hardware: greater storage capabilities; faster telecommunications; more powerful workstations; and expanded graphics for engineering, architectural, scientific, and artistic design capabilities. Hardware design is obviously continuing, but software design is perhaps less obvious, less glamorous. And yet, without the appropriate software, the most advanced terminal, display, or storage medium is crippled.

The Standard Generalized Markup Language and its many related markup languages represent an effort to provide users (authors, editors, compositors, and so forth) with the most advanced means of using electronic publishing technology. This effort to standardize descriptive markup languages has two goals that may be summarized as follows:

1. Authors, editors, and others involved in the publishing process must be able to process a text on almost any computer or electronic text-processing machine.
2. The text, once processed, must be reuseable for many later applications.

As mentioned earlier, an important barrier to the transmission of texts is the inability of most word processing systems to accept files processed on a different computer and word processor. The file you format using your IBM PC and Wordstar 2000 Plus will not work on an IBM using XYWrite II-Plus, much less a TRS-80 Model 4 using superScripsit. One answer is to use file conversion utilities to convert files from one word processing system to another. However, such utilities still leave the old formatting commands embedded within the transferred file. These commands must be replaced by system specific commands if the file or the file cannot be printed. With SGML, one can use any file created on almost any computer because the means of describing that file have been standardized. Any computer capable of using SGML software can process any file coded properly under SGML guidelines. This flexibility has widespread implications for freelance writers and editors as well as for the largest editorial and publishing environments.

One of the greatest advantages of SGML is the ability to process a text once and still use it for myriad applications. Because the document is generically coded, an editor can quickly and easily recode a document for a different application. For example, an article published in a journal can be recoded for publishing in a book of articles. New graphics may be updated with ease. An index can be quickly made. References can be searched and changed. Headings can be extracted. Key words and sentences can be traced. Equations can be extracted for study. The list of further uses goes on almost without limit.

SGML's focus on structure is important because "generic coding produces nothing more nor less than a structured database" (<u>Project Plan and RFP For Electronic Manuscript Project</u> 4). The original file, whether it be an article, monograph, or technical report, becomes a series of coded elements of information, each one generically listed and reproduceable (on a copier or terminal) or changeable electronically. Once again, we see how electronic text processing places information within a dynamic context: The information is not a static article frozen on a page; rather it is filled with possibilities for change, use in varied applications, greater potential for effectiveness.

Furthermore, an electronic document management system like SGML is designed to give editors the opportunity to produce texts in more than one final form. That is, a document coded for one purpose (say, a journal article) can be printed in a different form to conform to a different purpose (perhaps a condensed version based on key passages or headings). Paper publishing will undoubtedly benefit from the use of SGML, but electronic information systems stand to gain substantially as well. For this reason, a large number of information processing centers and publishers support the document metalanguage concept. Printers such as R.R. Donally and Kingsport Press support it; the National Library of Medicine supports it; Xerox Corporation has developed its own version (Interscript), as has International Business Machines (Generalized Markup Language, GML); the Department of Defence and the Internal Revenue Service support it; and the European economic community supports it (Personal Interview, July 1985, Jim Mason).

CHAPTER 5

THE FUTURE OF THE ELECTRONIC JOURNAL

In his seminal article on the structure of the information society, Daniel Bell offers the following lines: "The methodological promise of the second half of the 20th century is the management of organized complexity.... Beyond a certain threshold introducing added complexity results in answers that are less and less reliable" (Bell 503, 511). The means for managing this organized complexity are largely electronic. The means for extending the threshold of reliability are also largely electronic. The scientific community simply must rely on the products and technology of the electronic age in order to find new techniques of maintaining a relatively problem-free flow of the scientific and technological information that the same electronic age produces.

So far, this thesis has explored the complex growth of scientific communication and how one kind of technology (micorelectronics) has influenced the way doctors, scientists, and engineers communicate. The ability to communicate is a great factor in determining the success of scientific study and technological progress. Scientists have used the wide variety of communication methods (both formal and informal) to acquire data that they synthesize into knowledge, knowledge used to solve problems and ensure scientific advance. After the Second World War, the growth of scientific and technical information stretched the established journal system to it limits, but once again technology provided a solution to the growing communication problems: Introducing electronic and microelectronic technology to the publishing industry became an obvious way to deal with the growing information demands the United States and other technologically advanced nations faced. The method of communicating scientific information had reached the threshold. It managed complexity with less and less success. By the mid-1970s, the electronic journal seemed to be the cure to science's communication ills.

In the following paragraphs, I will discuss the range of success that electronic journals have found. I will examine the impact such journals have had and will have on the scientific world. I will discuss the future of electronic journals and what needs to be done to ensure their permanence in the world of scientific communication.

5.1 **Have Electronic Journals Been Successful?**

The immediate answer to this question is "yes--and no." Yes, electronic journals have proven that when the hardware, software, telecommunications facilities, and management function properly electronic publication can provide quality scientific information quickly and within the constraints of most budgets. For example, Donald King has claimed that the "advances in electronic technology will... reduce costs somewhat in the future"--that is, costs associated with publishing an article He estimates that electronic publication will save publishers $70 of the total cost of publishing an article, a 56% rise from savings of $45 in 1975 (King 288). The growth of newsletters, newspapers, and the early journals shows that even in the early days of scientific communication (the 17th, 18th, and 19th centuries) scientists encountered problems with efficient communication. Postal facilities were haphazard and slow; a standard form of communicating scientific symbols and terms did not exist; the scientific community was not organized and thus could not capitalize on the inherent strengths of paper journals. To some extent, similar problems exist today: Increases in postal rates (among other factors) are raising the costs of journals to a point where libraries and individuals can no longer afford to subscribe to journals; while a standard of communication exists (the SI system), we are still in the formative stages of establishing a standard language for document description in electronic communication. The leadership to provide centralized management of electronic communication resources is sadly lacking. That is, the technology of the information society presents problems that are not impossible to solve with the help of industry, R&D, and the government. But the political, organizational, and proprietary problems of electronic information processing are considerable--and perhaps the greatest obstacle to the success of the electronic journal.

Because the electronic journal makes so much information available to anyone with a computer and a modem, centralizing online information will soon become a problem. Who decides where and how to store the vasts amounts of information produced by the microelectronics revolution? Should the Congress oversee a national online storage center, or should private business be responsible for centralizing information? Will the military establishment have control over information it considers classified? And will the technology industry (for example, companies like Martin Marietta, Sperry Corporation, Boeing Corporation, and others) limit access to information they consider proprietary? Clearly, a need exists for qualified leadership to devise an information policy concerning the storing, publishing, and protection of electronic information.

To better understand the success of electronic journals, we must again examine the three purposes of the standard journal: 1) to disseminate new information quickly, 2) to act as an archive of information for researchers, and 3) to serve as a means of awarding prestige and recognition for scientific achievement.

5.1.1 Disseminating Information

As a conduit for transmitting information quickly, the electronic journal is without equal. A researcher at Sandia National Laboratory can put her information online almost immediately, and a coworker with the proper computer clearance at Pacific National Laboratory or in Washington D.C. can review and comment upon the information in a matter or hours or minutes (and not weeks or months). This ideal situation exists, but not to the extent that it should. The more typical case is that an article is accepted for publication by The New England Journal of Medicine online version and placed in electronic storage in a matter of days. The record of that article is thus available almost immediately after acceptance. A subscriber may view all of the contents of the article within days or weeks after its acceptance. Of course, the reader must still request visuals by mail, but this problem will be solved with improvements in graphics storage and transfer technology.

5.1.2 Storing Information

This is perhaps the electronic journal's main strength. Because storing articles online amounts to creating a huge database, electronic journals are an immense bibliographic resource. Once the information is captured, it may be stored and restructured in many ways. Thus, information stored online acquires dynamic characteristics. It can be changed to suit particular purposes: Abstracts may be stored separately; keywords can be isolated and listed; headings can be searched and listed; particular equations, paragraphs, subjects, and remarks may be searched; information can be updated or deleted, thus extending the life of a scientific article or report.

As mass storage becomes affordable, scientific facilities can keep huge amounts of data within reach. Facilities that cannot keep information online can gain access to electronic archives through telecommunication networks. In this way, large scientific concerns such as NASA can centralize information storage and still access that information from almost any part of the world, whether it be a tracking station in Australia or a research center in Virginia.

One of the criticisms aimed at electronic journals is the efficacy of the storage medium. How, exactly, does one store the information? Is current information stored differently from older, less used information? How reliable are storage facilities? The answer to the problem of information storage has for its answer (in part) the laser storage medium. Such a medium (similar in some respects to the current Compact Disk audio technology) can store immense amounts of information. Its strengths are that it can store visual and textual information. The weakness, so far, is that information can only be written once; the information cannot be changed once it is written to the disk. This limitation, however, will soon be bypassed as companies such as Sony develop methods of changing information on laser disks.

For the time being, however, electronic journals can store archival information on laser disks. More current information can be stored on hard disks based on established technology. This current information is backed up on tape and, when needed, on hard copy (paper or microform).

5.1.3 Prestige and Recognition

A serious obstacle to the success of the electronic journal is the feeling by scientists, researchers, and other publishing professionals that an article published in an electronic journal does not bring to the author the level of prestige and recognition that an article published in a paper journal brings. After all, why should a scientist publish in a newly established, little known electronic journal when he or she can publish in a paper journal read by colleagues across the nation or the world?

The scientist who prefers the paper journal would argue that the colleagues who work in the same area of study have access to the early drafts of the article via informal channels of communication--such as personal communication (letters or telephone) and professional meetings. The true weight of the information is felt before the information is published, not afterward. Publishing thus becomes an act of staking out territory, of saying officially "Here is my contribution--now give me my reward."

Of course, the other side of the coin must not go unnoticed. In Israel, medical researchers have developed (as of Summer 1985) a method for treating Acquired Immunodeficiency Syndrome (AIDS) in its early stages. Medical researchers in the United States and Europe know nothing about this new treatment, however, because the results have not been published--and may not be published for some months to come. If this information were available online, then doctors in the United States could learn of its use and development and offer their own contributions to further development of the treatment. A journal such as The New England Journal of Medicine, which has online capabilities, could publish preliminary findings in a matter of days or weeks, and a more thorough (though less current) article could be published in paper within 3 to 6 months.

Still, the feeling that electronic journals do not provide the kind of prestige found in established scientific and technical journals will continue to hinder the scientific community's acceptance of electronic publication. This feeling is summed up in the actions of a potential publisher of electronic journals, Comtex. This company, founded in 1981 by a number of entrepreneurs including noted researcher Fredrick Plotkin, attempted to create a network of electronic journals in all areas of science. However, by 1983 the company had lost the guidance of Plotkin and had redirected its energies toward more commercial areas of electronic publication. The company's Annual Report for 1983 tells the story:

> The Company experienced strong resistance from the scientific community which for a number of reasons tended to follow traditional scientific publishing patterns.
> The Company found that scientific authors were generally unwilling to provide the Company with their original unedited research documents for electronic publication and preferred to solicit comments from their colleagues, re-edit the work in progress and then publish through traditional hard copy mediums.
> In addition, the Company found that many research scientists were concerned that established scientific publishers would no longer publish their work if they published their preliminary work through the Company's ASR (Advanced Scientific Research) system. The Company was directly advised of this fact by certain publishing entities.... Potential contributors were extraordinarily proprietary with their material and indicated to the Company that they preferred to wait until the article was published through established journals.
> (Comtex 2)

The scientific community must overcome its inertia, its unwillingness to accept electronic publication on grounds of the increased professional status accorded to publishing in traditional journals. With time, scientists and other potential authors will accept electronic publication if it offers the usefulness connected to paper publishing. Until that time, however, online journals will have to struggle for their place in the publishing arena.

One means of gaining acceptance is to publish material both on paper and online, like The New England Journal of Medicine and the journals associated with the American Chemical Society. Another way is to find a niche, a type of publishing that does not threaten the traditional journal but that gives authors the chance to discover the advantages of electronic publishing. An example is electronic publication of less formal articles--abstract or synopsis journals, for instance, or a newsletter, or perhaps a bulletin board of comments on work in progress or other professional interests. Once authors became used to these less formal publications, they would find the transition to formal online journals less traumatic, and thus less threatening.

5.2 The Future of the Electronic Journal

In his examination of scientific and technical journals in the United States, Donald King states that publishers in America have the capability to establish a completely electronic system for writing, storing, and retrieving scientific articles (King 44-45). He points out that the already burdened traditional system of publishing scientific information will have to deal with increasing numbers of authors publishing in their disciplines (King 285). Some fields, such as the environmental and life sciences, will face publication increases of up to 79%. Thus, we see that the current system of publishing scientific information in the technologically advanced nations is overloaded. The increased use of microelectronics in telecommunications and data storage has helped to ease the burden on the information transfer system, but much needs to be accomplished before we can say that the communication channels in science are capable of dealing with the current and forecasted amounts of information they must handle.

And when will the channels return to normal? In 1975, the information specialist J.W. Senders stated that "the electronic journal represents a fairly profound shift in our approach to scientific information transfer.... All in all, it will probably take...20 years to really establish the concept and technology of the electronic journal..." (Senders et al 160). Ten years have elapsed since that time, and it appears that the technology has nearly become established. What remains, however, is for users to accept the changes and adapt to new ways of writing and publishing scientific information. Important changes need to be made for electronic information transfer to become truly useful, as the paragraphs below show.

5.3 **What Remains To Be Done?**

1. Telecommunications. The cost of telecommunications must decrease. Establishing telecommunications links in the United States has lagged behing the introduction of new

computer technology. The communication industry (AT&T and GTE, for example) is in the process of settling legal issues that will affect the size and makeup of the industry. The problems of placing satellites and making fiberoptics cost effective continue to slow the advancement of communication links between electronic publishers and authors. Applying "computer network technology to information retrieval systems, including the electronic journal" (Senders et al. 162) should therefore take high priority in the communications industry.

2. External Constraints. These constraints affect the physical characteristics and distribution of the hardware. For example, how will the telecommunications network be structured--where will the transfmitting centers be placed? How many terminals will be needed to make electronic publication work effectively? What kinds of terminals should be used?

The problem of terminals should not be ignored because it is here that major differences between using paper journals and electronic journals are strongly noticed. The author spends all her time writing at the terminal, and the reader spends most of his time reading and searching at the terminal. Thus, the displays readers and writers use must be designed according to their needs. The displays must have advanced graphics capabilities and must not strain the readers' eyes. To a great extent, then, hardware developers must consult users to provide the most efficient and ergonomic equipment for terminals.

3. Internal Constraints. These constraints affect the use of the electronic journal. For instance, the am ount of work expected of the system must be known--"that is for a given subscriber base, what will be the expected load on the system, and how will it vary through the day and week" (Senders et al. 168). Also, how many private and institutional subscribers will be supported? This number will seriously affect the cost of using the system. Private users will be unable to pay high costs institutions pay for journal subscriptions, but researchers hope that the factors affecting the cost of the electronic journal will remain manageable and predictable. Researchers must determine the length of the average session with an electronic journal. For instance, will most readers simply be browsing through data, or will they be conducting searches for selected material or receiving hardcopies for extended sessions? And how much manipulation of data will occur? That is, will users' searches through the online data be bibliographic in nature, involving the selection of key paragraphs, abstracts, outlines, and visuals?

Furthermore, users will need searching aids that are simple to understand (<u>not</u> written with programmers in mind) and quick to use. They will have to interact with a complicated command language that must be multilayered:

novice users will want to interact with easily understood command words and plenty of help screens; more experienced users will bypass this level of the command language and interact with a faster and probably more complicated command language. The system will probably need tutorials to help first time users. These subroutines must be built with almost every level of expertise in mind, in order to anticipate problems novices and experts will encounter.

5.4 Wes Jackson and Information Management

Standing in the shadows of this discussion is a view of the information world that receives little attention, mainly because it is associated with an agrarian scientist whose comments about our nation's natural resources are often received coolly by conservative thinkers. His name is Wes Jackson, and his thoughts about the land also apply to information; indeed, he has seen fit to compare the threats facing the farmer to threats facing people who must use information.

Jackson's basic ideas are these: We must preserve the land we live on because it nurtures our culture. A great part of learning to manage our natural inheritance is studying what methods of using the land have worked or failed--and why they worked or failed. We must take steps to protect the farming way of life through innovative and not necessarily traditional ways. For instance, Jackson advocates a communal farm economy for most of the nation, one based in part on successful communal farms in Pennsylvannia and in the Midwest. The more traditional, smaller family farm seems to be the best choice, but Jackson shows that such farms have crucial drawbacks that would hinder their success today.

On the information front, Jackson argues thus: Our agrarian culture is also an information culture. It is based on the concept of slow knowledge, the gradual accumulation over generations of knowledge about the way the world works. The destruction of the farming way of life will lead to an end to the culturally vital process of slow knowledge, of passing down from father to son, mother to daughter the way things work, the way the world is structured.

The so-called "information explosion," according to Jackson, is really an information implosion. More knowledge has been lost because of scientific effort than has been gained, mainly because the relatively stable amount of truly vital knowledge has been drowned out by the "noise" of the mass of irrelevant facts and figures that burden the scientist and engineer. Jackson does not offer any stratagies for solving this information dilemma, but his discussion of information culture, slow knowledge, and respect for preserving the fragile information ecosystem should be explored further by information users and information scientists. Researchers would probably gain much from a closer study of Jackson's theories of land and information preservation.

5.5 **Concluding Remarks**

To finish this report, we turn once again to remarks of Donald King.

> We expect that between 1985 and 2000, nearly all article manuscripts will be handled by word-processing and text-editing systems and thus could be sent to publishers in digital form.... The available electronic processes in authorship can also be expected to yield a greater degree of integration of research dissemination than was previously found in informal memoranda, conference papers, technical reports, journal articles, and books, which will substantially improve the quality of dissemination of research results.
>
> (King 289)

The electronic journal is neither a temporary nor an insignificant influence on the creation, processing, and transferring of information in the scientific community. As King shows, electronic text management systems play a vital role in improving the quality of scientific and technical information. My own experience working with authors and editors in a research facility that relies extensively on electronic text management (Oak Ridge National Laboratory) has proven to me that electronic publication is here to stay. More and more, authors simply transmit their articles to editors in digital form. Editors work online, using hardcopy when necessary, and transmit the finished product (after author review) to computerized photocomposition services.

Handling information online reduces error--the keystrokes are captured once, reducing errors created during recopying--and creates a body of information that can be modified, updated, transmitted, and stored with ease. The needs of the scientists will determine the design of the electronic data system, and not the other way around. Researchers will thus use the online journal to solve specific problems in scientific communication and still be able to handle the ever growing amounts of information they must rely upon.

LIST OF REFERENCES

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AMA/GTE Telenet Medical Information Network. Information package describing services of the AMA/GTE medical publishing services.

Anthony, L.J. ed. EURIM 4: A European Conference On Innovation In Primary Publication: Impact On Producers and Users. London: Aslib, 1980.

Balaban, Miriam ed. Scientific Information Transfer: The Editor's Role. Dordrecht, Holland: D. Reidel Publishing Co., 1977.

Bamford, Harold. "A Concept For Applying Computer Technology to the Publication of Scientific Journals." Journal of the Washington Academy of Science, 62 (1972): 306-314.

Bell, Daniel. "The Social Framework of the Information Society." In The Microelectronics Revolution, ed. Tom Forester.

Bernal, J.D. The Social Function of Science. Cambridge, Massachusetts: The MIT Press, 1939; rpt. 1967.

Carson, J. and H.V. Wyatt. "Delays in the Literature of Medical Microbiology: Before and After Publication." Journal of Documentation, 39(September 1983): 155-165.

Comtex Corporation. Form 10-K: Annual Report for Fiscal Year Ending March 31, 1983--Comtex Scientific Corporation. File #2-72408-NY. Securities and Exchange Commission.

Crane, Diane. Invisible Colleges: Diffusion of Knowledge in Scientific Communities. Chicago: The University of Chicago Press, 1972.

Economics of Scientific Journals. Edited by an ad hoc Committee on the Economics of Publishing, D.H.M. Bowan Chairman. Bethesda, Maryland: Council of Biology Editors, 1982.

Electronic Manuscript Project: Author Guidelines For the Preparation, Creation and Exchange of Electronic Manuscripts. Association of American Publishers, 1985.

Fersko-Weiss, Henry. "Data Storage: How Much Do You Need?" Personal Computing, June 1985, 9(6):64-71.

Garfield, Eugene. The Use of Citation Data in Writing the History of Science. Philadelphia: Institute of Scientific Information, 1964.

Garrison, Fielding H. "Journalism, Medical." In A Reference Handbook of the Medical Sciences, Thomas L. Stedman, ed. 4th Edition. New York: William Wood and Company, 1933, 706- 712.

Garvey, W.D., Nan Lin, and Kazud Tomita. "Research Studies in Patterns of Scientific Communication: III. Information Exchange Processes Associated with the Production of Journal Articles." In The Scientific Journal. A.J. Meadows, ed. Dorchester, England: Dorset Press, 1979.

Goffman, William. "The Ecology of the Biomedical Literature and Information Retrieval." In Coping with the Biomedical Literature, K.S. Warren, ed. New York: Praeger Publishers, 1981, 31-46.

Goffman, William. "A Pragmatic Approach to Literature Selection." In Selectivity in Information Systems: Survival of the Fittest, K.S. Warren, ed. New York: Praeger, 1985, 117-143.

Goldberg, Kay. Personal Correspondence, 7 June 1985.

Hertzberg, R.Y., J.A. Schultz, and J.F. Wanner. "The PROMIS Network." Computer Networks, Oct. and Nov. 1980, 4(5)215-228.

Hlava, Marjory. "The NASA Information System." In Second International Online Information Meeting: London, 5-7 December 1978. Oxford, England: Learned Information Ltd., 1978, 251-256.

Houghton, B. Scientific Periodicals: Their Historical Development, Characteristics and Control. Hamden, Connecticut: Limnet, 1975.

Hunter, Karen A. "Electronic Delivery of Scientific Information." Drexel Library Quarterly, Summer 1984, 20(3):75-86.

Kendrick, B.L. "RLMS Technology Committee: Image Storage, Document Delivery, and Electronic Publishing--ALA

Conference, 1983." Library of Congress Information Bulletin, 42(August 22):281-283.

King, Donald W. Scientific Journals In the United States: Their Production, Use, and Economics. Stroudsburg, Pennsylvania: Hutchinson Ross Publishing Co., 1981.

King, D.W. and N.K. Roderer. Systems Analysis of Scientific and Technical Communication In the United States: The Electronic Alternative To Communication Through Paper-based Journals. Rockville, Maryland: King Research, 1978.

Kroenfeld, M.R. and S.H. Gable. "Real Inflation of Journal Prices: Medical Journals, U.S. Journals, and Brandon List Journals." Medical Library Association Bulletin, 71(October 1983):375-379.

Kronick, D.A. "The Fielding H. Garrison List of Medical and Scientific Periodicals of the 17th and 18th Centuries; Addenda et Corrigenda." Bulletin of Medical History, 32(1958):456-474.

Kronick, D.A. A History of Scientific and Technical Periodicals. New York: Scarecrow Press, 1962.

Kronick, D.A. A History of Scientific and Technical Periodicals: The Origins and Development of the Scientific and Technical Press, 1665-1790. Second Edition. Metuchen, New Jersey: Scarecrow Press, 1979.

Kuhn, Thomas. The Structure of Scientific Revolutions. Second Edition. Chicago: University of Chicago Press, 1979.

Lancaster, F.W. Toward Paperless Information Systems. New York: Academic Press, 1978.

Lancaster, F.W., Laura Drasgow, and Ellen Marks. The Impact of a Paperless Society on the Research Library of the Future. NSF Report to NSF Division of Information Science and Technology (NSF Grant #DSI 78-04768). Library Research Center, Graduate School Library Science, University of Illinois, 1980.

Lancaster, F.W. and Herbert Goldhor. "The Impact of Online Services on Subscriptions to Printed Publications." Online Review, 1981, 5(4):301-311.

Lefrere, P. "Editors' Roles in Online Journals." Journal of Research Communication Studies, 1981, 3(1-2): 157-167.

Machlup, F. and K.W. Leeson. Information Through the Printed Word: The Dissemination of Scholarly, Scientific and Intellectual Knowledge, Volume 2: Journals. New York: Praeger, 1978.

Manville, Brook. Does Online Distribution Diminish Print Usage? Unpublished report presented at the National Online Conference, 2 May 1985, New York City.

Manville, Brook. Personal Correspondence, 8 October, 1985.

Mason, Jim. Personal Interview conducted June 1985 at Oak Ridge National Laboratory, Oak Ridge, Tennessee.

McKie, Douglas. "The Scientific Periodical From 1665 to 1798." In The Scientific Journal, A.J. Meadows, ed. Dorchester, Dorset: Dorset Press, 1979, 7-17.

Meadows, A.J, ed. The Scientific Journal. Dorchester, Dorset: Dorset Press, 1979.

Moray, Neville. "Electronic Journals: An Editor's View." In EURIM 4: A European Conference on Innovation in Primary Publication: Impact on Producers and Users. London: Aslib, 1980, 17-19.

Osborne, Adam. Personal Correspondence, 29 May 1985.

Price, Derek J. de Solla. "Networks of Scientific Papers." Science, 149(1965):510-515.

Price, Derek J. de Solla. Science Since Babylon. New Haven: Yale University Press, 1961.

Price, Derek J. de Solla. Little Science Big Science. New York: Columbia University Press, 1963.

Price, Derek J. de Solla. "Terminal Librarians and the Ultimate Invention." In EURIM 4: A European Conference on Innovation in Primary Publication: Impact on Producers and Users. London: Aslib, 1980, 103-106.

Project Plan and RFP for Electronic Manuscript Project: EMP Document #1. Association of American Publishers, 1983.

Relman, Arnold S. "Journals." In Coping With the Biomedical Literature: A Primer for the Scientist and the Clinician, K.S. Warren ed. New York: Praeger Publishers, 1981, 67-78.

Roistacher, R.C. "The Virtual Journal." Computer Netetworks, 2(1978):18-74.

Roistacher, R.C. "The Virtual Journal: Reaching the Reader." In The Role of the Library in an Electronic Society: Proceedings of the Sixteenth Annual Clinic on Library Applications of Data Processing, F.W. Lancaster ed. Urbana: University of Illinois, Graduate School of Library Science, 1980, 16-22.

Ruddle, Frank H. "The William Allan Memorial Award Address: Reverse Genetics and Beyond." The American Journal of Human Genetics, 36(1984):944-953.

Senders, John W. "The Electronic Journal." In EURIM 4, L.J. Anthony ed. London: Aslib, 1980.

Senders, John W. "An On-Line Scientific Journal." The Information Scientist, 2(1977):3-9.

Senders, John W. et al. Scientific Publications Systems: An Analysis of Past, Present and Future Methods of Scientific Communication. Toronto: Toronto University, 1975.

Shephard, David A.E. "Some Effects of Delay in Publication of Information in Medical Journals, and Implications for the Future." In The Scientific Journal, A.J. Meadows ed. Dorchester, Dorset: Dorset Press, 1979, 88-93.

Smith, Joan M. Computer Languages for the Processing of Text. n. d. and n. p. BSI/OIS/18/-/8 N.

Standard 101-1983 Document Markup Metalanguage: GENCODE and the Standard Generalized Markup Language (SGML). Graphic Communications Association, 1983.

Trubkin, Loene. "Migration from Print to Online Use." Online Review, 1980, 4(1):5-12.

Turoff, Murray. "The EIES Experience: Electronic Information Exchange System." Bulletin of the American Society for Information Science, 1978, 4(1):9-10.

Turoff, Murray and S.R. Hiltz. "Electronic Journal: A Progress Report." American Society for Information Science Journal, 33(July 1982):195-202.

Van Slype, Georges. "Impact of New Technologies on the Publications of Learned Societies and Other Specialist Periodicals: An Ergonomic Approach to the Reading of Scientific and Technical Journals." In EURIM 4, L.J. Anthony ed. London, Aslib, 1980, 53-56.

Vogel, Ezra. "The Changing Nature of Information Societies." Lecture given at the International Conference on 5th Generation Computer Systems, Tokyo, November 1984. To be published.

Warren, Kenneth S. Schistosomiasis: The Evolution of a Medical Literature: Selected Abstracts and Citations, 1852-1972. Cambridge, Massachusetts: The MIT Press, 1973.

Warren, Kenneth S. "Selective Aspects of the Biomedical Literature." In Coping With the Biomedical Literature: A Primer For the Scientist and the Clinician, K.S. Warren ed. New York: Praeger, 1981, 17-30.

Warren, Kenneth S. "Selectivity Within the Ecosystem of Scientific Communication." In Selectivity In Information Systems: Survival Of the Fittest, K.S. Warren ed. New York: Praeger, 1985, 3-9.

Woodward, A.M. "Editorial Processing Centres: A View From the United Kingdom." In Scientific Information Transfer: The Editor's Role, M. Balaban ed. Dordrecht, Holland: D. Reidel Publishing Co., 1977, 9-20.

APPENDIXES

APPENDIX 1

EXAMPLE TAGGED BOOK MANUSCRIPT

USING AAP AUTHOR GUIDELINES

KEYBOARDING CONVENTIONS

The following is an extract used with permission from "Organizational Burnout in Health Care Facilities," Chapter 4 - Implications of Personal Burnout, Earl A. Simendinger and Terence F. Moore. Copyright © 1985 by Aspen Systems Corporation.

2/11/85

This example tagged book manuscript uses the maximum amount of markup minimization and keyboarding conventions. An explanation of the markup minimization and keying conventions follows:

1. The following specific keyboarding conventions have been used:

Convention	Description	Tag or Multi-character Reference
(...)	ellipsis	&ELP;
-	en dash	&NDSH;
--	em dash	&MDSH;
"	quotation	<Q>text</Q>
[return] [return]	start paragraph	<P>

2. This manuscript contains a figure and two tables. The assumption used for the markup was that they would be treated as paste-ins. The author has tagged each graphic in text immediately following the tag referencing it. Since the physical placement of the graphics is usually not known until the page makeup stage, the location of the graphic tag is flexible. The important thing is that the author be consistent.

   In this example, the author has used tags for the graphics which contain three "attributes": height, width, and ID. The height and width are in inches. But, there are other ways the figure and tables could be handled in a manuscript. For instance, the author might not deal with the graphics at all but might let the editor indicate the location and provide measurements. Or, the graphics could be machine-generated, and an attribute specifying the storage location or filename would be referenced by the tags.

3. A number of markup minimization features were used in the manuscript: omission of end-tags where possible; the use of short tags (</>); and omission of tag attribute names where possible. The rule for short tags is that it is the end-tag for the most recent start-tag only. If an end-tag is omitted when it is required or a start-tag is not placed where it should be, the result will be some text associated with the wrong tag.

<C><H1>Implications of Personal Burnout

Burned out personnel, collectively, can burn out their organization. Certainly, burned out personnel at any level in an organization have a negative effect on the organization's total performance. Therefore, it is important to understand what constitutes personal burnout and how it influences individual and organizational performance.
<H2>CAUSES OF PERSONAL BURNOUT

Personal burnout is so closely associated with stress that the two terms are often used synonymously. There are psychosocial causes of stress, bioecological causes of stress, and personality causes of stress.

Psychosocial causes of stress include divorce, business readjustment, and retirement. Bioecological causes of stress include nutritional habits, noise pollution, and biological rhythms, which "can be viewed as natural fluctuations in body processes which promote survival by automatically dictating that periods of high energy be interspersed by periods of restorative rest. Generally speaking, biological rhythms are fixed by generations of genetic programming, but they have a built-in flexibility to allow maximum adaptations, thus increasing survival. As the seasons change, so does the amount of heat and light imposed on the body, so metabolic and hormonal adaptation is required. The biological rhythm that controls these processes has the ability to change--probably using the changing light as a trigger, although the exact mechanism is not known for certain.<FF A>"

Bob Lyons differed from the rest of us only in degree and only because of a combination of forces at a given point. Levinson believed that a change in any single force might have prevented it: more and harder work, psychiatric or psychological treatment, no vacation adding to his feelings of guilt and uselessness, or his own open recognition of the seriousness of mental illness.
<H2>COPING WITH STRESS

Often described as a silent but pervasive hazard, stress is usually considered a major contributing factor, if not the primary cause, of numerous ailments. Furthermore, there are debates as to which professions and occupations suffer the most from it--air traffic controllers, policemen, accountants (during the tax preparation season), or athletes, for example. Health care administrators undoubtedly rank high on this list because of their continual stress. As one colleague recently commented to a physician who was complaining about being on call, "What is it like not to be on call for anyone at anytime for anything?"

Stress is not always negative. It is a basic, essential demand on the body that does not inevitably lead to unpleasant reactions and outcomes. Those who reserve the right to interpret all stimuli in a way that best serves their conscience and purposes quickly realize that stress is definitely not synonymous with distress. Choices are available. In other words, an individual's attitude can have a positive or negative effect on his or her reaction to stress.

Some experts believe that people differ in their ability to cope with stress-producing situations. The more successful individuals appear to be distinguished from those less successful by their awareness of the stress potential in the situation, their sensitivity to their own reactions, and their capacity for alternate responses. Successful coping seems to be a skill that involves an ability to adapt to difficult situations.

Howard and several colleagues determined the effectiveness of various techniques in coping with stress.<FF B> They found that the six best techniques for coping with job stress were as follows:
<L>1. Build resistance by regular sleep, exercise, and good health habits.
<L>2. Compartmentalize work and nonwork life.
<L>3. Work hard on the job, but when at home, learn to blank out job problems.
<L>4. Engage in physical exercise.
<L>5. Talk through problems on the job with peers; have <E2>bitching</> sessions.
<L>6. Withdraw physically from the situation for a while; take a break.</LT>

Managers must realize that they cannot do everything that needs to be done, no matter how well they are organized. Accepting this, executives should focus on those areas where they can contribute the most.
<H3>The Role of the Manager in Preventing Stress

It is not enough for administrators to take care of their own physical and psychological well-being. They must also ensure that their subordinate managers are not placed in unduly stressful situations because of their managerial responsibilities.

Some administrators and assistant administrators resort to <E2>scare tactics</> and other petty activity in managing their subordinates. One carried this approach to an extreme and focused attention on such things as alingment of the chairs in meeting rooms and <E2>white glove</> inspection in the hospital. On several occasions, the entourage of followers who accompanied him on these inspections were berated while he tore off venetian blinds that were dusty. On one occasion, while touring the food preparation area, he tossed several pans on the floor because they had <E2>spots</> on them, even though they had been cleaned.
<H3>Ability to Handle Stress and Success

There has been considerable conjecture about why executives in general and health care executives in particular are successful.<FF C> Most authorities attribute success to specific traits, such as integrity, intelligence, or communication skills. Argyris, however, indicated that at least seven characteristics described as <E2>qualities of success</> can be regarded as techniques that top executives use to offset job strain. All seven were described by Uris:<FF D>
<L><E1>Frustration tolerance.</> "All that work and nothing to show for it," is a statement that often precedes executive rage and frustration. But the successful performer is able to work hard on a project knowing that his hard work might gain him nothing in the end. In other manifestations of the same frustration tolerance, executives accepted a temporary frustration--not being able to realize immediate objectives, for example, in order to achieve long-range goals. The frustration resistance of successful executives was shown by

their ability to avoid blowing up under the needling of small provocations. When they found it necessary to hold back their feelings, they were able to do it without paying the price in emotional upsets that impaired clear thinking.
<L><E1>Encouraging participation.</>The effective executive shucks off pressure by encouraging his subordinates to share in the control and development of the department. Especially noteworthy: subordinates were permitted to discuss and pull apart decisions without the executive feeling that his personal worth was being threatened. Acceptance of suggestions and criticism of others applies both up and down the line. The executive, in dealing with his superior, uses the same open discussion of problems and decisions without in any way lessening his sense of responsibility.(...) Two things are clear. Participation by subordinates makes it possible for the executive to sit back and be more judicious and objective in his consideration of problems. The ideas, the back and forth discussions, have the obvious virtue of assisting the executive in arriving at an understanding and a solution to operating problems.
<L><E1>Realistic goal setting.</>It's human nature to try for perfection, particularly when the concept of efficiency is accepted as a standard. In that case, error and failure become pressure producers. Successful executives, however, are satisfied if they can move toward perfection and do not fret if their efforts fall short. It's in this connection that sound goal setting becomes a key to effective handling of executive responsibility. Executive well-being developed when energies could be directed toward a goal sufficiently challenging to create a will to fight, but one that could be reached. Level of aspiration, in other words, was in line with capabilities and the realities of the situation<NXR N1> <NTX N1>Reprinted with permission from <TI>The Effective Executive,</> <PGN>pp. 270-275</>, by Owen Uris. Copyright (C 1958, McGraw-Hill Book Company.</NTX>
<H2>TOP MANAGEMENT TURNOVER IN HOSPITALS

When a baseball team loses game after game, the coach and perhaps some players are replaced--seldom does the franchise go out of existence. When the board of directors perceives an inordinate gap between performance and the potential for an organization, the chief executive officer and other administrators often become casualties.

A survey conducted by Witt Associates, a well-known consulting firm, revealed that, nationally, 17 percent of all hospital administrator turnover was caused by involuntary termination<FR F4>.<FF E><FG h=3.25in w=4.5in ID=F4>
Resignation and retirement were the leading reasons for turnovers in the chief executive officers of all types and sizes of hospitals. Following that came involuntary termination; reorganization, death, or new position; and promotion. Such data on turnover in other similar-sized industries are not available, but it appears that hospitals are particularly precarious places for executives. Witt found that the overall <E2>tenure</> for an administrator in an investor-owned hospital was about three years; in a nonprofit hospital, it was about eight years. The higher turnover rate in investor-owned hospitals can, in part, be attributed to their smaller size and the fact that upwardly mobile hospital administrators are more likely to move on to larger hospitals.

The president of the Massachusetts Hospital Association, David Kinzer, began analyzing executive turnover in hospitals when he realized that, over seven years, only 41 percent of the hospitals in Massachusetts had the same chief executive officer.<FF F> Kinzer probed further with his colleagues in other hospital associations and found that <E2>survival rates</> were even lower in other states<TR T2>.<TB ht=2.75in wd=4.5in ID=T2>

The next logical step for Kinzer was to examine the causes for the turnover in chief executive officers. He found that 186 executives had been terminated of a total of 851 who had left a position<TR T3>.<TB ht=2.75in wd=4.5in ID-T3>
That represents a termination rate of almost 22 percent during this seven-year period of time. Kinzer stated that even those figures are misleading. Many so-called <E2>retirements</> are actually departures in which administrators just packed their bags and fled, vowing publicly that they will never again have anything to do with hospitals.

Board insecurity, of course, is not unique to small hospitals. Many boards have long functioned under what are generally recognized as <E2>their management perogatives.</> Boards with this philosophy really did not want, and usually did not hire, a strong administrator.

Most likely, all these terminations are not the direct result of some well-defined cause relating to executive failure or increased organizational burnout; regardless, they remind one of the jingle about the good driver who died:
<E9>He was right,
Dead right,
As he sped along.
But he is just
as dead as if he had been wrong.</E9>
<H2>CONCLUSION

Personal burnout that affects organizations adversely may occur when employees are allowed to remain in a position of authority long after they have reached their prime (common when the owner is the chief executive officer) or when individuals throughout the organization suffer physical and mental burnout. The emphasis currently being placed on wellness and fitness by many progressive companies and even by hospitals is probably worthwhile, but it is as difficult to quantify the results of such efforts as it is to determine the level of personal burnout in an organization. Organizations have a responsibility, however, to recognize personal burnout in employees and attempt to reduce it wherever possible. Doing so reduces the potential for organizational burnout.

<FN A>Daniel Girdano and George Everly,<TI>Controlling Stress and Tension</>(Englewood Cliffs, NJ: Prentice-Hall, 1979), 86.</FN>
<FN B>John H. Howard, (paper presented at the Second International Symposium on the Management of Stress, Toronto, Canada, November, 1980).</FN>
<FN C>See, for example, Terence F. Moore and Walter Wentz <H>Administrative Success: Key Ingredients,</> <TI>Hospital and Health Services Administration</> Special II, (1981):35-93.</FN>
<FN D>Owen Uris, <TI>The Effective Executive</> New York: McGraw-Hill, 1958), 270-275.</FN>
<FN E>John Witt, <H>17% of CEO's Fired Revealing Pressure of the Job,</> <TI>Modern Healthcare</> 12(August 1982):103-106.</FN>
<FN F>David Kinzer, <H>Turnover of Hospital Chief Executive Officers: A Hospital Association Perspective,</> <TI>Hospital and Health Services Administration</>, (May-June 1982):60-64.</FN>

APPENDIX 2

The following four pages are sections of the preceding marked up manuscript which have been extracted from the published version of the book.

Howard and several colleagues determined the effectiveness of various techniques in coping with stress.[17] They found that the six best techniques for coping with job stress were as follows:

1. Build resistance by regular sleep, exercise, and good health habits.
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. . .

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1. *Frustration tolerance.* "All that work and nothing to show for it." is a statement that often precedes executive rage and frustration. But the successful performer is able to work hard on a project knowing that his hard work might gain him nothing in the end. In other manifestations of the same frustration tolerance, executives accepted a temporary frustration—not being able to realize immediate objectives, for example, in order to achieve long-range goals. The frustration resistance of successful executives was shown by their ability to avoid blowing up under the needling of small provocations. When they found it necessary to hold back their feelings, they were able to do it without paying the price in emotional upsets that impaired clear thinking.

TOP MANAGEMENT TURNOVER IN HOSPITALS

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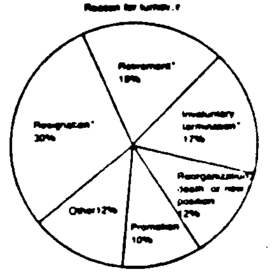
A survey conducted by Witt Associates, a well-known consulting firm, revealed that, nationally, 17 percent of all hospital administrator turnover was caused by involuntary termination (Figure 4–1).[20] Resignation and retirement were the leading reasons for turnovers in the chief executive officers of all types and sizes of hospitals. Following that came involuntary termination; reorganization, death, or new position; and promotion. Such data on turnover in other similar-sized industries are not available, but it appears that hospitals are particularly precarious places for executives. Witt found that the overall "tenure" for an administrator in an investor-owned hospital was about three years; in a nonprofit hospital, it was about eight years. The higher turnover rate in investor-owned hospitals can, in part, be attributed to their smaller size and the fact that upwardly mobile hospital administrators are more likely to move on to larger hospitals.

Figure 4–1 Chief Executive Officer Turnover in U.S. Hospitals



*In some cases, CEOs might have been asked to resign or retire early. The "resignation" and "retirement" percentages, therefore, may be artificially high, and the "involuntary termination" percentage too low.

Source: Reprinted with permission from the August 1982 issue of *Modern Health Care Magazine*.

2. *Encouraging participation.* The effective executive shucks off pressure by encouraging his subordinates to share in the control and development of the department. Especially noteworthy: subordinates were permitted to discuss and pull apart decisions without the executive feeling that his personal worth was being threatened. Acceptance of suggestions and criticism of others applies both up and down the line. The executive, in dealing with his superior, uses the same open discussion of problems and decisions without in any way lessening his sense of responsibility. . . . Two things are clear. Participation by subordinates makes it possible for the executive to sit back and be more judicious and objective in his consideration of problems. The ideas, the back and forth discussions, have the obvious virtue of assisting the executive in arriving at an understanding and a solution to operating problems.

. . .

7. *Realistic goal setting.* It's human nature to try for perfection, particularly when the concept of efficiency is accepted as a standard. In that case, error and failure become pressure producers. Successful executives, however, are satisfied if they can move toward perfection and do not fret if their efforts fall short. It's in this connection that sound goal setting becomes a key to effective handling of executive responsibility. Executive well-being developed when energies could be directed toward a goal sufficiently challenging to create a will to fight, but one that could be reached. Level of aspiration, in other words, was in line with capabilities and the realities of the situation.*

**Source:* Reprinted with permission from *The Effective Executive*, pp. 270–275, by Owen Uris.

CONCLUSION

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NOTES

1. Daniel Girdano and George Everly, *Controlling Stress and Tension* (Englewood Cliffs, N.J.: Prentice-Hall, 1979), 86.

. . .

19. Owen Uris, *The Effective Executive* (New York: McGraw-Hill, 1958), 270–275.

20. John Witt, "17% of CEO's Fired Revealing Pressure of the Job," *Modern Healthcare* 12 (August 1982) 103–106.

21. David Kinzer, "Turnover of Hospital Chief Executive Officers: A Hospital Association Perspective," *Hospital and Health Services Administration* (May-June 1982) 60–64.

APPENDIX 3

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APPENDIX 4

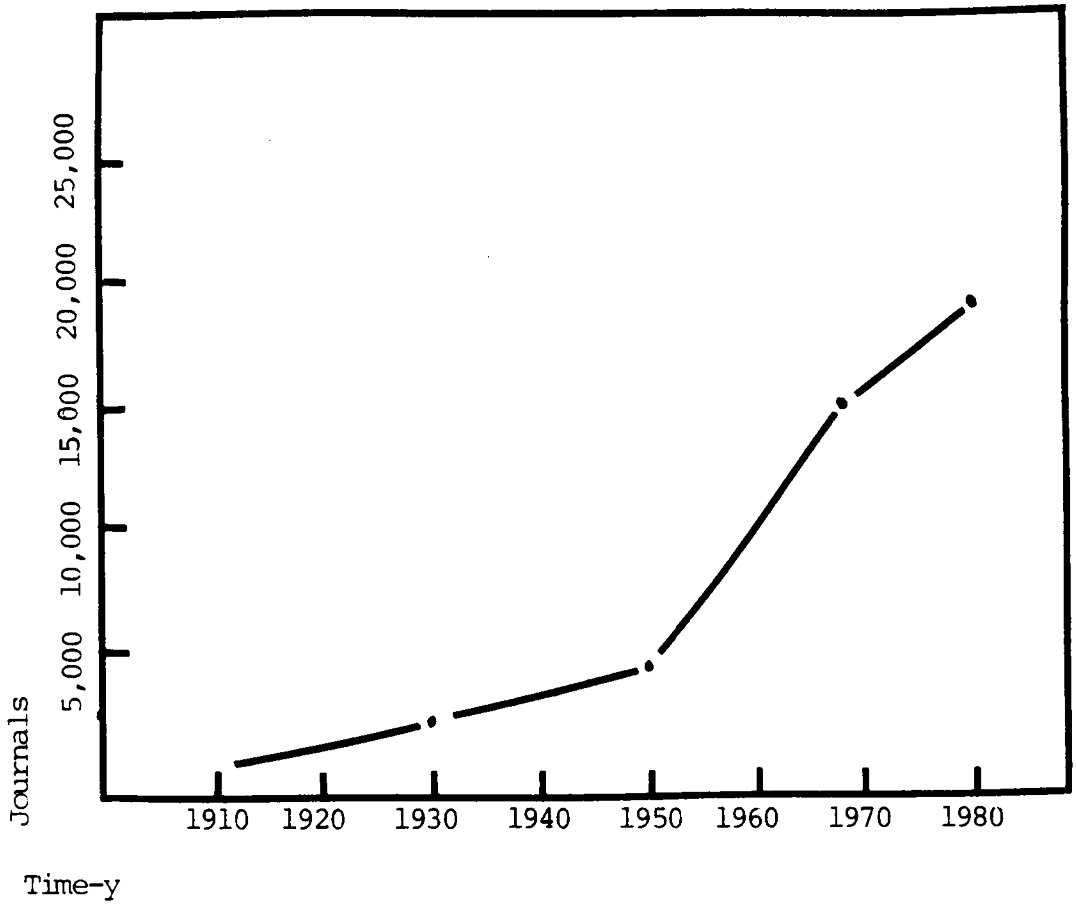

Figure 2.1. Rise in Number of Journals

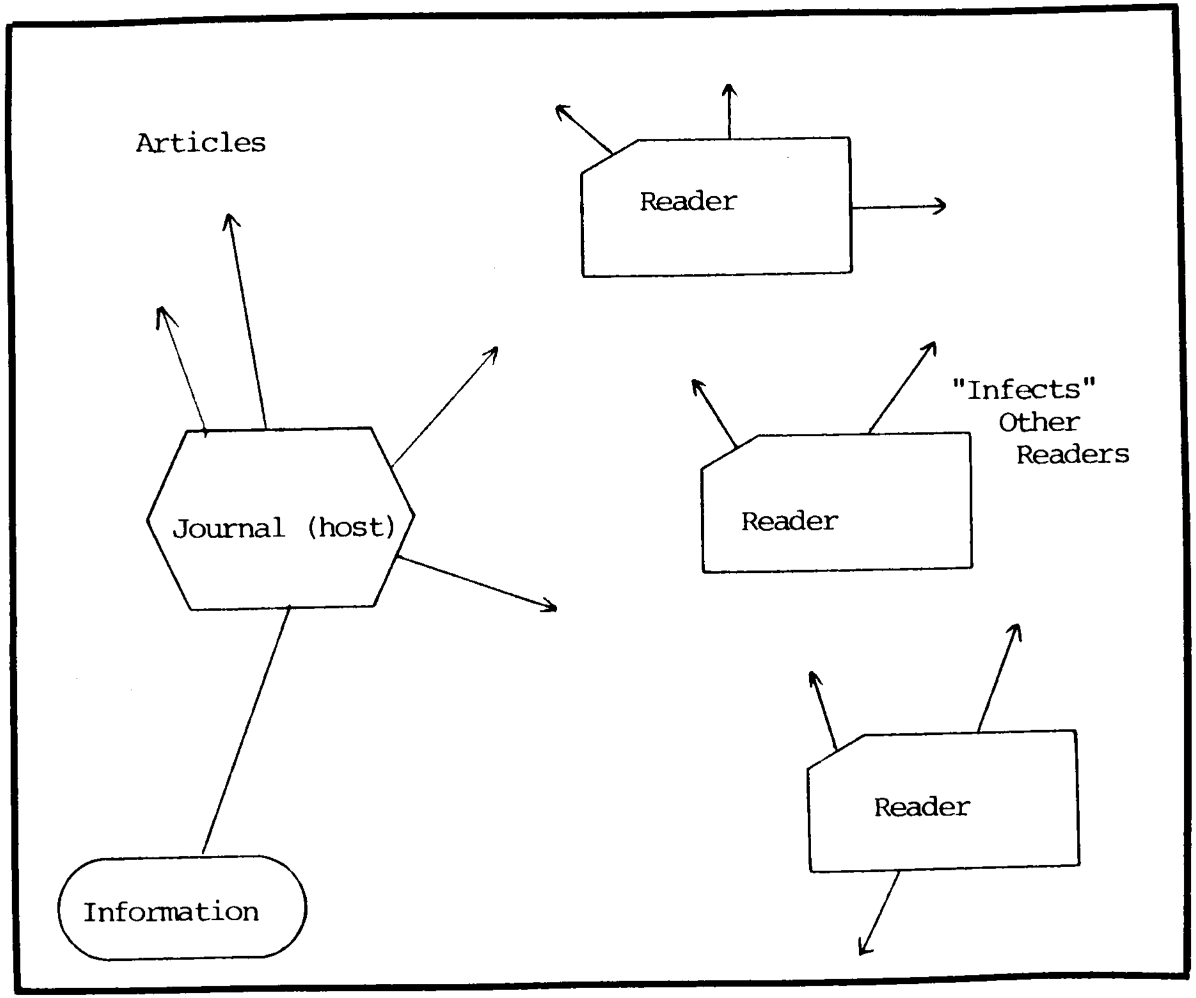

Figure 2.2. The Epidemic Model.

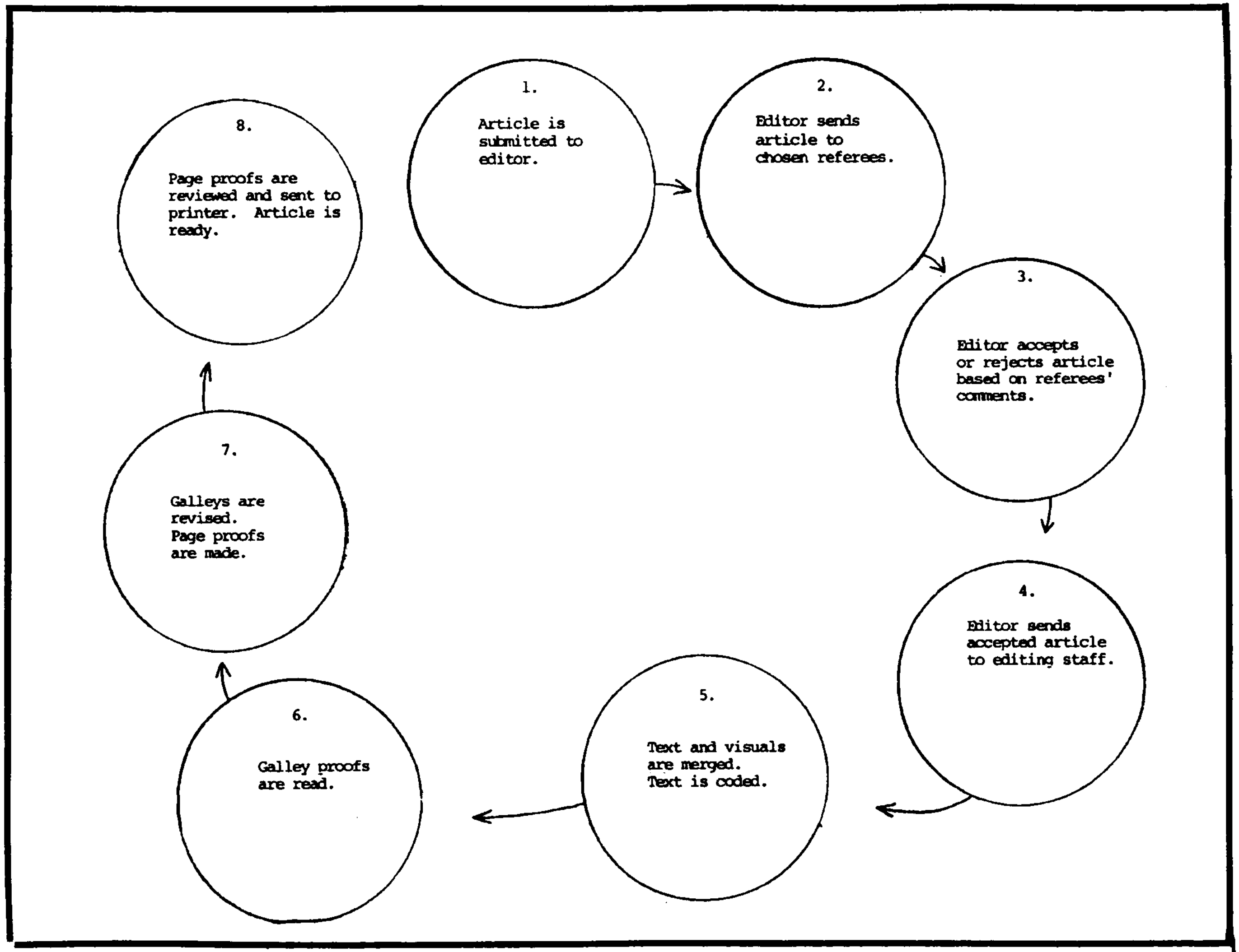

Figure 3.1. The Publication Process

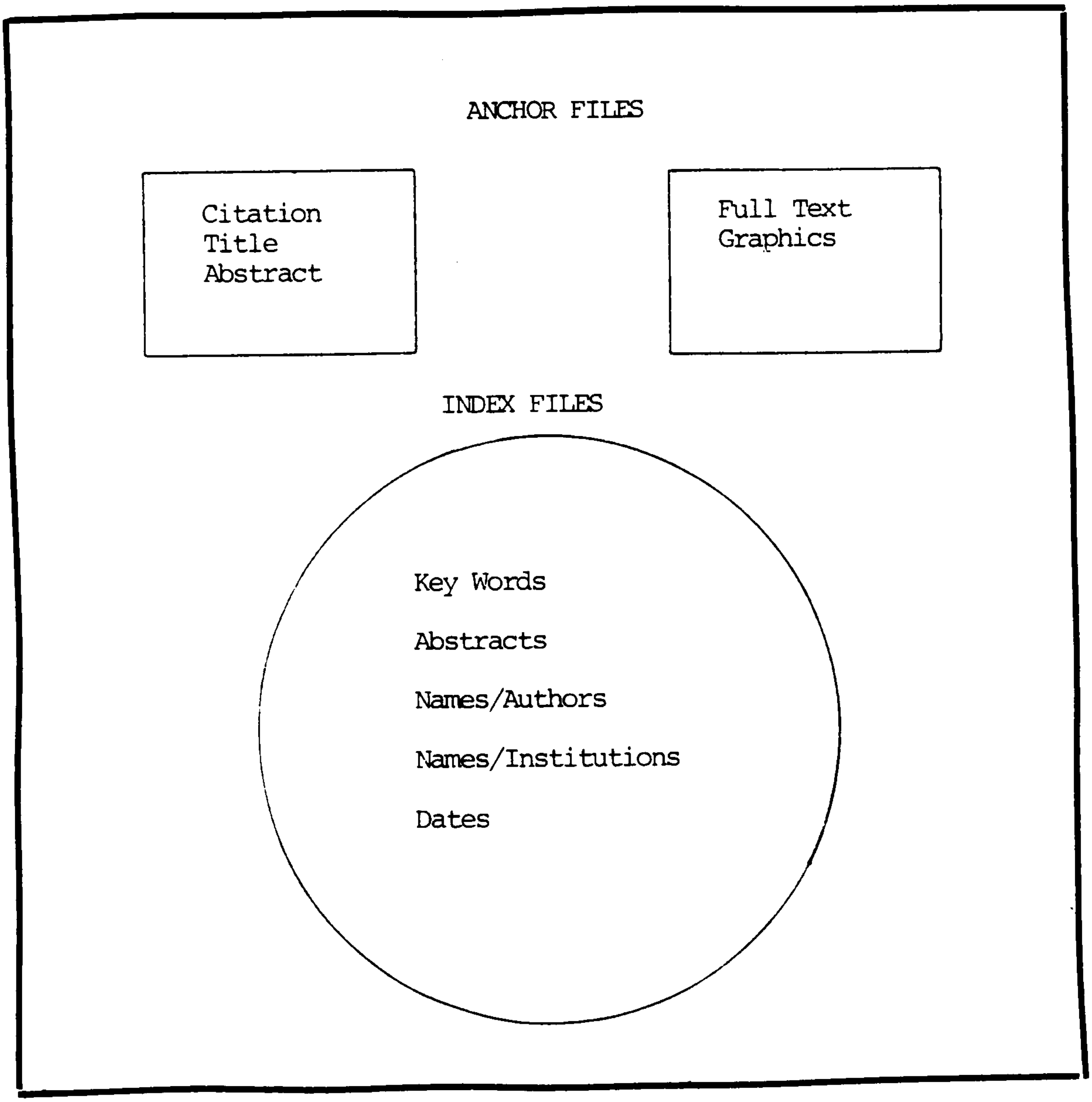

Figure 3.2. File System of an Electronic Journal.

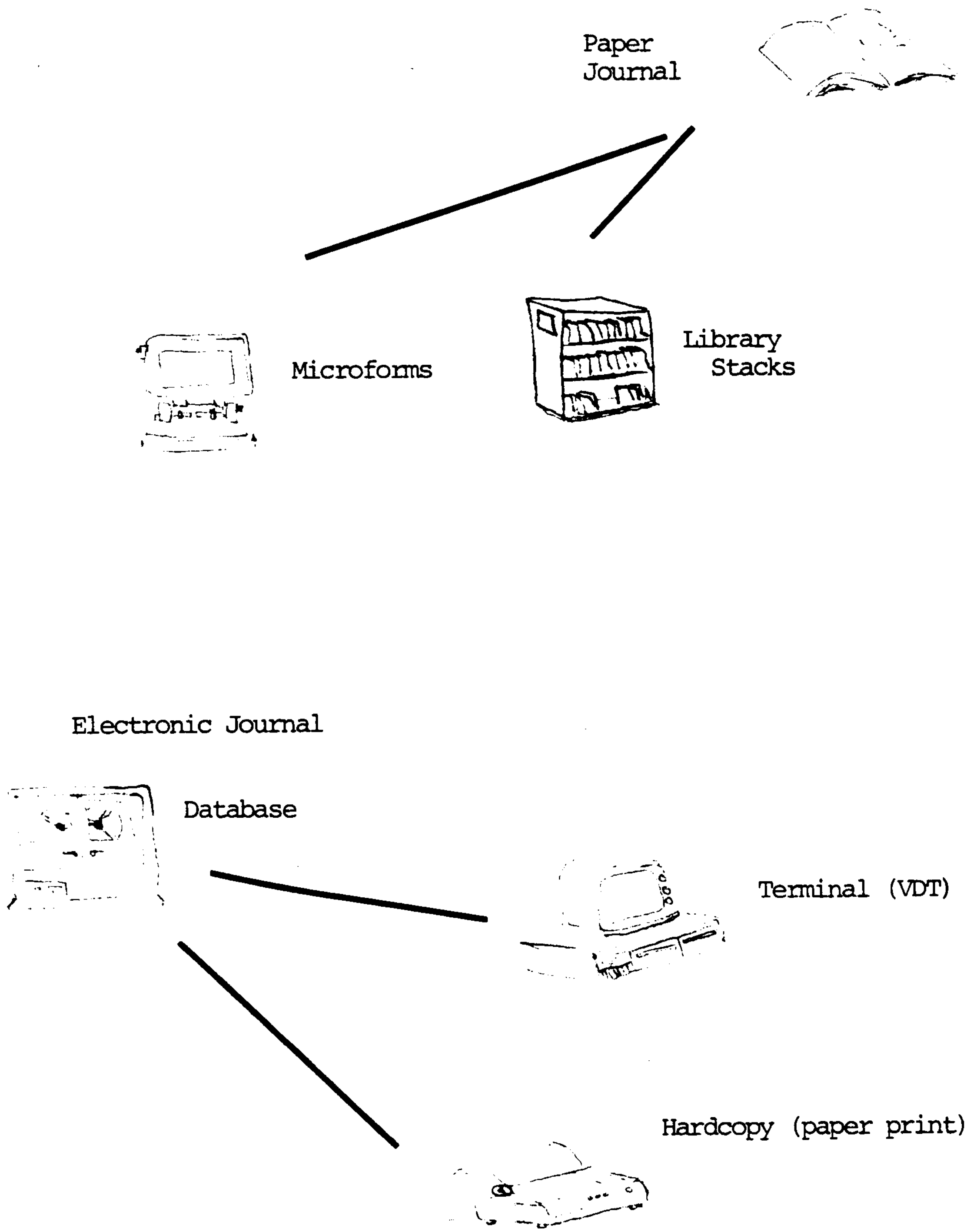

Figure 3.3. Uses of Traditional and Electronic Journals.

VITA

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