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Document-Delivery Systems in the Information Age

Eugene Garfield

In the past twenty years, information technology has radically transformed the way librarians and information scientists search the literature. Computerized indexing methods have made it possible to retrieve bibliographies on virtually any topic in a matter of minutes. This immediate access to bibliographic information is clearly a harbinger of the approaching information age. Many are enthusiastically predicting that when this age arrives, information on essentially any subject will be instantly available.

Unfortunately, document delivery still remains an important stumbling block in our march toward the information age. The computerized databases that instantly tell us a document exists are not backed up by systems for instantaneously obtaining them. If your library does not have the article identified by a database, it can be days or weeks before that article is in your hands. Ironically, computerized databases have compounded the document-delivery problem by increasing demand for foreign, obscure, and highly specialized journals not widely available.

Interlibrary loan (ILL) programs have provided some relief from the frustrations of document fulfillment. But reciprocal borrowing is only a partial and, given current demand, unsatisfactory solution. Librarians are spending increasing amounts of time locating and obtaining requested documents. And, while libraries have traditionally offered ILL as a free service, studies have shown a single loan can cost as much as $20.[1] Formal ILL networks have streamlined this process. But using the computerized databases created by these networks is still too expensive for many libraries. Use of commercial document fulfillment services, such as the Institute for Scientific Information's *Original Article Text Service* (*OATS*®), is growing, now that researchers can electronically order documents from these services. Articles available through *OATS*, for example, can be ordered online through DIALOG's DIALORDER service, SDC's ORBDOC, the ISI Search Network, and soon, BRS.

Henriette Avram of the Library of Congress told me recently that in the United States, some twenty million documents a year are obtained through various interlibrary loan systems. This number is expected to double in just a few years. At the same time, the telephone, mail, and labor costs of ILL will be rising. It is, therefore, imperative that more economic and efficient methods of delivery be developed. Many organizations believe that electronic document-delivery systems will provide the solution. Numerous research projects are currently underway on systems for electronically transmitting the full text of papers and entire journals. But several technological, financial, legislative, and attitudinal problems still block their implementation.

For example, many journals are already electronically typeset and could, conceivably, be transmitted over telephone lines to personal microcomputers. But few libraries, let alone scholars, can afford computers with enough memory to print and store journals or books in an electronic form. Even those who can afford such computers would find that text is delivered fairly slowly and at a high cost. Using display terminals to scan text for long periods can be fatiguing, and the quality of graphics from all but the most expensive computers is still quite poor. Furthermore, the lack of standardization in the electronic formats and codes used makes this problem quite complex. But software is under development that will make all these formats compatible.

Another technology considered promising for electronic document delivery is videotex. With this technology, computer-based information services would use the television set as a display terminal. Among the best-known of these systems is Prestel, an interactive system made commercially available by the British Post Office in 1979 for business and consumer

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use. Although the United Kingdom has spent about $100 million on videotex development, Prestel has not attracted the market initially forecast.[2] The cost of modifying TV sets for videotex is too expensive for most consumers, and the resolution of images, particularly graphics, is poor. As with computer display terminals, only a few lines of text are shown at one time, which makes reading quantities of text slow and tedious. Furthermore, many of the databases available through Prestel are not used by many consumers who are not accustomed to paying for information. This was ISI's experience with a science news service, called SCITEL®,[3] that we supplied to Prestel.

The limited success of systems such as Prestel and the inconvenience of receiving text over computer terminals are indications that widespread, electronic document delivery is still some years off. For the near future, electronic delivery will probably be limited to rapidly needed, disposable information, such as exchange rates, commodity prices, and abbreviated bibliographic information. Much of the research now being done on electronic delivery of full text, therefore, focuses on systems for producing hard copies of documents at the requester's end. Several systems have recently been proposed in which machine-readable documents would be electronically transmitted to a central location, where they would be printed or relayed to a requester's computer.

One such system, proposed by the Commission of the European Communities (formerly the Common Market), couples library networking with electronic document delivery. This concept, called Automatic Retrieval of Text from Europe's Multinational Information Service (ARTEMIS), calls for storing the full text of documents on magnetic tape and transmitting them via telephone wires to central computers at printing centers. At these centers, the full text would be either reproduced and sent through the mail or relayed directly to the requester. Documents electronically transmitted to requesters might be printed out on a videotex machine, copied on a facsimile receiver, or phototypeset in an organization's print shop.

The European Space Agency is considering testing the feasibility of the ARTEMIS concept through a pilot project, called Article Procurement with On-Line Ordering (APOLLO). With APOLLO, documents located through the bibliographic databases accessible through Direct Information Access Network for Europe (EURONET/DIANE) would be ordered through EURONET'S telephone network. These documents would be transmitted by satellite facilities of the European Space Agency to printing centers.

Another technology-based, document-delivery system has been proposed by a consortium of publishers, including Blackwell, Elsevier, Pergamon Press, Springer, and Academic Press. The system they envision is called Article Delivery Over Network Information Service (ADONIS). ADONIS members would provide journal articles in machine-readable form for storage on videodisks. When an article is requested, the computer would locate it on the appropriate disk, and a copy of the original document would be produced. This would be mailed to the requester. The consortium is also considering systems for transmitting papers online or by satellite to a printing center at the requester's end.

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Although systems such as these may eventually solve the document-delivery problem, the fact remains that they are still in a conceptual stage. The entire systems, including full-text databases, must still be assembled at substantial cost. Start-up costs for ADONIS, for example, are estimated to be more than $5 million.[4] Journals that are not electronically typeset will have to be converted into a machine-readable form. Although the technology for this conversion process is progressing well, for the near future this will probably have to be done by the fairly slow keyboard method. Even the more sophisticated optical character recognition machines, which essentially "copy" the document into a computer's memory, do not recognize many of the typefaces or the special characters used by scientific and scholarly publishers. Once these problems are ironed out, database suppliers must determine how much retrospective information to store. Such information takes up computer memory more acutely needed for current information. Most requests for journal articles occur within the first year after publication. Furthermore, systems must be developed for meshing full-text databases with bibliographic systems so users will know where to find documents.

Equipment will present a major problem for the people who use these systems. They will probably want hardware and software that can be used to interact with as many databases as possible. Until equipment has been standardized so that users can retrieve and print text from many databases, people are unlikely to make the substantial investment required.

Many of the obstacles to electronic document delivery are unrelated to technology. Publishers must be convinced that the large capital expenditures required to convert from print to electronic publishing will pay off. Legislation governing copyright of electronic information must be enacted, and international agreements must be reached on transmitting it. Scientists have been communicating on paper for hundreds of years, and it may be some time before they are ready to obtain information over a computer's display terminal. Most electronic, document-delivery systems now envisioned do not preserve the typeface, layout, and graphics of the original documents, so the form of the new electronic information may not be acceptable. In the future, high resolution screens will help overcome some of these problems. Furthermore, scholars who are accustomed to ordering free reprints or receiving documents at no charge through interlibrary loan may not be willing to pay for information. And many will object to being required to provide editors with machine-readable manuscripts.

Unfortunately, electronic delivery of full text is presently little more than a futuristic hope. Such hopes have been dashed many times in the past, as technological developments "just on the horizon" have proved unacceptable or unaffordable. Anyone who worked in a research library some twenty-five years ago will remember the optimism raised by early telefacsimile machines. These machines transmit documents or photos by encoding printed material into electrical signals which are sent over telephone lines. So far, librarians have been disappointed by the expense and slowness of these machines. Most older machines take about six minutes to transmit a single page. Newer machines have cut this time down to twenty seconds. Linking such telefacsimile capabilities to office copiers or microcomputers may increase their use. Unfortunately, the frustrated expectations of earlier years have left a residual resistance to telefacsimile within the information field.

F. W. Lancaster, of the University of Illinois at Urbana-Champaign, places us in the second of a four-phase transition from paper-based to electronic information.[5] We've already progressed from the paper-only phase to a dual phase in which the same information is available in both a paper and machine-readable form. In the third phase, certain publications will only be available electronically. The final phase will be the almost complete conversion to electronic information. When we have entered this phase, in perhaps one or two

decades, electronic "journals" may well become a reality. Manuscripts may be written, edited, and refereed on microcomputers. When completed, they might be directly transmitted to all readers who have expressed interest in the subject matter. Rather than subscribing to complete journals, you will subscribe to a selective dissemination of information (SDI) service such as ISI's *Automatic Subject Citation Alert (ASCA®)*. But, instead of receiving a list of relevant bibliographic citations each week, you would receive your own personalized journal. Such a personalized SDI journal has been described in my discussion of *ASCAmatic*.[6]

Rockefeller University President Joshua Lederberg has proposed an informal communication system that is even more radically altered through technology. Lederberg's EUGRAM system involves a network of special interest scientists communicating with one another through interconnected computer terminals. A scientist would prepare a scientific communication on a text-editing display terminal and electronically transmit it to other scientists. They, in turn, would amend it or add comments until some consensus on the subject was reached.[7] The final version would be accessible to the public.

Reference to this famous geneticist is a reminder that one day microcomputers that transmit documents to one another may even be "grown" in the lab. Genetic engineers are already turning their attention to creating new forms of recombinant DNA able to perform specific logical functions. Presumably, these "bio-chips" may someday function much like the silicon chips used in microprocessors.

When people in all parts of society have rapid electronic access to the information they want, we will have reached the information age. By that time, the use and demand for information will have increased exponentially. Already, as computer memory becomes less expensive, people are creating their own personal databases. Ironically, in some cases, the constant and rapid availability of information may obviate the need for such storage. Rather than maintaining a library or reprint collection, electronic or otherwise, scholars may simply purge older information, knowing they can retrieve it cheaply from centralized sources. Information will become a very perishable yet reusable commodity, creating a new and broader role for the information industry.

The form and function of libraries will also change. Rooms that now house shelves of books and journals may eventually be filled with computer hardware storing electronic documents and data. Libraries may, indeed, become electronic factories with facilities for receiving, storing, and transmitting a variety of electronic signals. Librarians may become database managers or information specialists, responsible for overseeing the collection and organization of information and for guiding users to appropriate databases. While this paperless society is still many years off, we must educate and prepare ourselves for the technologies that will transform our lives. In the meantime, we must continue to raise our standards on what is allowed to appear in print. I am convinced that future computer systems will increase the use of the best books and journals because of their intrinsic aesthetic and contact values. NF

Notes

1. R. Campbell, "Making Sense of Journal Publishing," *Nature* 299 (1982): 491–2.

2. R.C. Morse, "Videotex in America: The Birth of Electronic Newspapering," *Edit. Publ.* 115 (26) (1982): 41–7.

3. E. Garfield, "Viewdata and SCITEL Bring Interactive Information Systems into the Home," in *Essays of an Information Scientist* (Philadelphia: ISI Press, 1980), vol. 3: 253–8.

4. J. Gurnsey, *Electronic Document Delivery—III: Electronic Publishing Trends in the United States and Europe* (Medford, NJ: Learned Information, 1982). p. 55.

5. F. W. Lancaster, "The Future of the Library in the Age of Telecommunications," in *Telecommunications and Libraries*, ed. D. W. King (White Plains, NY: Knowledge Industry, 1981). pp. 137–56.

6. E. Garfield, "*ASCAmatic*—the Personalized Journal," in *Essays of an Information Scientist* (Philadelphia: ISI Press, 1977), vol. 1, p. 22.

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THE EVOLUTION OF THE "NEW LITERACY"

Benjamin Compaine

The popular press has discovered the gee-whiz technology that is in the process of being developed under such labels as videotex, teletext, viewdata, and database publishing.[1]

Now that the technology is here, we are faced with the question of who will use it and at what price. Some critics are skeptical of the electronic gadgetry that puts words and graphics on a television screen. "How can this replace the book?" they ask, conjuring up the nightmare of trying to curl up under a comforter on a winter night with the words of Tolstoi on a video screen. This electronic publishing stuff is not portable, like a book: we can neither "clip" it nor carry it on the train. And those letters on the screen are just darn tough on the eyeballs.

And, of course, in many ways these latter-day Luddites are correct. What they have not considered—or have decided to ignore—is that neither the new technology nor the culturally relevant skills applicable to using it are static.

The advances in semiconductors and computers in the past twenty years are evidence enough that the technology is moving ahead about as fast as we can adapt to it. Therefore, it is the culturally relevant skills that require further consideration at this time.

The extent to which the new information technology will be adopted, and at what speed, is closely tied to our notion of literacy. Literacy denotes a bundle of culturally relevant skills that have changed over time. Before the written record was widely used in England in the last half of the eleventh century, to be literate meant one had the ability to compose and recite orally. In the twelfth century, to make a "record" of something meant to bear oral witness, not produce a document for others to read. Despite the existence of written documents, "the spoken word was the legally valid record."[2]

Because of the difficulty of writing with a quill on parchment or a stylus on wax, writing in the Middle Ages was considered a special skill which was not automatically coupled with the ability to read. The most common way of committing words to writing in twelfth-century England was by dictating to a scribe. The scribe, a craftsman, was not necessarily himself able to

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compose. Thus, it was reading and dictating that were typically paired, rather than reading and writing.

By the time the ability to read and write did become relatively common in England in the mid-nineteenth century, the literati seemed to set a new standard for admission to full-fledged literacy. It was not merely the ability to read, they said, but the reading of the "right" materials that determined the true literacy. Of what use was widespread understanding of the printed word if it did not contribute to the spiritual enrichment and intellectual enlightenment of the English nation? "More people were reading than ever before; but in the opinion of most commentators, they were reading the wrong things, for the wrong reasons, and in the wrong way."[3]

All this suggests that today's standard of literacy, though rooted in the past, should not be presumed to be the standard for the future.

Similarly, the library, today's bastion of the book and reading, has not always been held in such high regard by the literati. Free libraries for the common man in England were viciously criticized by the reading elite. Instead of encouraging "habits of study and self-improvement, they catered to the popular passion for light reading—above all, for fiction."[4] One librarian actually told a meeting in 1879 that "schoolboys or students who took to novel reading to any great extent never made much progress in after life."[5] Someone recently must have made a very similar speech, substituting only "video game playing" for novel reading.

The new literacy. W. Bradford Wiley is chairman of one of New York's oldest publishing houses, John Wiley & Sons. It was the publisher of Herman Melville and Edgar Allen Poe. Today, Wiley says that

> To describe our business as one that traffics in paper, ink, and type is to miss the point entirely. Our real enterprise is ideas and information. . . . Until now, our medium has been the bound book; tomorrow our medium will expand to include (computer stored) data banks and videodisks.[6]

Is Wiley on to something? First, he has at least implicitly recognized that Marshall McLuhan was off base. The medium, by and large, is *not* the message. The message is the content, and the medium is its conveyance and display. That is, *content*—the ideas, knowledge, story, information, etc.—is the work of an author, a producer, a photographer. Technology, history, and even politics plays a role in how this content is processed and the format in which it is ultimately displayed. *Process* incorporates the gathering, handling, storage, and transmission of the content. The process may involve typewriters, computers, file cabinets; telephone lines, broadcasting towers, printing presses; trucks and retail stores. The *format* is the manner of display—such as ink on paper, sound from a vibrating speaker cone, images on a cathode ray tube, light projected through film, and so on.[7] Thus, the content may be quite independent of process and format—the medium.

This article, for example, was written at a standard typewriter keyboard. But instead of paper as the format, the letters appeared on a green television screen. Although you happen to be reading this in a conventional print format, the process for creating this journal is quite different from only ten or twenty years ago. Computer-generated type has replaced all the old slow Linotype machines that used to produce slugs of lead type. There is no technological or economic reason to keep recipients of this magazine from reading this article on a video screen. It may be argued that someday it will be. The major barrier to this may be cultural: most of us have been brought up with print on paper. Many educated people recoil at the thought of losing the feel, portability, etc., of printed volumes. But, as Wiley indicated, physically distributed print products are no longer the only way to deliver text and graphics.

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There are solid trends that support Wiley's thoughts. One is the pervasive and perhaps long-run impact of video games. In short order, these have gone from barroom novelties to a worldwide phenomenon. In 1976, Atari had revenue of $39 million. In 1982, its sales were about $2 billion. Americans spent about $8 billion in 1982 on video game units, cartridges, and arcade machines. That money is coming from somewhere, quite likely from the implicit budget people have for other media and entertainment. This includes movie admissions, records, and print media.

Even if the video-game craze itself is a fad, it nonetheless may have considerable cultural significance—much as the dime novel or penny press had in earlier eras. For the first time, it has made the video tube into something other than a passive format for the masses. Heretofore, only a handful of specialists, mostly computer programmers and some designers, used VDT's as an interactive medium. The rest of the world sat back and watched what others provided over their television tube.

Moreover, while critics of video games, echoing the lament of their nineteenth-century counterparts regarding the ill effects of literacy for the common reader, decry the video game parlors, they may well be myopic regarding the nature of the video games. The game players are becoming, almost painlessly, adept at manipulating and controlling a computer, not for its own sake but for the content—in this case, for entertainment. The U.S. Army, which must train large numbers of youngsters just removed from the video-game rooms, has quickly understood the implication of the games. They have already contracted for training exercises using video-game-like lessons played on microcomputers. The schools will no doubt follow.

The home video games are actually specialized personal computers. They have made consumers familiar with the concept of a computerized console that plugs into a video tube. All that a computer adds is a keyboard, and now the game manufacturers are selling these as add-ons to their consoles. There were about 1.5 million personal desktop computers in place by the end of 1981, with about 500,000 of these in homes. But the big drop in the price of a real, programmable computer did not fall to mass market levels until 1982, when Timex/Sinclair debuted for under $100. This price has been cut further. Computers began appearing on the shelves of K-Mart and toy discounters, taking them out of the realm of specialty goods. As a result, estimates indicate that the number of home computers tripled in 1982.

While educators are still concerned primarily with how students learn from print, today's youth spend more time (about twenty-eight hours weekly by one study) using electronic devices like television and electronic games than with print (about twenty-five hours). Moreover, most of the discretionary time is with the electronic medium, while most of the time spent with printed material was involuntary.[8] This all suggests that the current generation of school children are developing a new set of skills that may lead to a different standard for literacy.

One implication is that, unlike the miserable failure of computerized education in the 1960s, when expensive computers were imposed from the top, the current era has seen the development of grassroots interest in having microcomputers in the schools. It is the kids and their parents who are often in the forefront, with the local PTAs holding bake sales and the like to raise the funds when school districts are pinched for funds. (In the past, some of that effort went to buying books for the school library).

While much of the focus is on the kids, there are perhaps seven million or more adults working with video display terminals as part of their daily routine. They are clerks at the electric company and bank, travel agents, newspaper reporters, and stockbrokers.

Using a keyboard and terminal in the workplace, how will they approach the prospect of adopting similar tools at home to retrieve and manipulate content? Besides home computers, there are a few such opportunities already, with a great many more in prospect. Services such as those offered by CompuServe Information Service and Source Telecomputing have already offered portions of newspapers such as the *New York Times* and the *Los Angeles Times* via computer to home terminals, in addition to a wide range of other types of information. Book publisher Houghton Mifflin has produced an interactive videodisk version of Roger Tory Peterson's venerable, bird-identification books.

Several videotex services in the prototype stage in the United States in 1983 may well be made available commercially by traditional publishing firms. They include Times Mirror Company (publisher of the *Los Angeles Times* and other newspapers, books, and magazines), Knight-Ridder (publisher of newspapers, including the *Philadelphia Inquirer*, and books), and CBS Inc. (which in addition to being the largest television network also owns Holt, Rinehart & Winston publishers and many well-known magazines). The services offered by these firms are likely to tie together home terminals with large computers by telephone or cable television lines.

NEXIS, a service run by Mead Corporation, offers the full text of articles from the *Washington Post*, the *New York Times*, *Newsweek*, *U.S. News & World Report*, *Business Week*, UPI, Associated Press, and Reuters news services, *Encyclopaedia Brittanica*, and scores of other publications. The company's LEXIS service is known by most lawyers and used by many. It provides nearly unlimited access to tens of thousands of laws and cases, at the federal, state, and international level, that sometimes used to require days of work using books in a library. These can be accessed by users who have received very little special training. The cost today restricts NEXIS and LEXIS to use in institutions. But over time, similar powerful but easy-to-use services may become as inexpensive as today's mainstream media.

The interest in "electronic publishing" is motivated by more than a mere fascination with technological toys. In part, there are some significant economic trends involved. On the one hand, the price of the paper used by publishers has jumped far more than prices in general since the early 1970s. The cost of newsprint, used by newspaper publishers, increased 200 percent between 1970 and 1981, well over twice the rate of increase for all commodities. This is in large measure due to the high energy component in the manufacture of paper. Moreover, the physical distribution of printed materials, especially newspapers, is highly energy intensive. This cost trend contrasts dramatically with the costs for computer-stored information. These have been declining at about 25 percent annually for the last thirty years. (The magnitude of this is illustrated by the rough calculation that if the price of a Rolls-Royce had followed that of computer storage, it would cost about $2.50 today). The outlook is for continued decreases in cost of a similar nature in the foreseeable future.

The impact of all this in the workplace will be visible, if not profound. Whereas there is about $25,000 of capital invested for every worker in a manufacturing setting, until recently there has been only about $4000 in capital for every office—or knowledge-worker. But that may change soon. In 1980 even an information-intensive company such as Aetna Life and Casualty Company had only one video terminal for each six employees. By 1985 they expect to have one terminal for every two employees. The ubiquity of these terminals, and the increased familiarity workers will have with them, may result in expanded application, such as electronically transmitted and stored "mail" both within an office and from remote office sites, including overseas offices.

Traditional literacy and the new literacy. It should be emphasized that this essay is *not* about what is often referred to as "computer literacy." As popularly used, computer literacy seems to mean the ability to use a computer as a computer. That is, it stresses learning computer languages, programming, and computer jargon. While it is certainly crucial that there be a professional body of such people with such skills, the real message of the new literacy is that the computer is simply a tool—much as the printing press is a tool. Traditional literacy does not demand that we know how a book is produced and printed to be able to use one. As computers reach the point where they become imbedded in other familiar devices (such as an "intelligent" television set), the true test of literacy may be the ability to manipulate the information that is stored in computer devices in an equivalent manner to the way we manipulate printed products, such as using indexes, scanning pages, underscoring passages, or finding our way through the library.

In suggesting forces that may be shaping a new literacy, this essay has addressed some factors which may determine the rate at which the technological and economic components of communications-based content distribution may come together with the cultural changes that will be necessary for its widespread use. It is important to recognize that the knowledge that has traditionally been conveyed by print and stored on shelves in libraries will still be the type of knowledge that will be required to become an educated person. It is the manner by which the knowledge is stored, processed, and transmitted that is the subject of the new literacy. The forces and trends at work will be of strategic concern to educators, publishers, government, other employers, and, eventually, all literate people. NF

Notes

1. This article is drawn from a more extensive essay in *Daedalus*, Winter 1983.
2. M. T. Clanchy, *From Memory to Written Record, England, 1066–1307* (Cambridge, MA: Harvard University Press, 1979), p. 88.
3. Richard D. Altick, *The English Common Reader: A Social History of the Mass Reading Public, 1800–1900* (Chicago, IL: University of Chicago Press, 1974), p. 368.
4. Ibid., p. 231.
5. Ibid., p. 233.
6. Jack Egan, "Publishing for the Future," *New York*, August 16, 1982, p. 10.
7. Benjamin M. Compaine, *A New Framework for the Media Arena: Content, Process and Format* (Cambridge, MA: Program on Information Resources Policy, Harvard University, 1980), pp. 6–17.
8. Fred M. Hechinger, "About Education," *New York Times*, December 15, 1982, p. C–5.

Dissolution at Sea

Upon this sea the fingerprints are strange:
The shifting whorls provide a path of curves
For ships and parsings of the memory, for time
To change (my watch forgets), for images of atoms
Wavering on the waters, depths beneath
The sun. Suspended between continents,
We glide through hands that change like clouds, or clocks
That can't keep pace with longitude. Somewhere
In this sleep of sky, reversed in oceans
Holding all the dead, my father dreams
That I have come to drown his grave, to carve
His grandson's name on water, to melt this stone.

Larry Rubin

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