Writing Space

Computers, Hypertext, and the Remediation of Print

Second Edition

Jay David Bolter
Georgia Institute of Technology

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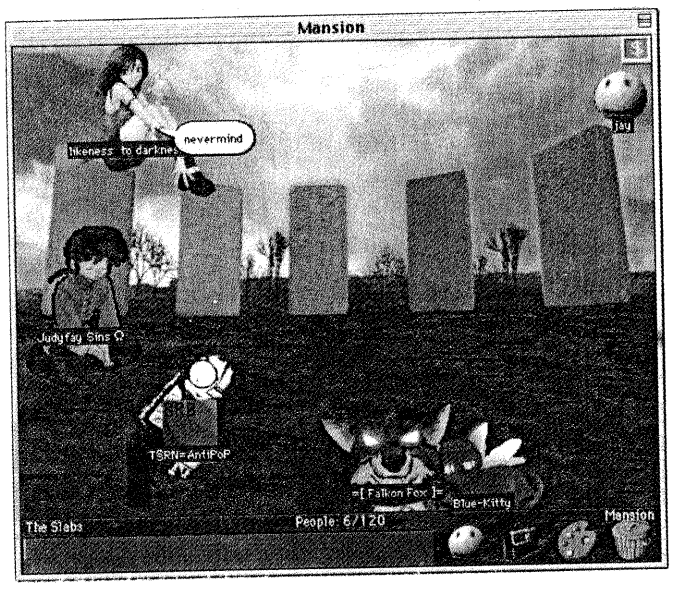

FIG. 4.6. The Palace, a graphical MOO. (Used by permission of Communications.com.)

by imitating the static form of the comic book, the Palace can function over even the lowest bandwidth connections on the Internet. The cultural effect, however, is once again to subordinate the text, as comic books or so-called "graphical novels" do in print. Other more graphically sophisticated MOOs will no doubt eventually exploit full-motion animation and video, and in the process they will remediate film and television and further diminish the status of any text that appears in this electronic environment.

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The Electronic Book

THE CHANGING IDEA OF THE BOOK

At various periods, Western cultures have chosen to embody writing in various technological forms, and these choices have in turn affected the organization, style, and genres of writing and our expectations as authors and as readers. The physical unit of a writing technology helps to define the conceptual unit—what comes to be regarded as a written volume. For centuries in the ancient world, the papyrus roll, about 25 feet long, constituted a volume. (Our word "volume" comes from the Latin *volumen*, which means roll.) The codex, which replaced the roll, was more effective in enclosing, protecting, and delimiting the writing it contained. A whole work could be contained in a single codex, which was less often the case with the smaller papyrus roll, which might hold only segments or "chapters" of a work. The writer was and still is encouraged to think of his codex as a unit of meaning, a complete verbal structure. The codex has been associated with the idea that writing should be rounded into finite units of expression and that a writer or reader can and should close his text off from all other texts.

The papyrus roll was poor at suggesting a sense of closure, and in fact closure does not seem to have had the significance for ancient writers and readers that it acquired, for example, in the industrial age of print. In the ancient world, authors, especially poets, would often perform their works before an audience of listeners, who did not have their own copies. The writing on the roll served as a script, to be consulted when memory failed. The character and the length of these ancient texts were not determined by the size of the roll, but rather by the needs of performance. Because Greek epic poets were probably illiterate, their poetry was not determined by writing at all. The *Iliad* and *Odyssey*, each far too long to fit on one papyrus roll,

were in a sense unbounded poems, fragments of a network of stories that could be extended indefinitely. Each Greek tragedy, on the other hand, was too small to fill up one roll, because its length depended on the conventions of the Greek dramatic festivals. The tragedian did, however, have to write down his play in order to convey it to the actors, so that tragedy remained halfway between orality and full literacy. Even when prose writers like Plato wrote for individual readers, the oral character of ancient writing remained strong. Perhaps for that reason the ancients were content with the papyrus roll, which was better suited to reading aloud than to silent reading and study. Throughout the ancient period, the papyrus roll remained too short to meet its own culture's need as a grand unit of expression, so that a major work by a philosopher, historian, or poet typically occupied several rolls. The papyrus roll did not contribute to any cultural sense of closure, and it is no coincidence that many ancient poetic and historical texts do not have climactic endings. They often simply fall silent, leaving the impression that there is always more to say. Perhaps it is characteristic of a primarily oral rather than written culture that its texts are often incomplete in this sense.

The development of the codex corresponded to a set of new possibilities for writers and readers. In place of a script for performing the text aloud, it provided a space that was visually more sophisticated and finished. A codex could hold several times as much text as a roll. The early Christians apparently preferred this new technology, because one codex could hold all the New Testament writings. Pagan texts followed in being transferred to the new medium (see Reynolds & Wilson, 1978, pp. 30–32). The physical presence of the book also began to matter more as public performance was replaced by individual study. Silent reading became common by the later Middle Ages, but long before that books were set before individual readers—monks in their libraries, for example (see Saenger, 1982). Writers and readers were encouraged to identify the physical book, which they held in their hands, with the text and to regard the end of the book as the end of the text. The importance of the book as an object perhaps reached its zenith in the Middle Ages, when illuminated manuscripts were examples of multimedia writing at its finest, in which all the elements functioned symbolically as well as aesthetically to define a verbal–visual meaning. In this one sense, printing was not an improvement, for it destroyed the synthesis that medieval manuscripts had achieved. On the other hand, Renaissance culture used print technology to strengthen the idea of the book as a complete and closed verbal structure. Although in medieval codices and early printed books, unrelated texts were often bound together, standardization and

economies of scale eventually encouraged printers and publishers to put one text in each volume.

In the centuries following the invention of printing, then, it became the goal of serious writers to add another volume to the world's library. The paged book became the physical embodiment, the incarnation, of the text it contained. Incarnation is not too strong a metaphor, because, through printing, Western culture came more and more to anthropomorphize books, to regard each book as a subject with a name, a place (in the library), a voice, and a bibliographic life of its own. Modern printing includes the making of the binding and dust jacket, so that every edition of a book has its own visual identity. Although today you can tell a book by its cover, this was not the case in early printing, when books were often bound after they had been transported and sold (Febvre & Martin, 1971, p. 159). The unique identity of each publication has come to be sanctioned and even required by copyright law. Each book must be different enough from all other books to deserve its own place in the library, and it should be complete in its own terms. Each book strives to assert its identity, while at the same time entering into a cascade of relationships with other books. The relationships are attractive and repulsive, as the book refers the reader to some books and warns him against others.

As we refashion the book through digital technology, we are diminishing the sense of closure that belonged to the codex and to print. Various electronic devices (desktop, laptop and palmtop computers, digital assistants, pagers, and so on) pay homage to the printed codex and other paper-based materials, while at the same time aiming to supersede them. Portable computers present themselves as new and improved books: "notebook" has become a generic term for these devices, while Apple Computer has had lines called "Powerbooks" and "iBooks" and Hewlett Packard has sold "Omnibooks." These full-fledged computers are hybrid books, in which we can read and write texts and process numerical information. Here as elsewhere in the late age of print, we see the move to heterogeneity and hybrid forms, including on-demand printing from digital databases, printed books and magazines that refer to Web sites, Web sites that preview and sell books, and so-called "information appliances" that combine the characteristics of books, notebooks, and calendars (see Donald Norman's *The Invisible Computer*, 1999). All such hybrids work against closure, because both in form and function they refer their users to other texts, devices, or media forms.

One class of information appliances is positioned explicitly to replace the paged book: an example is the Rocket eBook. As its Web-based advertising

indicates (Fig. 5.1), the eBook appropriates and refashions many of the physical properties as well as the "interface" of a traditional book. It is lightweight and easy to carry; the reader can write notes in its margins and underline passages as in a printed book. Unlike desktop computers, the eBook tries to imitate the physical presence of the codex. In addition, it offers its users texts that have already appeared in print: principally books, but potentially newspapers, magazines, or other materials. The designers of the eBook wanted to give their users a new way to approach the heritage of print. As with any remediation, however, the eBook must promise something more than the form that it remediates: it must offer what can be construed as a more immediate, complete, or authentic experience for the reader. One innovation is that the eBook turns any text into a hypertext, in which the reader can search for the occurrence of words and phrases

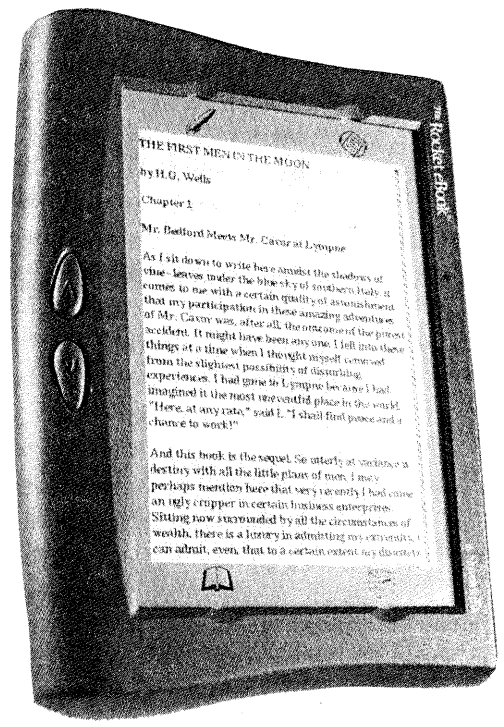

FIG. 5.1. The Rocket eBook. © 1998–2000 NuvoMedia, Inc. (Used by permission.)

throughout the text, so that the whole text becomes immediately available to the reader in a way a printed book is not. The second, and ultimately more important, innovation is implied in the exhortation to "let the Rocket eBook put a world of books in the palm of your hand." Unlike a printed book, which can only contain one fixed text, the eBook is designed to be reloaded. Because its texts are downloaded from the Internet, the eBook is connected to a growing world of materials available online. The eBook becomes not only a stand-alone device, but also a portal that leads the reader into cyberspace. In fact, most of the new information appliances are or will be networked: they will connect to the Internet at least for getting or sending data and may then disconnect for periods of personal use.

Such ersatz electronic books reflect our growing ambivalence about closed forms. (On closure in electronic texts, see Landow, 1997, pp. 79–88.) We remain under the influence of the tradition of print and its definition of closure. These electronic books look like closed forms, and as portable devices they assert their physical identity as strongly as traditional bound volumes. The designers of the eBook, with its strong lines reminiscent of Art Deco, sought to make the device stand out as a consumer object. On the other hand, the pull of the Internet is now culturally and economically overwhelming. Designers and their corporate managers want to connect almost every electronic device to the Internet, and such a connection works against the separate identity of electronic book forms and their contents. Thus, electronic books become information structures that reach out to other structures, not only metaphorically, as printed books did, but also operationally. An electronic book does not join itself to other books end-to-end, as printed books do when we set them on a shelf; instead, merging into the network of the World Wide Web, the electronic book invites exploration as part of a network of texts. The openness of such networked devices reflects our growing desire to construct writing in a way that breaks down the traditional distinctions between the book and such larger forms as the encyclopedia and the library.

GREAT BOOKS

The desire to make a great book, to set down all verbal knowledge in one place, was a dream shared by medieval writers and by the Greeks and Romans. In the cultures of the papyrus roll and of the codex, that desire expressed itself in two complementary forms: the library and the encyclopedia. A library amasses books, while an encyclopedia condenses them.

Both seek to organize and control texts in order to make them available to the reader.

The encyclopedic impulse was strong in later antiquity, when editors produced numerous handbooks or miscellanies on subjects important to their culture, such as rhetoric, poetry, natural history, and medicine. The impulse was also strong at times among Byzantine scholars and during the Middle Ages in Western Europe. Because Western medieval scholars attached great importance to authoritative texts (such as the Church fathers and later Aristotle), they felt the need to collect and summarize those texts in handbooks of their own. The most influential encyclopedias (by Martianus Capella, Isidore of Seville, and later Vincent of Beauvais) became authoritative texts themselves. These compilations were great books, and they encouraged philosophers and even poets to produce their own great books in response. Philosopher-theologians produced *summae*, which were encyclopedic in ambition—attempts to join the major philosophical and theological traditions into a convincing whole. This joining and reconciling of written authorities was a central task of medieval scholarship, as Ernst Curtius (1973) pointed out:

> For the Middle Ages, all discovery of truth was first reception of traditional authorities, then later—in the 13th century—rational reconciliation of authoritative texts. A comprehension of the world was not regarded as a creative function but as an assimilation and retracing of given facts; the symbolic expression of this being reading. The goal and the accomplishment of the thinker is to connect all these facts together in the form of the "summa." Dante's cosmic poem is such a summa too (p. 326).

The encyclopedic impulse diminished somewhat in the age of print. As books multiplied, it became harder to aspire to the goal of a book that would encompass all important works, even in a single field. Although more encyclopedias and handbooks were produced than ever before, the aim of the encyclopedists became more utilitarian: to report more accurate information rather than to synthesize all knowledge. The French *Encyclopédie*, whose first volume appeared in 1751, was perhaps both the last successful encyclopedia in the medieval sense and the first modern encyclopedia, because it was a statement of the ideals of the Enlightenment as well as a compendium of technical information. In the 19th and particularly in the 20th century, making encyclopedias became a business rather than a philosophical or scholarly endeavor. Major encyclopedias now maintain permanent editorial staffs,

which revise the volumes continuously to furnish up-to-date information in a convenient package. Their concern is to provide information on subjects of popular interest, not to demonstrate the interrelations of all subjects. Today, however, the ideal of the encyclopedia as a synthesis of knowledge has reemerged in a new form. Many works on CD-ROM or DVD and on the World Wide Web explicitly remediate the printed encyclopedia, while in a larger sense the millions of pages hyperlinked on the World Wide Web are being read by our culture as an electronic compendium of knowledge, both a new encyclopedia and a new library.

ENCYCLOPEDIC ORDER

Prior to the invention of the printing, the population of books grew and declined along with the associated culture. In some periods manuscripts were plentiful; in other periods few manuscripts were read or copied, and many works were lost altogether. A great period of loss of ancient texts, for example, occurred from the 6th to the 8th centuries—both in the Latin West and in the Byzantine East (see Reynolds & Wilson, 1978, pp. 47–48, 75–76). Each period of sustained growth created a "textual overload," when there were many more books than a reader could afford to own or had the time or dedication to read. The opposite problem was a lack of books during periods of literary cultural decline. Whenever texts have become inaccessible—either because the available technology was too successful at producing texts or because the culture went into a literary decline—readers have turned to encyclopedias and handbooks. At the time of Pliny the Elder's *Natural History*, in the 1st century A.D., for example, readers had to confront an enormous quantity of scientific and literary texts produced by the Greeks of the classical and Hellenistic periods. By the time of Martianus Capella's allegorical encyclopedia of the liberal arts in the 5th century or Isidore of Seville's *Etymologies* in the 7th, the problem was scarcity. Vincent of Beauvais' *Speculum* appeared in the 13th century, when the already large medieval library was again being supplemented by Aristotle and other ancient texts. Three hundred years of printing created a vast textual space for the French *Encyclopédie*. Indeed, printing made textual overload a permanent condition: more books were produced in each succeeding century, and new editions preserved all books that changing cultural norms continued to regard as important (Eisenstein, 1979, vol. 1, pp. 181ff). What many have called the "information revolution" ushered in by the computer is only the most recent manifestation of a problem that is now 500 years old. (Geoffrey Nunberg has even suggested that the notion of quantifiable information

was particularly well suited to what I have called the industrial age of print and that electronic technology ushers in not the beginning, but the end of this "information age." See Nunberg, 1996, pp. 103–133.)

The encyclopedia offers a solution for both conditions of surplus and scarcity. When there are too many books, it offers to control information that has gotten out of hand. When books are not available, the encyclopedia summarizes information that the reader cannot get from original sources. In either case, the encyclopedia puts textual elements in a place where the reader can be sure to find them and in this sense performs a therapeutic as well as a bibliographic function. An encyclopedia reassures its reader that the texts in the contemporary writing space are under control. The key to any encyclopedia is therefore its organization, the principles by which it controls other texts, and the choice of organizing principles depends on both the contemporary construction of knowledge and the contemporary technology of writing.

Ancient and medieval encyclopedias were organized at first simply by association and then by progressively more elaborate hierarchies of topics. Pliny the Elder constructed his *Natural History* on principles of association. He began with the stars and planets, then moved to the geography of the Earth, then to humans, animals, plants, and finally minerals. His intuitive approach was appropriate both for his Roman readers, who were not scientifically sophisticated, and for the highly linear papyrus rolls on which his work was recorded. After the invention of the codex, encyclopedists (such as Martianus Capella, Isidore of Seville, Hugh of St. Victor, and Vincent of Beauvais) gradually developed more elaborate categories and deeper hierarchies (Châtillon, 1966; Lemoine, 1966). The motive in all cases was to provide a framework that would be familiar or accessible to an educated reader. The codex form of these encyclopedias with its "random access" made the reader's work easier and allowed the author to develop a more elaborate outline of knowledge. The outline in turn solved the problem of textual overload by providing categories for all the elements of learning and so suggesting that one book could indeed encompass the textual world.

Hierarchies continued to be used in the Renaissance and after, but the cumulative medieval systems became less and less appropriate for categorizing new scientific knowledge. Francis Bacon responded by trying to derive his topics from first principles. In the second book of the *Advancement of Learning* he offered a system based upon three mental faculties: memory, imagination, and reason. To the faculty of memory belonged historical experience and writing, imagination was responsible for art, and reason for

philosophy and natural science. Bacon went on to elaborate these categories and include the traditional disciplines in this new hierarchy. After Bacon, however, as the printing press and scientific discovery continued to generate materials that needed to be accounted for in any great book, there was a growing trend toward neutral methods of "information processing"—alphabetization and indexing, which unlike topical outlines did not presuppose a shared body of knowledge or worldview among the readers. The shift from hierarchical to alphabetic organization in dictionaries and encyclopedias was an acknowledgment that such systems as the seven liberal arts, which could be possessed by all educated readers, could no longer accommodate specialized knowledge in physics, anatomy, geography, and mathematics. Most encyclopedias from the 18th century to the present have been alphabetical, because access to information, understood in an increasingly technical sense, has become more important than philosophical vision. A good contemporary encyclopedia exploits every technique of print technology (including tables of contents, indices, headnotes, sidenotes, and various type sizes and styles) to help the reader find the relevant articles, paragraphs, and even finer units of text. Thus, printing, which had made possible a new degree of textual overload, also offered the solution of alphabetical order and precise indices.

Editors of encyclopedias, however, have perhaps never been entirely happy with this solution, for the obvious reason that those who set out to make encyclopedias are writers who want to impose an intellectually satisfying order on the world of texts. Alphabetic ordering does not define a writing space that clarifies the relationships among topical elements. The editors of the *Encyclopédie* printed their articles alphabetically, but they did not wish to deny the philosophical value of a hierarchical arrangement of knowledge. D'Alembert wrote in the "Preliminary Discourse" that such an arrangement:

> ... consists of collecting knowledge into the smallest area possible and of placing the philosopher at a vantage point, so to speak, high above this vast labyrinth, where he can perceive the principal sciences and the arts simultaneously.... It is a kind of world map which is to show the principal countries, their position and their mutual dependence, the road that leads directly from one to the other (D'Alembert, 1963, p. 47).

Diderot and D'Alembert included in their preface a tree of knowledge based on Francis Bacon's. Articles in the *Encyclopédie* contained references to indicate their place in this tree, although readers could not easily use the

tree to organize their reading. The *Encyclopaedia Metropolitana* (1849) in the 19th century also tried to have it both ways: it was a "Universal Dictionary of Knowledge on an original plan, projected by the late Samuel Taylor Coleridge, comprising the twofold advantage of a philosophical and an alphabetical arrangement." Coleridge himself saw the encyclopedia as an educational tool: the reader should be introduced to all knowledge through the proper method, which consisted "in placing one or more particular things or notions, in subordination, either to a preconceived universal Idea, or to some lower form of the latter ... " (p. 22). Coleridge seems to have imagined the ideal reader starting at page one of the encyclopedia and working straight through. So, although he believed strongly in the topical arrangement that goes back to the Middle Ages, Coleridge's encyclopedia was clearly a product for the industrial age of print, in which the text is laid out in one ideal order.

More than a century later, the 15th edition of the *Encyclopaedia Britannica*, first issued in 1974, became another curious hybrid, a book straining to break free of the limitations of print. Mortimer Adler gave the *Britannica* both a topical and an alphabetic arrangement. The main articles were printed alphabetically in volumes called the Macropaedia. A separate volume, the Propaedia, was a vast outline, in which all knowledge was arranged into ten parts, the parts into some 140 divisions, the divisions into sections, and so on. The Propaedia outline was not adventurous or idiosyncratic: it was "constructed and corrected in the light of detailed recommendations, directions, and analytical contributions from scholars and experts in all the fields of knowledge represented" (*Encyclopaedia Britannica*, 1974–1987, vol. 1, p. 6). The most original aspect of Adler's outline was that it was meant to be a guide for reading the Macropaedia articles. The reader who pursued topics through the outline was eventually referred to pages in the Macropaedia. The Propaedia therefore served to reorder the articles of the Macropaedia: to show their relationships in Adler's structure of knowledge. There might be no single extended essay in the *Britannica* on creation myths in various cultures, but the reader could construct such an essay by finding that topic in the Propaedia and following the references. The Propaedia referred the reader to paragraphs, sections, or articles in the Macropaedia from which the essay could be fashioned. In this sense, the Propaedia turned the encyclopedia into a hypertext whose parts could be assembled by the reader.

The problem was that the references were hard to follow in a printed work of 30 folio volumes. Most readers of the *Britannica*, unwilling to go to the trouble of constructing their own essays, were content to read the articles in the conventional order. In any library that possessed the *Britannica*, the Propaedia could immediately be identified as the shiny new volume among the well-used and worn ones. In fact, the *Britannica* was trying to deny what modern culture had construed as the defining qualities of the printed book—its fixity and its linear order. If an encyclopedia is to be an alphabetical sequence of articles, the reader expects that each article will be a self-contained essay. The *Britannica* tried to create both a sequence of articles and a set of instructions for dismantling and reassembling those articles to make new readings. Eventually, the editors of the *Britannica* decided to add a conventional index and take most of the references out of the Propaedia. The Propaedia remained an outline of knowledge, but was no longer a blueprint for alternate readings of the rest of the work, when in the mid-1980s the *Britannica* became again a conventional printed encyclopedia.

THE ELECTRONIC ENCYCLOPEDIA

In spite of or indeed because of its inconsistencies, the 15th edition of the *Britannica* can be regarded as a forerunner of the electronically refashioned encyclopedia. The system of references in the Propaedia, which seemed irrelevant to readers of a printed book, would make more sense in an electronic edition, where the computer can facilitate the task of moving through the encyclopedic outline and among the various articles. The computer can take over the mechanical aspects of consultation: by getting the reader to the article and letting her read, by transferring her from one text to another, and by keeping her aware of her current position within the structure of the encyclopedia. In general the structure of an electronic encyclopedia can be both deeper and broader than that of its printed counterpart. If a printed book is generally divided into chapters or headings within chapters, in an electronic version the visible and useful structure may extend to the paragraph or even the sentence, and the computer can permit the reader to manipulate text at a variety of levels. In this way the computer might restore some of the legitimacy of topical arrangements for great books like the encyclopedia. At least, it answers the modern objections: that the world of textual knowledge is now too complex to be organized by topics; that any topical outline may be arbitrary or confusing; and that the reader will not be able to find topics because she will not know their place in the editor's outline. All this is true for a printed encyclopedia but not an electronic one. The problem of finding information in an electronic encyclopedia is fa-

cilitated by the fact that searching can be partly or wholly automatic, and such searching can cut across any categories established by the editor. In an electronic encyclopedia, alphabetical order is not the single canonical order of the text, as it is with a printed encyclopedia. Outlines or other topical arrangements can coexist with the alphabetical order, so that an electronic encyclopedia can be organized in as many ways as the editors and the readers can collectively imagine.

Any single topical outline today must seem arbitrary, because it reflects one editorial view of the organization of knowledge, which the reader may not share or even comprehend. The problem was less serious in the Middle Ages, when there was much broader agreement about the available structures of knowledge. But by the time of the *Encyclopédie*, D'Alembert recognized that there were many possible structures. When he compared the encyclopedia to a world map, he went to say that " ... one can create as many different systems of human knowledge as there are world maps having different projections.... There are hardly any scholars who do not readily assume that their own science is at the center of all the rest, somewhat in the way that the first men placed themselves at the center of the world" (D'Alembert, 1963, p. 48). When the encyclopedists were forced to choose one map, they preferred one validated by Bacon. In the *Britannica*, 200 years later, Mortimer Adler felt compelled to defend himself against this charge—by pointing out that his Propaedia outline was certified by contemporary experts. Adler's other defense was that his outline was not rigid: the topics could be displayed in a circle around which the reader could move associatively. However, the circle as a structure is the antithesis of the printed book, which wants to be linear in presentation and hierarchical in organization. In a printed book, the reader is certainly not invited to begin anywhere and move to any related section. By allowing multiple organizations, the *Britannica* anticipated an attitude toward knowledge that belongs to the late age of print, where the circle and the line are equally at home.

As it now moves into electronic media forms, the encyclopedic impulse is being directed in two channels. The first is the explicit remediation of the printed encyclopedia or handbook. Numerous CD-ROM and DVD products—such as the *Britannica DVD 99*, *Encarta Encyclopedia Deluxe 99*, *Year 2000 Grolier Multimedia Encyclopedia* (1999), and the *World Book CD Multimedia Encyclopedia*—have sought to appropriate the cultural significance of the printed encyclopedia. Many, like the *Britannica DVD 99*, depend on the reputation of the printed version and are excellent examples of the ways in which hypertext and hypermedia remediate print. If the printed *Britannica*

has the reputation of being the premier general encyclopedia in the English language, its DVD counterpart suggests that it can bring the sophistication and knowledge of the original into cyberspace. The Web page advertising the DVD proclaims: "Discover the world's most authoritative source of knowledge, *Encyclopædia Britannica*, brought to life with the world's most advanced digital technology, DVD-ROM" (see www.eb.com/bookstore June 22, 1999). The electronic version promises greater immediacy (it is "brought to life") through multimedia, including "hundreds of new videos, thousands of new images, sound files and more." Immediacy of information is also guaranteed by hyperlinks among the articles and by the search capability, which allows the reader to retrieve articles that contain a key word or phrase. Finally, the topical organization of knowledge championed by Adler for the 15th edition is offered here as the "circle of learning" (a literal translation of the Greek for encyclopaedia): "More than just another multimedia encyclopedia, *Britannica DVD* turns information into understanding through its unique circle of learning, so you can see how facts and ideas combine to form the big picture." *Encarta* also remediates the printed encyclopedia, but in this case it borrows its cachet not from a venerable printed version, but from the reputation of Microsoft as a high technology computer company. It too depends on search capabilities, hyperlinks, and multimedia to suggest that it is an improvement on printed encyclopedias. Some version of the strategy of remediation is followed by the numerous handbooks and specialized encyclopedias also offered in CD-ROM or DVD format. Furthermore, the *Britannica*—like many others, including *Funk and Wagnalls*, *Grolier*, *World Book*, and the *Columbia Encyclopedia*—also exists in a Web version available by subscription. These online editions of the great book add to their claim of immediacy by connecting their user to cyberspace, which is itself already construed as a vast encyclopedia.

The other channel for the encyclopedic impulse lies in fact in the organization of cyberspace itself—in the many so-called portal Web sites that provide access to for the millions of pages on the World Wide Web. The Web is a textual universe that is by definition growing out of control; the distributed nature and economic potential of the Web ensure that designers will be constantly adding and deleting pages and sites without the knowledge of any central authority. Cyberspace is a universe that needs to be organized in order to be useful, and portal sites, such as Yahoo! (www.yahoo.com), provide that organization by refashioning the two principal organizing structures of the printed book: the table of contents and the index. A Web search engine func-

tions like an index, permitting the user to retrieve Web pages that contain word or phrases of interest. Such a search facility lies at the heart of portal sites and gives a purely technical solution to the problem of control. Some portal sites like Yahoo! also provide a topical organization, a structure of nested menus that point the user to various categories of sites. This topical organization does not appear to come from any Baconian first principles or from consultation with scholars and scientists. At the top of its hierarchy, for example, Yahoo! currently offers 14 categories: Arts & Humanities, Business & Economy, Computers & Internet, Education, Entertainment, Government, Health, News & Media, Recreation & Sports, Reference, Regional, Science, Social Science, and Society & Culture (www.yahoo.com June 22, 1999). This menu is thoroughly ad hoc. Even in its heterogeneity, however, it constitutes a contemporary encyclopedic vision, a map of cyberspace and to some extent of our culture in the late ages of capitalism and print. It is our equivalent of Vincent of Beauvais or Pliny the Elder.

The organizational flexibility of hypertext together with the enormous capacity of electronic storage, especially on the Web, thus changes the scope of the encyclopedia. The encyclopedic vision has always been that the great book should contain all symbolic knowledge, although the making of such a great book has never been possible because of the inevitable limitations of the editors as well as the limitations of the available technology of writing. Even the World Wide Web must contain only a fraction of recorded symbolic knowledge. Thus, editors of encyclopedias have always made explicit or implicit exclusions: the mechanical arts, for example, were not represented in the early medieval encyclopedias of Martianus and Isidore, and biographies were excluded from the first *Britannica*. Encyclopedias in the Middle Ages were often statements of high learning; the utilitarian value of encyclopedias has been emphasized only in the past 200 years. In this century American encyclopedias have cut out scholarly subjects in favor of articles of popular interest in order to maintain the largest possible readership. The electronic encyclopedias are following that trend, while the World Wide Web considered as an encyclopedia is an utterly eclectic collection of texts and images.

Our culture's understanding, however, is that the computer can hold so much information that there is little need to be selective: the reader need only look at a tiny portion at any one time. Furthermore, the attitude toward knowledge structures reflected in electronic encyclopedias is opportunistic because of the temporary character of electronic information. This was not the case for an encyclopedia in manuscript or in print, where the

technology encouraged more or less permanent structures of knowledge. What we have today is a view of knowledge as collections of (verbal and visual) ideas that can arrange themselves into a kaleidoscope of hierarchical and associative patterns—each pattern meeting the needs of one class of readers on one occasion.

THE LIBRARY AS A WRITING SPACE

The library as a great book adopts a strategy complementary to that of the encyclopedia. If the encyclopedia absorbs and digests other books, the library attempts to control knowledge by collecting as many books as possible within one conceptual and physical structure. The library is the physical realization of a culture's writing space of books. What the reader does metaphorically in the encyclopedia, he or she can do literally in the library—move into and through a textual space.

The space of the library has evolved along lines similar to those of the encyclopedia, but the principles of organization for libraries have generally been more ad hoc and utilitarian. Ancient Greek and Roman libraries of papyrus rolls were arranged by subject and then by author (Jackson, 1974, p. 23). It was common in the Middle Ages and even later to divide the books by university faculty: law, medicine, theology, and the arts. Within each division the organization was roughly alphabetical. However, unlike modern encyclopedias, modern libraries did not adopt a completely alphabetical arrangement. They continued to classify books by topic, and, as we would expect, the classifications became more complicated and more apparently arbitrary. When Conrad Gesner published his *Pandects* in 1548, he still suggested classing books under the seven liberal arts as well as by university faculty (Jackson, 1974, pp. 128ff). But by the end of the 19th century, the founders of modern classification, C. A. Cutter and Melvil Dewey, claimed to reject anything but utility as their criterion. Describing his system, Dewey wrote: "[t]he impossibility of making a satisfactory classification of all knowledge as preserved in books, has been appreciated from the first, and nothing of the kind attempted. Theoretical harmony and exactness have been repeatedly sacrificed to the practical requirements of the library ... " (Jackson, 1974, p. 388). The Library of Congress call numbers now used in research libraries in the United States follow a topical system that few users bother to learn. Apart from knowing that books on psychology or books on German literature are shelved together, the user simply treats the call number as a street address, a means of locating the book.

The call numbers in fact constitute a system of addresses, a mapping of the conceptual library onto the building, which is itself a physical hierarchy of floors, stacks, and shelves. At the same time the library's computerized catalog provides different conceptual views of the library: by author, by title, by subject, and so on. The library is a single physical hierarchy that is reorganized or "written over" in several ways by its catalog system. In current libraries the catalog, often available as a Web site, makes it relatively easy for the user to jump back and forth among views and to search for keywords in titles or subjects. The user can therefore rearrange the conceptual library with relative ease. Because the books themselves are still printed, the user must eventually leave the electronic world and set out on a physical journey among the stacks.

In a fully digital library, in which the books themselves are stored in machine readable form, the library would no longer be need to a building that the reader had to visit. The computers, storage devices, and communications equipment must be housed somewhere, but the reader has no need to see the equipment, any more than he or she needs to see the physical plant of the local telephone company. In such a library, the books could rearrange themselves at the reader's request. The same book could in effect appear on different shelves: for example, a book on the history of theories of mind could appear in the psychology section and in the philosophy section. It is often claimed that a principal advantage of a physical library is that the reader can browse and come across interesting books by chance. But an electronic library could give the reader the same opportunity. A graphical interface could even display the spines of the books on shelves and allow the reader to reach in and open the books, if that is really the best way for the reader to browse. Although a major library of printed books is always changing, as new books come in, and the physical shelving is expanded or redone, the ideal of such a library is not change, but preservation. Libraries have seemed venerable because they preserved what was created by past writers and valued by past readers. Francis Bacon called libraries " ... shrines where all the relics of the ancient saints, full of true virtue and that without delusion or imposture, are preserved and reposed" (Bacon, 1955, p. 233). No one would apply this rhetoric to an electronic library that reorganizes texts as readily as it preserves them.

The reverence accorded to the traditional library of manuscripts and printed books was reflected in the fact that the building itself was a kind of monumental writing, a writing and reading space in stone. In the industrial age of print, the library itself became the replacement for Victor Hugo's ca-

thedral: the entry hall or reading room of more than one great library was built to resemble the nave of a cathedral, with the circulation or information desk as the altar. Because the physical libraries continue to fulfill a variety of institutional and cultural purposes, it seems unlikely that they will be dismantled in the near future. Instead, in the late age of print, academic and public libraries are becoming hybrids, combinations of printed texts with electronic facilities, accessed through terminals and computers onsite or online through the Internet. These hybrids are already remediations of the traditional printed library, as they both pay homage to print and offer new electronic services. In a larger sense, however, our culture also treats the World Wide Web or cyberspace itself as a library.

DIGITAL LIBRARIES

The electronic library is already decades old, in the sense there have been bibliographic and textual databases since the 1970s. At first these databases were expensive and were therefore restricted to medicine, law, the physical sciences, and government agencies. But now all kinds of information are being put into commercial and public databases, many of which are available through the Web, such as newspaper and journal articles, airline schedules, enormous amounts of government data, and scholarly bibliographies. As full texts become available online, we see the impulse to create "universal" databases: to have all U.S. Court decisions, all archaeological data from pre-Columbian America, all medical journals, or all medieval English literature in one electronic place. For several years, the National Science Foundation and research institutions have participated in a "Digital Libraries Initiative": to create the underlying technology, to collect the texts, and to study the user-related issues in the remediation of the research library (www.nsf.gov/pubs/1998/nsf9863/nsf9863.htm June 21, 1999); (see also Fox & Marchionini, 1998). The emphasis of this initiative has been on scientific and technical literature, but for the humanities, too, there exist electronic text repositories, of which the best-known in the United States is probably the Center for Text in the Humanities, CETH (www.ceth.rutgers.edu June 22, 1999).

With its low costs of production and distribution, the World Wide Web permits the publication of specialized libraries designed for small communities of users. For example, Perseus Project (www.perseus.tufts.edu June 26, 1999) calls itself "an evolving digital library" (or is it an encyclopedia? the distinction becomes harder to draw) of materials for classical studies: it pro-

vides millions of words of ancient texts in Greek and Latin and in translation, together with grammatical notes, a Greek dictionary, an historical atlas, diagrams, and pictures of archaeological sites. Perseus seeks to place before the reader all the materials of a small research library and to link these materials hypertextually. Perseus still has great scope to grow; nevertheless, because the textual and archaeological remains of classical antiquity are (relatively) limited, the goal of a universal scholarly library of antiquity becomes thinkable. Scholars of other literatures are pursuing similar collections.

Once they are on the Internet, such individual collections become steps toward the greater goal of a universal library. The desire is always to extend the collection, to incorporate new texts, to bring new fields into the same electronic structure, which for us today is the Web. Something like the Web as universal library was envisioned years ago under the appropriate name "Xanadu" by Ted Nelson, who also coined the word "hypertext" (=> p. 43). Xanadu was to be an electronic subscription library. Although users would pay to participate, Nelson expected that everyone would see the value of participation and that the library would become the universal writing space. Nelson labeled his project: "A Piece of Software that Proposes a New Era of Computers, a New Form of Instant Literature and a Whole New World." The Xanadu system structured information in the computer in such a way that any text could be referenced by any other, these references could in turn be referenced, and so on. Nelson explained that "[b]y using links to mark and type data elements, and to represent typed connections between the data elements, the Xanadu system provides A UNIVERSAL DATA STRUCTURE TO WHICH ALL OTHER DATA MAY BE MAPPED ... " (Nelson, 1987, p. 1). Nelson had much more in mind than a computer data structure. He saw writers and readers throughout the world working in the same conceptual space. Xanadu was "a plan for a worldwide network, intended to serve hundreds of millions of users simultaneously from the corpus of the world's stored writings, graphics and data" (Nelson, 1987, p. 1; see also *Literary Machines* by Nelson, 1984). Xanadu was a vision for the macrocosm: millions of texts were to be managed and ultimately joined into one world network. The result would be far larger than any library realized in print or manuscript, or indeed through today's World Wide Web. Nevertheless, what appealed to Nelson in imagining Xanadu still appeals to us today in our cultural construction of the Web as a universal library.

The historian Roger Chartier (1995) has aptly described how electronic technology figures the dream of the universal library:

> If all existing texts, manuscript or printed, were digitized (in other words, converted into electronic text), then the universal availability of the written inheritance would become possible. All readers, wherever they might be, with the sole condition that it be before a reading post connected to a network for the distribution of computerized documents, could consult, read, study any text, regardless of the original location (p. 21).

Elsewhere Chartier (1994) writes:

> ... the library of the future is inscribed where all texts can be summoned, assembled, and read: on a screen. In the universe of remote communications made possible by computerized texts and electronic diffusion, texts are no longer prisoners of their original physical material existence.... The opposition long held to be insurmountable between the closed world of any finite collection, no mater what its size, and the infinite universe of all texts ever written is thus theoretically annihilated (p. 89).

This passion is a familiar one: what other goal have librarians ever had than to bring all books under their systematic control? The goal of a universal collection goes back at least to Alexandria, where the authorities apparently ordered that rolls found aboard ships entering the port were to be seized for their library. The modern equivalents of the Alexandrian library are the great national collections, such as the Library of Congress, the British Library, and the Bibliothèque Nationale de France, which are supposed to receive by law copies of all books printed in their respective countries. These national libraries are already building electronic extensions of themselves. In the 1990s the Library of Congress initiated the American Memory Project, collections of materials in machine-readable form, and since 1995 has had a National Digital Library as its goal (lcweb.loc.gov/loc/ndlf/digital.html June 22, 1999). The Bibliothèque Nationale de France has combined a massive new physical building (Tolbiac) with the beginnings of a digital collection, with some of the texts preserved as digital images and some in ASCII format (www.bnf.fr October 17,1999). The great national libraries of course want to maintain their physical presence. They are seeking to show that digital technologies do not make traditional libraries obsolete, but rather that these organizations with their long traditions of cataloging and control can now effectively colonize cyberspace. At the Bibliothèque Nationale de France, for example, the building now functions almost as a portal to cyberspace. If the physical collection validates and anchors the shift into the electronic medium, the electronic collection is meant to ensure that the great national library will not become obsolete.

In the late age of print, working libraries continue to be hybrids: combinations of machine-readable materials, computer services, and familiar printed books and journals. The example of earlier periods of remediation suggests that the transfer of materials from physical to electronic form may never be complete. The shift from papyrus roll to codex apparently left many ancient pagan texts behind, as did the shift from uncial to minuscule script in the Middle Ages, and the shift from manuscript to print. With considerable effort our culture could probably transfer all or almost all texts and images, but the question is whether we will ever make the effort. Each such shift in the past has been an occasion for weeding out texts that no longer seemed culturally relevant. Although we are likely to retain a broader variety of texts than ever before, texts that appeal to small or economically disadvantaged groups may still be neglected. On the other hand, for most readers and for most purposes, cyberspace itself in the form of World Wide Web may come to be treated as if it were a universal library. Readers will turn to the Web for information, and if they cannot find it there and are not willing to look elsewhere, then cyberspace may become by default the universal book, encyclopedia, and library all in one.

REFASHIONING THE BOOK OF NATURE

> ... the end of the *codex* will signify the loss of acts and representations indissolubly linked to the book as we now know it. In the form that it has acquired in Western Europe since the beginning of the Christian era, the book has been one of the most powerful metaphors for conceiving of the cosmos, nature, history, and the human body. If the object that has furnished the matrix of this repertory of images ... should disappear, the references and the procedures that organize the 'readability' of the physical world, equated with a book in the *codex* form, would be profoundly upset as well (Chartier, 1994, pp. 90–91).

Networked information appliances can be seen as first attempts to break down the limits of the traditional volume or codex and to put the whole world of writing into one book. At the same time, such devices take the book out into the world. Writers carry their devices everywhere. When they write on (or talk to) their portable computers, the information moves back and forth through a network that blurs the distinction between the world of nature and the world of texts. For writers in their cars or, better still, seated under the trees, beaming information to other writers and readers, the world has become an enormous volume in which they can leave their electronic marks. They are writing in and on the world.

As Chartier notes, the metaphor of the world as a book is not peculiar to the late age of print. Throughout the history of writing, the book has served as a metaphor for nature as a whole and for the human mind in particular. Scholars such as Curtius have traced a series of analogies among the ideas of mind, book, encyclopedia, library, and the world of nature. The metaphor of the book of nature appealed to the Middle Ages, precisely because of the importance of venerable texts and textual authorities for the medieval mind. For the medieval scholar, the world was made intelligible through such key works as those of Augustine and Aristotle. The very structure of the world was supposed to be mirrored in such books, and conversely the universe itself came to be viewed as a great book—hence the importance of encyclopedias and summae that brought the whole textual world under control. As Gellrich puts it in *The Idea of the Book* (1985), the ambition of encyclopedists and theologians was nothing less than " ... to gather all strands of learning together into an enormous Text, an encyclopedia or summa, that would mirror the historical and transcendental orders just as the Book of God's Word (the Bible) was a speculum of the Book of his Work (nature)" (p. 18). Curtius argued that the poet Dante could invoke the same metaphor. At the end of the *Paradiso*, Dante's ultimate vision is of the universe as an enormous book that has finally been put together properly: " ... all that has been scattered throughout the entire universe, that has been separated and dissevered, like loose quaderni [quires], is now 'bound in one volume.' The book—[in which all is contained]—is the Godhead" (Curtius, 1973, p. 332). Dante's poem itself has been called a summa, an attempt to encompass all knowledge between two covers. In the same way, the *Encyclopédie* or the 15th edition of the *Encyclopaedia Britannica* can be understood as modern secular attempts to encompass the book of nature in the technology of print. We recall that D'Alembert described the *Encyclopédie* as a world map (D'Alembert, 1963, p. 47).

Contemporary projects and proposals for hypertextual encyclopedias and digital libraries remediate this vision, although the metaphor has changed in response to the new technology. In the age of the manuscript and especially in the age of print, the book was valued for its capacity to preserve and display fixed structures. It was a technological reflection of the great chain of being, in which all of nature had its place in a subtle, but unalterable hierarchy. The hierarchical divisions of knowledge by Hugh of St. Victor or even Francis Bacon belonged on the written or printed page. Even

as late as Coleridge, an encyclopedist thought that the purpose of his great book was to demonstrate how each notion is subordinated "to a preconceived universal Idea" (*Encyclopaedia Metropolitana*, 1849, p. 22)—in other words, to present hierarchies of knowledge. The passion for hierarchy finds expression in the elaborate table of contents of modern encyclopedias and other great books in print. The table of contents is both hierarchical and linear: it shows subordination and superordination, and it also shows the reader the order in which he or she will encounter these ideas in reading from first page to last.

Electronic structures are less rigid. Menus in an electronic information system can indicate a hierarchy of topics, as Yahoo! does, but only provisionally, and there is no single, linear order of pages to determine how the reader should move through the hierarchy. Our culture is defining the electronic encyclopedia, and electronic books in general, to reflect a different natural world, in which relationships are multiple and developing. It is a world in which the distinctions between nature and culture and between information and medium are unstable, as Donna Haraway (1991, 1997), N. Katherine Hayles (1999), and many others have argued. In fact, the metaphor of the book of nature is now moribund. Electronic writing technologies suggest a different metaphor: cyberspace, which blurs the distinction between nature and our networked culture. Cyberspace is not, as some enthusiasts have argued, divorced from the natural and social world that we know; rather, it is an expression and extension of both. Cyberspace is a great book of cultural choices that overlap and coincide with the "natural" order (=> p. 201). This new metaphor is yet another way in which digital technology suggests a refashioning of the tradition of the great book.

6

Refashioned Dialogues

THE READING PATH

A written text is a structure in space that also implies a structure in time: in some sense writing turns time into space, with a written text being like a musical score. The score is a visual pattern of barlines, notes, rests, and dynamic markings, but the pattern only makes sense when read as a sequence of measures. Most of us can read music, if at all, only by playing it on an instrument, but a good musician can read the score directly, activating the musical signs in his or her head. Those who can only read music by playing it are like people who read verbal texts by saying the words aloud: they are almost entirely absorbed by the unfolding temporal structure of the music. The musician, however, can appreciate the second dimension, the "vertical" structure of the score as well. A thorough reading of text or music may require attention to the space as well as the time of the writing. Once again, the writing technology used plays its role in defining the relationship between the time and space of the text. In a medieval codex the spatial structure is the pattern of rubrication and various sizes of letters; in a printed book it is the arrangement into paragraphed pages; in today's computers it is the pattern of text windows and images on the screen. The temporal dimension of a text is created by the reader's moment-by-moment encounter with these structures.

When a reader is reading a novel or an essay, the words create a rhythm of expectations. One word alludes to something earlier in the text or looks ahead to something to come. Expectations, explicit references, and allusions are also part of the purely oral arts of storytelling and public speaking. But one important difference between listening to a story and reading a book is that, although listeners simply allow the words to come to them,