Hypertext: An Introduction

When designers of computer software examine the pages of *Glas* or *Of Grammatology*, they encounter a digitalized, hypertextual Derrida; and when literary theorists examine *Literary Machines*, they encounter a deconstructionist or poststructuralist Nelson. These shocks of recognition can occur because over the past several decades literary theory and computer hypertext, apparently unconnected areas of inquiry, have increasingly converged. Statements by theorists concerned with literature, like those by theorists concerned with computing, show a remarkable convergence. Working often, but not always, in ignorance of each other, writers in these areas offer evidence that provides us with a way into the contemporary *episteme* in the midst of major changes. A paradigm shift, I suggest, has begun to take place in the writings of Jacques Derrida and Theodor Nelson, Roland Barthes and Andries van Dam. I expect that one name in each pair will be unknown to most of my readers. Those working in computing will know well the ideas of Nelson and van Dam; those working in literary and cultural theory will know equally well the ideas of Derrida and Barthes.

All four, like many others who write on hypertext and literary theory, argue that we must abandon conceptual systems founded on ideas of center, margin, hierarchy, and linearity and replace them by ones of multilinearity, nodes, links, and networks. Almost all parties to this paradigm shift, which marks a revolution in human thought, see electronic writing as a direct response to the strengths and weaknesses of the printed book, one of the major landmarks in the history of human thought. This response has profound implications for literature, education, and politics.
The many parallels between computer hypertext and critical theory have many points of interest, the most important of which, perhaps, lies in the fact that critical theory promises to theorize hypertext and hypertext promises to embody and thereby test aspects of theory, particularly those concerning textuality, narrative, and the roles or functions of reader and writer. Using hypertext, digital textuality, and the Internet, students of critical theory now have a laboratory with which to test its ideas. Most important, perhaps, an experience of reading hypertext or reading with hypertext greatly clarifies many of the most significant ideas of critical theory. As J. David Bolter points out in the course of explaining that hypertextuality embodies poststructuralist conceptions of the open text, “what is unnatural in print becomes natural in the electronic medium and will soon no longer need saying at all, because it can be shown” (Writing Space, 143).

In S/Z, Roland Barthes describes an ideal textuality that precisely matches that which has come to be called computer hypertext—text composed of blocks of words (or images) linked electronically by multiple paths, chains, or trails in an open-ended, perpetually unfinished textuality described by the terms link, node, network, web, and path. “In this ideal text,” says Barthes, “the networks [réseaux] are many and interact, without any one of them being able to surpass the rest; this text is a galaxy of signifiers, not a structure of signifieds; it has no beginning; it is reversible; we gain access to it by several entrances, none of which can be authoritatively declared to be the main one; the codes it mobilizes extend as far as the eye can reach, they are indeterminable . . . ; the systems of meaning can take over this absolutely plural text, but their number is never closed, based as it is on the infinity of language” (5–6 [English translation]; 11–12 [French]).

Like Barthes, Michel Foucault conceives of text in terms of network and links. In The Archaeology of Knowledge, he points out that the “frontiers of a book are never clear-cut,” because “it is caught up in a system of references to other books, other texts, other sentences: it is a node within a network . . . [a] network of references” (23).

Like almost all structuralists and poststructuralists, Barthes and Foucault describe text, the world of letters, and the power and status relations they involve in terms shared by the field of computer hypertext. Hypertext, a term coined by Theodor H. Nelson in the 1960s, refers also to a form of electronic text, a radically new information technology, and a mode of publication. “By hypertext,” Nelson explains, “I mean non-sequential writing—text that
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branches and allows choices to the reader, best read at an interactive screen. As popularly conceived, this is a series of text chunks connected by links which offer the reader different pathways (Literary Machines, 0/2). Hypertext, as the term is used in this work, denotes text composed of blocks of text—what Barthes terms a lexia—and the electronic links that join them. Hypermedia simply extends the notion of the text in hypertext by including visual information, sound, animation, and other forms of data. Since hypertext, which links one passage of verbal discourse to images, maps, diagrams, and sound as easily as to another verbal passage, expands the notion of text beyond the solely verbal, I do not distinguish between hypertext and hypermedia. Hypertext denotes an information medium that links verbal and nonverbal information. In this network, I shall use the terms hypermedia and hypertext interchangeably. Electronic links connect lexias "external" to a work—say, commentary on it by another author or parallel or contrasting texts—as well as within it and thereby create text that is experienced as nonlinear, or, more properly, as multilinear or multisequential. Although conventional reading habits apply within each lexia, once one leaves the shadowy bounds of any text unit, new rules and new experience apply.

The standard scholarly article in the humanities or physical sciences perfectly embodies the underlying notions of hypertext as multisequentially read text. For example, in reading an article on, say, James Joyce’s Ulysses, one reads through what is conventionally known as the main text, encounters a number or symbol that indicates the presence of a footnote or endnote, and leaves the main text to read that note, which can contain a citation of passages in Ulysses that supposedly support the argument in question or information about the scholarly author’s indebtedness to other authors, disagreement with them, and so on. The note can also summon up information about sources, influences, and parallels in other literary texts. In each case, the reader can follow the link to another text indicated by the note and thus move entirely outside the scholarly article itself. Having completed reading the note or having decided that it does not warrant a careful reading at the moment, one returns to the main text and continues reading until one encounters another note, at which point one again leaves the main text.

This kind of reading constitutes the basic experience and starting point of hypertext. Suppose now that one could simply touch the page where the symbol of a note, reference, or annotation appeared, and thus instantly bring into view the material contained in a note or even the entire other text—here all of Ulysses—to which that note refers. Scholarly articles situate themselves within a field of relations, most of which the print medium keeps out of sight.
and relatively difficult to follow, because in print technology the referenced (or linked) materials lie spatially distant from the references to them. Electronic hypertext, in contrast, makes individual references easy to follow and the entire field of interconnections obvious and easy to navigate. Changing the ease with which one can orient oneself within such a context and pursue individual references radically changes both the experience of reading and ultimately the nature of that which is read. For example, if one possessed a hypertext system in which our putative joyce article was linked to all the other materials it cited, it would exist as part of a much larger system in which the totality might count more than the individual document; the article would now be woven more tightly into its context than would a printed counterpart.

As this scenario suggests, hypertext blurs the boundaries between reader and writer and therefore instantiates another quality of Barthes's ideal text. From the vantage point of the current changes in information technology, Barthes's distinction between readerly and writerly texts appears to be essentially a distinction between text based on print technology and electronic hypertext, for hypertext fulfills

the goal of literary work (of literature as work) [which] is to make the reader no longer a consumer, but a producer of the text. Our literature is characterized by the pitiless divorce which the literary institution maintains between the producer of the text and its user, between its owner and its consumer, between its author and its reader. This reader is thereby plunged into a kind of idleness—he is intransitive; he is, in short, serious: instead of functioning himself, instead of gaining access to the magic of the signifier, to the pleasure of writing, he is left with no more than the poor freedom either to accept or reject the text: reading is nothing more than a referendum. Opposite the writerly text, then, is its countervalue, its negative, reactive value: what can be read, but not written: the readerly. We call any readerly text a classic text. (5/Z, 4)

Compare the way the designers of Intermedia, one of the most advanced hypertext systems thus far developed, describe the active reader that hypertext requires and creates:

Both an author's tool and a reader's medium, a hypertext document system allows authors or groups of authors to link information together, create paths through a corpus of related material, annotate existing texts, and create notes that point readers to either bibliographic data or the body of the referenced text . . . Readers can browse through linked, cross-referenced, annotated texts in an orderly but nonsequential manner. (17)⁶

To get an idea of how hypertext produces Barthes's writerly text, let us examine how the print version and the hypertext version of this book would
differ. In the first place, instead of encountering it in a paper copy, you would read it on a computer screen (or already have if you’ve read the Johns Hopkins translation of the first version into hypertext). In 1997, computer screens, which had neither the portability nor the tactility of printed books, made the act of reading somewhat more difficult than did the print version. For those people like myself who do a large portion of their reading reclining on a bed or couch, screens on desktop machines are markedly less convenient. For the past four years, however, I have worked with a series of laptops whose displays do not flicker and whose portability permits enjoyable reading in multiple locations. Of course, my Apple G4 laptop still doesn’t endow the documents read on it with the pleasurable tactility of the printed book, but since my wife and I use wireless access to the Internet, we can both read Internet materials anywhere in the house or sitting outside in a recliner on the porch. Although I used to agree with people who told me that one could never read large amounts of text online, I now find that with these new displays I prefer to read the scholarly literature on my laptop; taking notes and copying passages is certainly more convenient. Nonetheless, back in the late 1980s, reading on Intermedia, the hypertext system with which I first worked, offered certain important compensations for its inconveniences.

Reading an Intermedia, Storyspace, or World Wide Web version of this book, for example, you could change the size and even style of font to make reading easier. Although you could not make such changes permanently in the text as seen by others, you could make them whenever you wished. More important, since on Intermedia you would read this hypertext equivalent of a reference mark (glyph, button, link marker), and this action would bring the endnote into view. A hypertext version of a note differs from that in a printed book in several ways. First, it links directly to the reference symbol and does not reside in some sequentially numbered list at the rear of the main text. Second, once opened and either superimposed on the main text or placed alongside it, it appears as an independent, if connected, document in its own right and not as some sort of subsidiary, supporting, possibly parasitic text.

Although I have since converted endnotes containing bibliographic information to in-text citations, the first version of Hypertext had a note containing the following information: “Roland Barthes, S/Z, trans. Richard Miller (New York: Hill and Wang, 1974), 5–6.” A hypertext lexia equivalent to
this note could include this same information, or, more likely, take the form of
the quoted passage, a longer section or chapter, or the entire text of Barthes's
work. Furthermore, in the various hypertext versions of this book, that pas-
sage in turn links to other statements by Barthes of similar import, com-
ments by students of Barthes, and passages by Derrida and Foucault that also
concern this notion of the networked text. As a reader, you must decide
whether to return to my argument, pursue some of the connections I suggest
by links, or, using other capacities of the system, search for connections I
have not suggested. Reading on the World Wide Web produces this kind of
reading experience. The multiplicity of hypertext, which appears in multiple
links to individual blocks of text, calls for an active reader.

A full hypertext system, unlike a book and unlike some of the first ap-
proximations of hypertext available—HyperCard™, Guide™, and the current
World Wide Web (except for blogs)—offers the reader and writer the same
environment. Therefore, by opening the text-processing program, or editor,
as it is known, you can take notes, or you can write against my interpreta-
tions, against my text. Although you cannot change my text, you can write a
response and then link it to my document. You thus have read the readerly
text in several ways not possible with a book: you have chosen your reading
path, and since you, like all readers, will choose individualized paths, the
hypertext version of this book would probably take a very different form, per-
haps suggesting the values of alternate routes and probably devoting less
room in the main text to quoted passages. You might have also have begun to
take notes or produce responses to the text as you read, some of which might
take the form of texts that either support or contradict interpretations pro-
posed in my texts.

When one considers the history of both ancient literature and
recent popular culture, the figure of the reader-as-writer hardly
appears at all strange, particularly since classical and neo-
classical cultural theory urged neophyte authors to learn their craft by read-
ing the masters and then consciously trying to write like them. Anyone who’s
taken an undergraduate survey course will know that Vergil self-consciously
read and rewrote Homer, and that Dante read and rewrote both Homer and
Vergil, and Milton continued the practice. Such very active readers appear
throughout the past two centuries. To an important extent, Jane Eyre repre-
sents a very active reading of Pride and Prejudice, just as North and South and
Aurora Leigh represent similar readings and rewritings of the two earlier
texts. In fact, all four works could have been entitled "Pride and Prejudice,"
crete, finished text; the reader's response—writing a new text—demonstrates that this kind of reader both accepts that fact and also does not want to accept its limitations. This active reading characterizes readers of blogs: they take an existing text and add to it, but because they write in a networked computer environment the commented-on blog, employing TrackBack, can link to the active reader's text, incorporating it into the ongoing discussion. ⁸

Like blogs, by-now atypical hypertext systems that permit readers to add their own links and materials (Intermedia, Storyspace in the authoring environment) or even websites that solicit reader contributions represent ways that readers can assume the role of authors. All of these forms of active reading differ from the experience of the hypertext reader in read-only systems, whose writing takes the form not of adding new texts but of establishing an order of reading in an already-written set of texts. Readers of large bodies of informational hypermedia create the document they read from the informed choices they make. It might appear that such is rarely true of readers of fictional hypertexts who may not know where particular links lead. Nonetheless, the best hyperfictions, I submit, permit the reader to deduce enough basic information, sometimes, as in Michael Joyce's afternoon, by retracing their steps, to make informed (thus creative) decisions when they arrive at links. Still, no matter how much power readers have to choose their ways through a hypertext, they never obtain the same degree of power—or have to expend as much effort—as those who write their texts in response to another's.

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**Vannevar Bush and the Memex**

Writers on hypertext trace the concept to a pioneering article by Vannevar Bush in a 1945 issue of *Atlantic Monthly* that called for mechanically linked information-retrieval machines to help scholars and decision makers faced with what was already becoming an explosion of information. Struck by the "growing mountain of research" that confronted workers in every field, Bush realized that the number of publications had already "extended far beyond our present ability to make real use of the record. The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-rigged ships" (17–18). As he emphasized, "there may be millions of fine thoughts, and the account of the experience on which they are based, all encased within stone walls of acceptable architectural form; but if the scholar can get at only one a week by diligent search, his syntheses are not likely to keep up with the current scene" (29).

According to Bush, the main problem lies with what he termed "the mat-
ter of selection"—information retrieval—and the primary reason that those
who need information cannot find it lies in turn with inadequate means of
storing, arranging, and tagging information:

Our ineptitude in getting at the record is largely caused by the artificiality of systems
of indexing. When data of any sort are placed in storage, they are filed alphabetically
or numerically, and information is found (when it is) by tracing it down from subclass
to subclass. It can be in only one place, unless duplicates are used; one has to have
rules as to which path will locate it, and the rules are cumbersome. Having found one
item, moreover, one has to emerge from the system and re-enter on a new path. (31)

As Ted Nelson, one of Bush's most prominent disciples, points out,
"there is nothing wrong with categorization. It is, however, by its nature trans-
sient: category systems have a half-life, and categorizations begin to look
fairly stupid after a few years . . . The army designation of 'Pong Balls, Ping'
has a certain universal character to it" (Literary Machines, 2/49). According to
Bush and Nelson, then, one of the greatest strengths of hypertext lies in its
capacity of permitting users to find, create, and follow multiple conceptual
structures in the same body of information. Essentially, they describe the
technological means of achieving Derrida's concept of decentering.

In contrast to the rigidity and difficulty of access produced by present
means of managing information based on print and other physical records,
one needs an information medium that better accommodates the way the
mind works. After describing present methods of storing and classifying
knowledge, Bush complains, "The human mind does not work that way" ("As
We May Think," 31) but by association. With one fact or idea "in its grasp,"
the mind "snaps instantly to the next that is suggested by the association of
thoughts, in accordance with some intricate web of trails carried by the cells
of the brain" (32).

To liberate us from the confinements of inadequate systems of classi-
fication and to permit us to follow natural proclivities for "selection by as-
sociation, rather than by indexing," Bush therefore proposes a device, the
"memex," that would mechanize a more efficient, more human, mode of
manipulating fact and imagination. "A memex," he explains, "is a device in
which an individual stores his books, records, and communications, and
which is mechanized so that it may be consulted with exceeding speed and
flexibility. It is an enlarged intimate supplement to his memory" (32). Writ-
ing in the days before digital computing (the first idea for a memex came to
him in the mid-1930s), Bush conceived of his device as a desk with translu-
cent screens, levers, and motors for rapid searching of microform records.
In addition to thus searching and retrieving information, the memex also permits the reader to "add marginal notes and comments, taking advantage of one possible type of dry photography, and it could even be arranged so that [an individual] can do this by a stylus scheme, such as is now employed in the telautograph seen in railroad waiting rooms, just as though he had the physical page before him" (33). Two things demand attention about this crucial aspect of Bush's conception of the memex. First, he believes that while reading, one needs to append one's own individual, transitory thoughts and reactions to texts. With this emphasis Bush in other words reconceives reading as an active process that involves writing. Second, his remark that this active, intrusive reader can annotate a text "just as though he had the physical page before him" recognizes the need for a conception of a virtual, rather than a physical, text. One of the things that is so intriguing about Bush's proposal is the way he thus allows the shortcomings of one form of text to suggest a new technology, and that leads, in turn, to an entirely new conception of text.

The "essential feature of the memex," however, lies not only in its capacities for retrieval and annotation but also in those involving "associative indexing"—what present hypertext systems term a link—"the basic idea of which is a provision whereby any item may be caused at will to select immediately and automatically another" (34). Bush then provides a scenario of how readers would create "endless trails" of such links:

When the user is building a trail, he names it, inserts the name in his code book, and taps it out on his keyboard. Before him are the two items to be joined, projected onto adjacent viewing positions. At the bottom of each there are a number of blank code spaces, and a pointer is set to indicate one of these on each item. The user taps a single key, and the items are permanently joined. In each code space appears the code word. Out of view, but also in the code space, is inserted a set of dots for photocell viewing; and on each item these dots by their positions designate the index number of the other item. Thereafter, at any time, when one of these items is in view, the other can be instantly recalled merely by tapping a button below the corresponding code space. (34)

Bush's remarkably prescient description of how the memex user creates and then follows links joins his major recognition that trails of such links themselves constitute a new form of textuality and a new form of writing. As he explains, "when numerous items have been thus joined together to form a trail . . . it is exactly as though the physical items had been gathered together from widely separated sources and bound together to form a new book." In fact, "it is more than this." Bush adds, "for any item can be joined into
numerous trails” (34), and thereby any block of text, image, or other information can participate in numerous books.

These new memex books themselves, it becomes clear, are the new book, or one additional version of the new book, and, like books, these trail sets or webs can be shared. Bush proposes, again quite accurately, that “wholly new forms of encyclopedias will appear, ready-made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified” (35). Equally important, individual reader-writers can share document sets and apply them to new problems.

Bush, an engineer interested in technical innovation, provides the example of a memex user

studying why the short Turkish bow was apparently superior to the English long bow in the skirmishes of the Crusades. He has dozens of possibly pertinent books and articles in his memex. First he runs through an encyclopedia, finds an interesting but sketchy article, leaves it projected. Next, in a history, he finds another pertinent item, and ties the two together. Thus he goes, building a trail of many items. Occasionally he inserts a comment of his own, either linking it into the main trail or joining it by a side trail to a particular item. When it becomes evident that the elastic properties of available materials had a great deal to do with the bow, he branches off on a side trail which takes him through textbooks on elasticity and tables of physical constants. He inserts a page of longhand analysis of his own. Thus he builds a trail of his interest through the maze of materials available to him. (34–35)

And, Bush adds, his researcher’s memex trails, unlike those in his mind, “do not fade,” so when he and a friend several years later discuss “the queer ways in which a people resist innovations, even of vital interest” (35), he can reproduce his trails created to investigate one subject or problem and apply them to another.

Bush’s idea of the memex, to which he occasionally turned his thoughts for three decades, directly influenced Nelson, Douglas Englebart, Andries van Dam, and other pioneers in computer hypertext, including the group at the Brown University’s Institute for Research in Information and Scholarship (IRIS) who created Intermedia. In “As We May Think” and “Memex Revisited” Bush proposed the notion of blocks of text joined by links, and he also introduced the terms links, linkages, trails, and web to describe his new conception of textuality. Bush’s description of the memex contains several other seminal, even radical, conceptions of textuality. It demands, first of all, a radical reconfiguration of the practice of reading and writing, in which both activities draw closer together than is possible with book technology. Second,
despite the fact that he conceived of the memex before the advent of digital computing. Bush perceives that something like virtual textuality is essential for the changes he advocates. Third, his reconfiguration of text introduces three entirely new elements—associative indexing (or links), trails of such links, and sets or webs composed of such trails. These new elements in turn produce the conception of a flexible, customizable text, one that is open—and perhaps vulnerable—to the demands of each reader. They also produce a concept of multiple textuality, since within the memex world texts refers to individual reading units that constitute a traditional “work,” those entire works, sets of documents created by trails, and perhaps those trails themselves without accompanying documents.

Perhaps most interesting to one considering the relation of Bush's ideas to contemporary critical and cultural theory is that this engineer began by rejecting some of the fundamental assumptions of the information technology that had increasingly dominated—and some would say largely created—Western thought since Gutenberg. Moreover, Bush wished to replace the essentially linear fixed methods that had produced the triumphs of capitalism and industrialism with what are essentially poetic machines—machines that work according to analogy and association, machines that capture and create the anarchic brilliance of human imagination. Bush, we perceive, assumed that science and poetry work in essentially the same way.

Before showing some of the ways this new information technology shares crucial ideas and emphases with contemporary critical theory, I shall examine in more detail the link, the element that hypertext adds to writing and reading. The very simplest, most basic form of linking is unidirectional lexia to lexia (Figure 1). Although this type of link has the advantage of requiring little planning, it disorients when used with long documents, since readers do not know where a link leads in the entered document. It is best used, therefore, for brief lexias or in systems that use card metaphors.

Next in complexity comes bidirectional linking of two entire lexias to one another—identical to the first form except that it includes the ability to retrace one's steps (or jump). Its advantage lies in the fact that by permitting readers to retrace their steps, it creates a simple but effective means of orientation. This mode seems particularly helpful when a reader arrives at a lexia that has only one or two links out, or when readers encounter something, say, a glossary definition or image, that they do not want to consult at that point in their reading.
Lexia to Lexia Unidirectional

Advantage: simple, requires little planning.

Disadvantage: disorients when used with long documents, since readers do not know where link leads; best used for brief lexias or in systems that use card metaphor.

Lexia to Lexia Bidirectional

Advantage: by permitting readers to retrace their steps creates simple but effective means of orientation. Particularly helpful when arriving at lexias that have only one or two departure links.

String (word or phrase) to Lexia

Advantages: (1) allows simple means of orienting readers; (2) permits longer lexias; (3) encourages different kinds of annotation and linking.

Disadvantage: disorients when used with long documents, since readers do not know where link leads; best used for brief lexias or in systems that use card metaphor.

Figure 1. Three Forms of Linking

Linking a string—that is, word or phrase—to an entire lexia, the third form of linking, has three advantages. First, it permits simple means of orienting readers by allowing a basic rhetoric of departure (Figure 1). When readers see a link attached to a phrase, such as “Arminianism” or “Derrida,” they have a pretty good idea that such a link will take them to information related in some obvious way to those names. Second, because string-to-lexia linking thus provides a simple means of helping readers navigate through information space, it permits longer lexias. Furthermore, since one can choose to leave the lexia at different points, one can comfortably read through longer
texts. Third, this linking mode also encourages different kinds of annotation and linking, since the ability to attach links to different phrases, portions of images, and the like allows the author to indicate different kinds of link destinations. One can, for example, use icons or phrases to indicate that the reader can go to, say, another text lexia, one containing an illustration, bibliographical information, definitions, opposing arguments, and so forth.

The difficulties with string-to-lexia links, the form most characteristic of links in World Wide Web documents, arise in problems encountered at the destination lexia. Readers can find themselves disoriented when entering long documents, and therefore string-to-lexia linking works best with brief arrival lexia. The fourth form of linking occurs when one makes the link joining a string to an entire lexia bidirectional. (Most linking in HTML [HyperText Markup Language] documents takes this form in effect—"in effect," because the return function provided by most browsers creates the effect of a bidirectional link.)

The fifth form, unidirectional string-to-string linking, has the obvious advantage of permitting the clearest and easiest way to end links and thereby create a rhetoric of arrival. By bringing readers to a clearly defined point in a text, one enables them to perceive immediately the reason for a link and hence to grasp the relation between two lexias or portions of them. Readers know, in other words, why they have arrived at a particular point. The anchor feature in HTML, which is created by the \texttt{\textless a name\textgreater} tag, thus permits authors to link to a specific section of long document. The possible disadvantage of such a mode to authors—which is also a major advantage from the reader's point of view—lies in the fact that it requires more planning, or at least, more definite reasons for each link. Making such links bidirectional, our sixth category, makes navigating hyperspace even easier.

Full hyperextuality in a reading environment depends, I argue, on the multisequentiality and the reader choices created not only by attaching multiple links to a single lexia but by attaching them to a single anchor or site within a single lexia. A fully hyperextual system (or document) therefore employs a seventh form, one-to-many linking—linking that permits readers to obtain different information from the same textual site (Figure 2). One-to-many linking supports hyperextuality in several ways. First, it encourages branching and consequent reader choice. Second, attaching multiple links to a single text allows hypertext authors to create efficient overviews and directories that serve as efficient crossroad documents, or orientation points, that help the reader navigate hyperspace. Multiple overviews or sets of overviews have the additional advantage of easily permitting different authors to pro-
String to String

Advantage: permits clearest way to end links.

Disadvantage: requires more planning than do links to full lexias.

One-to-Many

Advantages: (1) encourages branching and consequent reader choice; (2) permits efficient author-generated overview and directory documents; (3) when combined with systems that provide link menus and other preview functions, helps greatly in orienting readers.

Disadvantage: can produce sense of an atomized text.

Figure 2. Two Forms of Linking

...vide multiple ways through the same information space. Third, when combined with software, such as Microcosm, Storyspace, or Intermedia, that provides link menus and other so-called preview functions, one-to-many linking greatly helps in orienting readers. The major disadvantage of this kind of link, which plays a major role in most hypertext fiction, lies in its tendency to produce a sense of atomized text.

The eighth kind of link—many-to-one linking—proves particularly handy for creating glossary functions or for creating documents that make multiple references to a single text, table, image, or other data (Figure 3). DynaText,
Many-to-One Linking

Advantages: (1) handy for glossary functions or for texts that make multiple references to a single text, table, image, or other data; (2) encourages efficient reuse of important information; (3) allows simple means of producing documents for readers with differing levels of expertise.

Disadvantage: systems that create many-to-one linking automatically can produce a distracting number of identical links.

Figure 3. Many-to-One Linking

Microcosm, and the World Wide Web exemplify hypertext environments in which one can have many links lead to a single document, an arrangement that has major advantages in educational and informational applications. In particular, many-to-one linking encourages efficient reuse of important information. For example, having once created an introductory essay on, say, Charles II, Lamarckianism, or Corn Law agitation, the original (and later) authors simply use linking to provide access to it as the occasion arises. Furthermore, by providing an easy, efficient means of offering readers glossaries and other basic information, many-to-one linking also permits webs to be used easily by readers with differing levels of expertise.

The major disadvantage of such linking involves not the links themselves but the means various systems use to indicate their presence. Systems that create many-to-one linking, particularly those that create it automatically, can produce a distracting number of link markers. The World Wide Web uses colored underlining to indicate hot text (link anchors), and in the DynaText version of the first version of this book, Paul Kahn chose red text to signify the presence of links. In both cases the reader encounters distracting markup intruding into the text. Experience with these systems quickly convinces one of
the need for a means of easily turning on and off such link indicators, such as one can do in Eastgate System's Storyspace. The disadvantages with many-to-one links derive not from this form of linking itself but from other aspects of individual hypertext environments, and any such disadvantages became amplified by the inexperience of readers: in the first years of the Web, for example, authors and designers generally agreed that users, many of whom had little experience with computing, required colored underlining to find links; otherwise, it was correctly reasoned, readers would not know what to do. In the very earliest days of the Web, in fact, one often encountered linked underlined text immediately beneath a linked icon because web designers knew that many neophyte users would not realize they could follow links by clicking on the icon. As people began to use the Web every day, however, they recognized that when they moved a cursor across the surface of a web browser, it changed from an arrow to a hand when placed over a link. Experienced users thus no longer required the once ubiquitous blue underlining, and many sites now do not use it.

As we shall observe shortly, some systems, such as Microcosm, include a particularly interesting and valuable extension of many-to-one linking that permits readers to obtain a menu containing two or more glossary or similar documents. While creating a hypertext version of my book on Holman Hunt and Pre-Raphaelite painting for the World Wide Web, an environment that does not permit either link menus or one-to-many links, I had to choose whether to link (connect) multiple mentions of a particular painting, say, the artist's Finding of the Saviour in the Temple, to an introductory discussion of the picture or to an illustration of it. In contrast, while creating a hypertext version of the same book in Microcosm, I easily arranged links so that when readers follow them from any mention of the painting, they receive a menu containing titles of the introductory text and two or more illustrations, thereby providing readers with convenient access to the kind of information they need when they need it (see Figure 6).

Typed links, our ninth category, take the form of limiting an electronic link to a specific kind of relationship, such as "exemplifies," "influences," "contrary argument," "derives from" (or "child of"), and so on (Figure 4). Software that includes such link categorization range from proposed research systems that, in attempting to help organize argument, permit only certain kinds of connections, to those like Marc and Jocelyne Nanard's MacWeb, which allows authors to create their own categories. In fact, any system, such as Intermedia, Storyspace, or Microcosm, that permits one to attach labels to individual links allows one to create typed links, since labels permit authors
Typed Links

**Advantages:** (1) if clearly labeled, acts as a form of link preview and aids reader comfort; (2) can produce different kinds of link behavior, including pop-up windows.

**Disadvantage:** can clutter reading area or confuse by producing too many different actions when one follows links.

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Figure 4. Typed Links

to indicate everything from document type (essay, illustration, statistics, timeline) to a particular path or trail of links that overlay a number of lexias. In fact, as the experience of the World Wide Web reveals, one can use icons or text to create what are essentially typed icons even when the system makes no provision for them. Thus, one can make clear (as I have in the Victorian Web) that a link leads to bibliographical information, an illustration, or an opposing argument by simply linking to a word, such as *source* or *illustration*, within parentheses.

The advantage of typed links includes the fact that, when clearly labeled, they offer a generalized kind of previewing that aids reader comfort and helps navigating information space. Such labeling can take the form of icons in the current lexia (DynaText, Voyager Expanded Book, World Wide Web), similar indications in a second window (Intermedia's Web View and similar dynamic hypergraphs, such as that created experimentally for Microcosm), and dynamic link menus (Intermedia, Storyspace). In systems that include pop-up windows overlaying the current lexia (DynaText, the proprietary one created by Cognitive Systems for the Microsoft Art Gallery; and ones created by Java for the World Wide Web), typed links can also produce different kinds of link behavior. A potential disadvantage for readers of the typed link might be confusion produced when they encounter too many different actions or kinds of information; in fact, I have never encountered hypertexts with these problems, but I'm sure some might exist. A greater danger for authors would
exist in systems that prescribe the kind of links possible. My initial skepticism about typing links arose in doubts about the effectiveness of creating rules of thought in advance and a particular experience with Intermedia. The very first version of Intermedia used by faculty developers and students differentiated between annotation and commentary links, but since one person’s annotation turned out to be another’s commentary, no one lobbed for retaining this feature, and IRIS omitted it from later versions.

An equally basic form of linking involves the degree to which readers either activate or even create links. In contemporary hypertext jargon, the opposition is usually phrased as a question of whether links are author or reader determined, or—putting the matter differently—whether they are hard or soft. Most writing about hypertext from Bush and Nelson to the present assumes that someone, author or reader functioning as author, creates an electronic link, a so-called hard link. Recently, workers in the field, particularly the University of Southampton’s Microcosm development group, have posed the question, “Can one have hypertext ‘without links’?”—that is, without the by-now traditional assumption that links have to take the form of always-existing electronic connections between anchors. This approach takes the position that the reader’s actions can create on-demand links. In the late 1980s when the first conferences on hypertext convened, such a conception of hypertext might have been difficult, if not impossible, to advocate, because in those days researchers argued that information retrieval did not constitute hypertext, and the two represented very different, perhaps opposed, approaches to information. Part of the reason for such views lay in the understandable attempts of people working in a new field in computer science to distinguish their work—and thereby justify its very existence—from an established one. Although some authors, such as the philosopher Michael Heim, perceived the obvious connection between the active reader who uses search tools to probe an electronic text and the active reader of hypertext, the need of the field to constitute itself as a discrete specialty prompted many to juxtapose hypertext and information retrieval in the sharpest terms. When the late James H. Coombs created both InterLex and full-text retrieval in Intermedia, many of these oppositions immediately appeared foolish, since anyone who clicked on a word and used Intermedia’s electronic version of the American Heritage Dictionary—whether they were aware of it or not—inevitably used a second kind of linking. After all, activating a word and following a simple sequence of keys or using a menu brought one to another text (Figure 5). Of course, Web users now have near-immediate access to the

Microcosm, a system on which work began in the early days of Intermedia, has built this idea of reader-activated links into its environment in two ways. First, using the “Compute Links” function, readers activate what are essentially information-retrieval software tools to produce menus of links that take exactly the same form as menus of links created by authors. Soft links—links created on demand—appear to the reader identical to hard ones created by authors. Second, readers can activate implicit or generalized
Hypertext 3.0

links. When readers click on hard links, they activate a connection established by a hypertext author, who, in some systems, could be a previous hypertext reader. When readers activate "soft linking," they use what are essentially information-retrieval devices to create a dynamic relation between one text and another. In contrast to both these previous approaches, Microcosm's generalized link function produces a different form of electronic connections that we call term soft linking, linking activated only on demand. Essentially, Microcosm's generalized links create a link that only appears when a reader asks for it (Figure 6). No link marker, no code, indicates its existence, and nothing deforms the text in a lexia to announce its presence. In fact, only a reader's interest—a reader's energy, active interest, or aggressive relation to the text—brings such a link fully into being. Readers will recognize that this approach, this kind of linking, permits the many-to-more-than-one linking that permitted me to have readers obtain an introductory discussion and two plates of a painting by a Victorian artist by clicking on the title of one of his paintings. Microcosm's generalized linking facility, in fact, permitted me to recreate in a matter of hours links that had taken weeks to create manually in another system.

The final forms of linking—action links, warm links (or reader-activated data-exchange links), and hot linking (automatic data-exchange links)—represent, in contrast, kinds that carry the hard, author-created link in other directions. These author-created links do more, in other words, than allow readers to traverse information space or bring the document to them. They either initiate an action or they permit one to do so.

In later chapters when we examine examples of hypermedia containing animation and video, we shall observe yet other permutations of the link. Nonetheless, these preliminary remarks permit us to grasp some of the complex issues involved with adding the link to writing, with reconfiguring textuality with an element that simultaneously blurs borders, bridges gaps, and yet draws attention to them.

Linking in Open Hypermedia

Systems: Vannevar Bush
Walks the Web

For more than a quarter century, many computer scientists have proposed a conception of linking that differs fundamentally from the one used by HTML, Storyspace, and earlier systems, such as Guide and HyperCard. This different way of conceiving the link, not surprisingly, is also associated with a different theory of how hypermedia systems should work. HTML and Storyspace have accustomed most of us to the idea that links exist as integral parts of documents in which they appear. To anyone who has
Chapter Two. Typological Symbolism in Hunt's Major Works

Finding of the Saviour in the Temple

The Finding of the Saviour in the Temple, Hunt opposed inner and outer
uses while at the same time
in the Temple the builders are lit
enous to rising
ed peers

William Holman Hunt The Finding of the Saviour in the
Temple. 1854-60. Oil on canvas, 33 3/4 x 55 1/2 in
Birmingham City Museum and Art Gallery

Figure 6. Generic Linking in Microcosm. This screen shot shows the results of following a generic link either from the word “Finding” or from the phrase “The Finding of the Saviour in the Temple” in the Microcosm version of my book William Holman Hunt and Typological Symbolism. This action produces a menu (at right) with three choices: a section of my original book containing the principal discussion of this painting and two discussions of it. Since choosing “Follow Link” (or double clicking) on any word or phrase that serves as an anchor produces these three choices, this screen shot represents many-to-many linking. Furthermore, although readers experience the results of generic linking (here the menu with three destination lexicis) just as if the author had manually linked each anchor to the discussion and two illustrations, in fact the links only come into existence when readers call for them. One can therefore consider this screen to exemplify soft many-to-many linking. Although Microcosm permits authors to create the usual manual form of one-to-one and one-to-many links, the generic link function takes a great deal of the work out of creating informational hypertext webs.
ever created a link in HTML that point seems obvious, and, in fact, placing
links within each lexia has major benefits, including simplicity, ease of
creating them, and permanence—they don't move or get lost. This concep-
tion of the link, however, represents a fundamental departure from the kind
of medium proposed by Vannevar Bush. The user of the memex, we recall,
created trails of associative links on top of already existing texts, saved those
trails, and shared them with others. Different readers could create very different
collections of links for the same texts. Links, in other words, exist outside
the individual lexia in this kind of hypermedia.

Many hypertext researchers, inspired by Bush, have designed and imple-
mented such open hypermedia systems and infrastructures, a defining char-
acteristic of which is the link database or linkbase (see Rizk and Sutcliff for
a list of such systems). Intermedia, one such system, drew upon its separation
of links and data to permit users to generate multiple webs from the same
body of texts and images; depending on an individual user's access rights, he
or she could view the webs created by others. In educational terms, using a
linkbase had the effect of permitting students to use the main course web plus
links added by students or to screen out links created by them. It also per-
mitted instructors, as we shall see in chapter 4, to use links to incorporate ma-
terials created by those in other disciplines within their webs without affect-
ing either the original author's text or web. In practice, readers experienced
an Intermedia web, such as Context32, much as they do its HTML descen-
dant, The Victorian Web. In fact, each hypermedia collection of documents ex-
isted only as a virtual web called into being by the linkbase and linkserver.

The linkbase and its associated server, which combine to create link ser-
ves, lie at the heart of open hypermedia systems like Hyperbase, Multicard,
Sun's Link Service, Microcosm, and its various later incarnations. David C.
De Roure, Nigel G. Walker, and Leslie A. Carr offer the following definition
of these key terms:

At its simplest, a hypermedia link server takes a source anchor in a multimedia doc-
ument and returns the possible destination anchors, obtained by interrogating a link
database (henceforth a linkbase) for links containing that anchor. The anchors might
identify specific locations or objects in particular multimedia documents; alterna-
tively they might have broader applicability, matching content rather than position
(so-called generic linking). The linkbase query might also be refined by the user's con-
text, perhaps based on their profile, current role, task and location. Link services may
be accessed before, during or after document delivery, and they may provide an in-
terface for link creation and maintenance as well as retrieval. (67)
The Multimedia Research Group at the University of Southampton under the leadership of Wendy Hall and Hugh Davis stands out as the team of computer scientists that has the longest continuous experience with open hypermedia. Their articles dominate the literature in the field, and they have produced a number of commercial systems. Microcosm, at which we looked earlier, appeared in commercial form as Multicosm (1994), and as the World Wide Web became increasingly prominent, the Southampton team applied the heart of Microcosm—its link services—to the Internet, creating Distributed Link Services (1995), Multicosm (1998), and Portal Maximizer (2001). Multicosm, the company formed to provide commercial versions of the group’s link-services-based applications, has recently become Active Navigation, but the open hypermedia approach remains the same.

As Hays Goodman points out about Active Navigation, “the core technology behind the company’s products is the ability to insert active hyperlinks on-the-fly in almost any textual format document.” The already-observed forms of linking possible with Microcosm show what an immensely powerful system it is, but that power came at considerable cost—or, rather, at two different kinds of costs. Like all open systems, Microcosm and all its descendants require a separate server for the linkbase, and the team also had to create the software to make it work. A different kind of cost appears in the way Microcosm has created anchors. At first, Microcosm recorded links solely in terms of the anchor’s position—essentially counting off numbers of characters or units of spatial measurement to record where in the document a phrase (or image) begins and ends. This method proved to have enormous advantages. Initially, the Southampton team had the goal of creating the kind of hypermedia system that Vannevar Bush would love, since it could create links not just in other people’s documents but also in other software: one could, for example, link a document in MS Word to another in Word Perfect to another in a PDF file. This version of Microcosm worked, and much research went into devising ways of linking among different kinds of applications; one of the most interesting of these projects involved placing links inside a very large CadCam document used by architects, and part of the difficulty included creating tiny, yet accurate, summaries of the visual data. Eventually the team discovered that some features they wished to add to the system could function only if all text had the same format, and so they turned to a more closed system. In the Microcosm version of my book on Pre-Raphaelite painting, all the text documents were created in Word and saved as in the RTF (rich text format) file format, and although the system, like cur-
rent HTML, permits linking to images, in practice the need to attach captions to them resulted in placing images within text documents.

This wonderfully powerful system, which was convenient for both author and reader, permitted linking all kinds of data, but it had one Achilles heel: the computer files to which the system added links could not be modified in any way. Unlike Intermedia's linkbase, Microcosm's required freezing a document once it had links; adding or deleting words would move the link to an irrelevant phrase.

To solve this problem, one had to add a second method of identifying link anchors in the linkbase, one that required "matching content rather than position" (De Roure, Walker, and Carr, 67). This method has the great advantage of enabling powerful generic linking, but it is also much less suited to non-alphanumeric media. This seems to be the form of linkbase storage that allowed Microcosm-Multicosm to become a Web application. Goodman explains how one version marketed by Active Navigation works:

Portal Maximizer is implemented essentially as a Web proxy server. When the user requests a Web page, the browser will be directed to the Webcosm proxy. Webcosm will fetch the page from the original location and annotate the page with extra links before passing the modified Web page back to the user's browser. When the webmaster has activated this feature, the user will see portions of the text transformed into hyperlinks, which are derived from what is known as a linkbase. This linkbase contains at a minimum a source word or phrase, a destination URL (Uniform Resource Locator) and a description of the link. The linkbase is generated automatically by crawling the Web site at predetermined intervals, with the results fully tunable so that by moving a slider one can decide how broad or narrow particular themes can be. By making the themes broader, nearly every word in a document could theoretically be hyperlinked, but by selectively tuning that variable, more relevant results are obtained. Multiple linkbases can be used, so that different groups of users could see different results, depending on their profile or interests. (Emphasis added)

By storing links apart from text, images, and other media forms, open hypermedia systems can place links in someone else's Web document without ever affecting that document. Vannevar Bush walks the Web. Depending on the desires of those who own the server, these added links can be viewed by anyone who visits their website, or they can be screened from outsiders. The capacity of open hypermedia applications like Portal Maximizer to add links to documents coming from another site has important implications for our conceptions of authorship, intellectual property, and political rights, particularly the right of free speech.
essential spirit. Digital information technology, in other words, is only the latest to shape an institution that, as Carlyle reminds us, is both itself a form of technology, a mechanism, and has also long been influenced by those technologies on which it relies.

A second form of resistance to recognizing the role of information technology in culture appears in implicit claims that technology, particularly information technology, can never have cultural effects. Almost always presented by speakers and writers as evidence of their own sophistication and sensitivity, this strategy of denial has an unintended effect: denying that Gutenberg’s invention or television can exist in a causal connection to any other aspect of culture immediately transforms technology—whatever the author means by that term—into a kind of intellectual monster, something so taboo that civilized people cannot discuss it in public. In other words, it takes technology, which is both an agent and effect of our continuing changing culture(s), and denies its existence as an element of human culture. One result appears in the strategies of historical or predictive studies that relate cultural phenomena to all sorts of economic, cultural, and ideological factors but avert their eyes from any technological causation, as if it, and only it, were in some way reductive. The effect, of course, finally is to deny that this particular form of cultural product can have any effect.

We have to remind ourselves that if, how, and whenever we move beyond the book, that movement will not embody a movement from something natural or human to something artificial—from nature to technology—since writing, and printing, and books are about as technological as one can get. Books, after all, are teaching and communicating machines. Therefore, if we find ourselves in a period of fundamental technological and cultural change analogous to the Gutenberg revolution, one of the first things we should do is remind ourselves that printed books are technology, too.

Analogues to the Gutenberg Revolution

What can we predict about the future by understanding the “logic” of a particular technology or set of technologies? According to Kernan, “the ‘logic’ of a technology, an idea, or an institution is its tendency consistently to shape whatever it affects in a limited number of definite forms or directions” (49). The work of Kernan and others like Chartier and Eisenstein who have studied the complex transitions from manuscript to print culture suggest three clear lessons or rules for anyone anticipating similar transitions.

First of all, such transitions take a long time, certainly much longer than early studies of the shift from manuscript to print culture led one to expect.
Students of technology and reading practice point to several hundred years of gradual change and accommodation, during which different reading practices, modes of publication, and conceptions of literature obtained. According to Kernan, not until about 1700 did print technology "transform the more advanced countries of Europe from oral into print societies, reordering the entire social world, and restructuring rather than merely modifying letters" (9). How long, then, will it take computing, specifically computer hypertext, to effect similar changes? How long, one wonders, will the change to electronic language take until it becomes culturally pervasive? And what byways, transient cultural accommodations, and the like will intervene and thereby create a more confusing, if culturally more interesting, picture?

The second chief rule is that studying the relations of technology to literature and other aspects of humanistic culture does not produce any mechanical reading of culture, such as that feared by Jameson and others. As Kernan makes clear, understanding the logic of a particular technology cannot permit simple prediction because under varying conditions the same technology can produce varying, even contradictory, effects. J. David Bolter and other historians of writing have pointed out, for example, that initially writing, which served priestly and monarchical interests in recording laws and records, appeared purely elitist, even hieratic; later, as the practice diffused down the social and economic scale, it appeared democratizing, even anarchic. To a large extent, printed books had similarly diverse effects, though it took far less time for the democratizing factors to triumph over the hieratic—a matter of centuries, perhaps decades, instead of millennia.

Similarly, as Marie-Elizabeth Duceur and Roger Chartier have shown, both printed matter and manuscript books functioned as instruments of "religious acculturation controlled by authority, but under certain circumstances [they] also supported resistance to a faith rejected, and proved an ultimate and secret recourse against forced conversion." Books of hours, marriage charters, and so-called evangelical books all embodied a "basic tension between public, ceremonial, and ecclesiastical use of the book or other print object, and personal, private, and internalized reading."

Kernan himself points out that "knowledge of the leading principles of print logic, such as fixity, multiplicity, and systematization, makes it possible to predict the tendencies but not the exact ways in which they were to manifest themselves in the history of writing and in the world of letters. The idealization of the literary text and the attribution to it of a stylistic essence are both developments of latent print possibilities, but there was, I believe, no precise necessity beforehand that letters would be valorized in these particu-
One of the most important changes involved the democratization of the new information technologies. During the shift from manuscript to print culture, an early system of polite or courtly letters—primarily exchanged through personal networks—was replaced by a new print-based, market-centered system. The new technologies have similarity because they are based on print, while being digitally interconnected and networked. However, the fundamental values were not simply determined by print. The shift from print to electronic technology may not parallel the shift from manuscript to print, but it is possible to describe the implications of this shift for the technology of alphabetic text production and the effects of this transition on the political and cultural implications of the new technologies.

The shift from manuscript to print may not be as radical as the shift from oral to written traditions. However, the changes in the way that information is recorded and disseminated have had significant effects on the political and cultural landscape. The democratization of information technologies has created new opportunities for individuals to participate in the broader cultural conversation. As a result, the role of the writer, the scholar, and the teacher has changed, and their writing practice has been redefined.

Furthermore, the shift from manuscript to print has also affected the way that information is organized and stored. The new technologies have made it easier to search for and retrieve information, and this has had significant implications for the way that individuals interact with the world around them. In this sense, the shift from manuscript to print may not be as radical as the shift from oral to written traditions, but it is still a significant change that has had far-reaching effects.
HYPERTEXT 3.0

...ate, it noticeably increased the importance and number of critics, editors, bibliographers, and literary historians." Print technology similarly redefined the audience for literature by transforming it from

a small group of manuscript readers or listeners ... to a group of readers ... who bought books to read in the privacy of their homes. Print also made literature objectively real for the first time, and therefore subjectively conceivable as a universal fact, in great libraries of printed books containing large collections of the world's writing ... Print also rearranged the relationship of letters to other parts of the social world by, for example, freeing the writer from the need for patronage and the consequent subservience to wealth, by challenging and reducing established authority's control of writing by means of state censorship, and by pushing through a copyright law that made the author the owner of his own writing. (4–5)

Electronic linking shifts the boundaries between one text and another as well as between the author and the reader and between the teacher and the student. It also has radical effects on our experience of author, text, and work, redefining each. Its effects are so basic, so radical, that it reveals that many of our most cherished, most commonplace, ideas and attitudes toward literature and literary production turn out to be the result of that particular form of information technology and technology of cultural memory that has provided the setting for them. This technology—that of the printed book and its close relations, which include the typed or printed page—engenders certain notions of authorial property, authorial uniqueness, and a physically isolated text that hypertext makes untenable. The evidence of hypertext, in other words, historicizes many of our most commonplace assumptions, thereby forcing them to descend from the ethereality of abstraction and appear as corollary to a particular technology rooted in specific times and places. In making available these points, hypertext has much in common with some major points of contemporary literary and semiological theory, particularly with Derrida's emphasis on decentering and with Barthes's conception of the readerly versus the writerly text. In fact, hypertext creates an almost embarrassingly literal embodiment of both concepts, one that in turn raises questions about them and their interesting combination of prescience and historical relations (or embeddedness).
Chapter 1. Hypertext

1. An important caveat: here, right at the beginning, let me assure my readers that although I demonstrate that Barthes and Derrida relate in interesting and important ways to computer hypertext, I do not take them—or semiotics, poststructuralism, or, for that matter, structuralism—to be essentially the same.

2. In fact, some of the most exciting student projects and published examples of hypermedia take the form of testing, applying, or critiquing specific points of theory, including notions of the author, text, and multivocality. Cicero Ignacio da Silva's *Plato On-line: Nothing, Science and Technology* (2003–4) exemplifies a particularly carnivalesque, rambunctious experiment with conventional attitudes toward authorship and its relation to conceptions of a work. The Brazilian scholar explains in *Plato On-line*, which has no pagination, that "in order to test my hypothesis that there is no work without a 'signature,' and there is no 'safe' means to authenticate the signature of a text and in a text on the internet," he created "hundreds" of websites for fictional research institutes, scientific journals, and survey centers "hosted by free-of-charge providers (geocities, tripod, among others)" upon which he placed computer-generated texts created by a combination of "PERL and Java Script programming" from "fragments of text from the internet." Each text is signed with "Algorithm [author's name]," such as "Algorithm Giles Deleuze," and the resultant text is "purposefully unstructured and rarely makes any sense." All the texts he keeps on the Internet appear in Portuguese, which Babelfish then translates into English, French, German, and Japanese. Finally, *Plato On-line* makes the element of spoof quite clear when it announces that it is "a serious journal interested only in publishing texts written by electric generators. This magazine does not have the intention to publish anything that makes sense... The names of the authors are not true and all the names are not from authors who exist [but from] programmed algorithms." Nonetheless, da Silva has discovered that readers persist in submitting "articles, reviews on articles, and comments on the texts, etc." Moreover, despite the fact that
his computer-generated texts signed with a clearly suspicious-sounding name do not make sense, he has found that readers take them seriously enough to quote them in both blogs and scholarly work, such as graduate theses. The presence of what da Silva calls a signature—a name similar to that of an established author—convinces readers that they are reading a genuine text, even if it does not make grammatical and other sense. (I would add that the appearance of these jumbled texts on sites that supposedly represent serious-sounding, if fictional, institutions also convinces people that authorship and text are genuine.)

3. Although the following pages examine some aspects of the history of hypertext theory, they do not provide a history of earlier pioneering systems, such as NLS, Augment, HES, FRESS, Guide, and Hyperties, and later developments, since valuable basic surveys can be found in Nielsen, Multimedia and Hypertext and Hall, Davis, and Hutchings, Rethinking Hypermedia, 11–32.

4. A second important caveat: by hypertext I mean only one of at least five possible forms of the digital word. In addition to hypertext, there are four other important kinds of electronic textuality, each of which can exist within hypertext environments, though not itself hypertextual:

1. Graphic representations of text. Using computer graphics to represent text produces images of it that cannot be searched, parsed, or otherwise manipulated linguistically. The resulting images can be animated, made to change in size, accompanied by sound, and so on. This kind of e-text, which is familiar from television advertising, is often created using Macromedia Director and Flash.

2. Simple alphanumeric digital text. This form of electronic text, which functions linguistically, appears in electronic mail, bulletin boards, and word-processing environments.

3. Nonlinear text. In contrast to hypertext, which enables multisequential reading, this form is best thought of as nonlinear. According to Espen Aarseth (whose “Nonlinearity and Literary Theory,” in Hyper/Text/Theory, ed. Landow, provides the essential discussion of its subject) the various forms of nonlinear textuality include (a) computer games, (b) text-based collaborative environments, such as Multi-User Domains (MUDs) and Multi-User Domains that employ Object-Oriented programming methods (MOOs), and (c) cybertext, or text generated on the fly. See essays by Carreño, Donguy, Lenoble, Vuillemin, and Balpe in A¹ Littérature: Colloque Nord Poésie et Ordinateur. See Meyer, Blair, and Hader for a MOO for the World Wide Web.

4. Simulation. Text in simulation environments can range from computationally produced alphanumeric text (and hence have much in common with the nonlinear form) to instances of fully immersive virtual (or artificial) reality. For discussions of the educational use of such simulation environments within electronic books, see my “Twenty Minutes into the Future, or How Are We Moving beyond the Book?” For general discussions of virtual reality, see Benedikt, ed., Cyberspace; Heim, The Metaphysics of Virtual Reality; Earnshaw, Gigante, and Jones, eds., Virtual Reality Systems; and Wexelblat, Virtual Reality.
5. A third (and last) caveat: as I pointed out in the introduction to *Hyper/Text/ Theory*, some hypertext environments, which are not chiefly text- or image-based, employ logical and conceptual links as a means of assisting organization, collaborative work, and decision making. Systems like Xerox PARC's Acquaint and IDE thus far have appealed to workers in computer and cognitive science investigating the business applications of information technology. For Acquaint, see the articles by Catherine C. Marshall listed in the bibliography; for IDE see those by Daniel Russell. Clara Mancini's 2003 doctoral dissertation includes a brief summary with screen shots of various systems of semantic hypertext.

6. The developers of Microcosm, currently the most advanced hypertext system yet developed, similarly argue: "There should be no artificial distinction between author and reader. Many systems have an authoring mode and a reader mode; such a system is not open from the reader's point of view. We believe that all users should have access to all parts of the system; this does not imply that one user will be able to access or change another's data, but implies that this aspect should be controlled by the granted rights of access to the operating system. Users should be able to create their own links and nodes within their private workspace, then change the access rights so that other users may view or edit them as required" (Hall, Davis, and Hutchings, *Rethinking Hypermedia*, 30).

7. The original text here read, "Intermedia, the hypertext system with which I work," but shortly after the print publication of *Hypertext*, my students and I found ourselves forced to use several other systems after Apple Computers, which had funded a portion of the project, fundamentally changed its version of UNIX, thus halting development—and eventually even the use—of Intermedia. Two fully illustrated articles describe IRIS Intermedia in detail: Yankelovich, Meyrowitz, and Drucker, "Intermedia"; and Bernard J. Haan, Kahn, Riley, Coombs, and Meyrowitz, "IRIS Hypermedia Services." The Intermedia section of my *Cyberspace, Hypertext, and Critical Theory* website, which contains a detailed introduction to the system with many screenshots, can be found at http://www.cyberartsweb.org/ht/HTatBrown/Intermedia.html. This URL also provides information about obtaining Paul Kahn's archival video, *Intermedia: A Retrospective*, from the Association of Computing Machinery.

8. One could make the same point about contributors to discussion lists, but since these lists are intended to take the form of group discussions, new contributions don't seem unusual, and one experiences what seems a very different form of collaboration.

9. Writers have offered other classifications of links, often in terms of binary oppositions. Thus in 1988, Paul Kahn compared objective to subjective links, an opposition chiefly relevant to so-called legacy text—text, that is, translated into hypertext from print or other paper presentation. According to Kahn, footnotes and cross references represent objective links, because they are present in the original text structure, whereas subjective links are added by the person translating the document into hypertextual form. Kahn's objective versus subjective links appear closely related to Anna Gunder's analog and digital links ("Aspects of Linkology," 112–13). Gunder also distinguishes between internal and external links: "Links within a work are called *internal* links while links running between works are labeled *external* links" (113).
10. Such media reversals continue today, though for different reasons: Geert Lovink’s *Dark Fiber: Tracking Critical Internet Culture*, which MIT Press published in 2002, reproduces essays that appeared on various Internet discussion groups between 1995 and 2001. In this case, the characteristic qualities of networked digital text discussed later in this section have been exchanged for the relative fixity and stability of print.

11. At conferences I’ve several times found myself defending Bolter and Grushin’s valuable idea of remediation from charges that it is too simple or limiting. Markku Eskelinen and Raine Koskimaan, for example, claim that “the concept of remediation carries worrying stabilizing effects with it. Whatever new form, mode or medium there is, there’s no time to study it and build a decent scholarship around it, as we supposed to be immediately stuck with remediating it” (9). I don’t see how pointing out that various information technologies remediate one another has any limiting effects, and Bolter and Grushin’s emphasis that we have to consider the place of any particular form of IT (such as hypertext) within a media ecology, strikes me as an essential place to begin, in large part because it goes a long way toward preventing misunderstandings about supposed total oppositions of earlier and later technologies (such as, say, print and hypertext).

12. In *Writing Space*, Bolter explains some of these costs: “Electronic text is the first text in which the elements of meaning, of structure, and of visual display are fundamentally unstable. Unlike the printing press, or the medieval codex, the computer does not require that any aspect of writing be determined in advance for the whole life of a text. This restlessness is inherent in a technology that records information by collecting for fractions of a second evanescent electrons at tiny junctions of silicon and metal. All information, all data, in the computer world is a kind of controlled movement, and so the natural inclination of computer writing is to change” (31).

13. Terry Eagleton’s explanation of the way ideology relates the individual to his or her society bears an uncanny resemblance to the conception of the virtual machine in computing: “It is as though society were not just an impersonal structure to me, but a ‘subject’ which ‘addresses’ me personally—which recognizes me, tells me that I am valued, and so makes me by that very act into a free, autonomous subject. I come to feel, not exactly as though the world exists for me alone, but as though it is significantly ‘centred’ on me, and I in turn am significantly ‘centred’ on it. Ideology, for Althusser, is the set of beliefs and practices which does this centring” (*Literary Theory*, 172).

14. Marie-Laure Ryan’s *Narrative and Virtual Reality*, which provides a valuable discussion of virtuality with specific emphasis on its relation to immersion (25–47), suggests “three distinct senses of virtual: an optical one (the virtual as illusion), a scholastic one (the virtual as potentiality), and an informal technological one (the virtual as computer mediated)” (13).

15. Hayles’s demand that we recognize the importance of embodiment and materiality in a digital age derives from her recognition of the absurdity of some postmodern claims: “Every epoch,” she points out, “has beliefs, widely accepted by contemporaries, that appear fantastic to later generations... One contemporary belief likely to stupefy future generations is the postmodern orthodoxy that the body is
primarily, if not entirely, a linguistic and discursive formation. . . . Although researchers in the physical and human sciences acknowledged the importance of materiality in different ways, they nevertheless collaborated in creating the postmodern ideology that the body's materiality is secondary to the logical or semiotic structures it encodes" (192). Compare J. David Bolter and Diane Gromola's discussions of "the myths of disembodiment" in *Windows and Mirrors*, 117-23.

16. Mitchell wittily narrates the evolution of computers (rather than monitors or displays) from the vantage point of an architect-designer: "Mainframes were designed as large scale items of industrial equipment, and at their best—in the hands of Charles Eames, for example—achieved a tough, hard-edged, machine age clarity of form. They were often put on display in special, glass-enclosed rooms. The bulky computer workstations of the 1970s and 1980s were medium-scale wheeled furniture—not too different from writing desks, pianos, and treadle sewing machines, but styled for laboratory rather than domestic environments. PCs evolved from clumsy beige boxes to sleekly specialized, various colored and shaped versions for offices, classrooms, and homes. Now that they are fading into history, after a life of approximately twenty years, they look increasingly like surrealist constructions—the chance encounter of a typewriter and a television on a desktop. Portables started out mimicking luggage (right down to the handles and snaps), then appropriated the imagery of books that could open, close, and slip into a briefcase" (M&&++, 70-71).

17. Mitchell points out that the effect on work-practice of such location-independent information has turned out differently than many predicted: "The emerging, characteristic pattern of twenty-first century work is not that of telecommuting, as many futurists had once confidently predicted; it is that of the mobile worker who appropriates multiple, diverse sites as workplaces" (153).

18. This brings up the entire subject of computer humor and parody, often directed at Microsoft products. Anyone who's found annoying the Microsoft Office Assistant in earlier versions of Word, which pops up with the intrusive statement that you seem to be writing a letter and asks if you want help, will appreciate Dave Deckert's parody: one encounters what appears to be a screenshot of a document from an earlier version of Microsoft Word (5.1?), in which a user has typed "Dear World, I just can't take it anymore. I've decided" at which point a cartoon image of dancing paperclip pops up on the screen accompanied by the message "Looks like you're committing suicide," followed below by the text "Office Assistant can help you write a suicide note. First, tell us how you plan to kill yourself." This text appears above two rows of buttons, the top one of which offers the options "Pills," "Jump," "Pastry," and the bottom row has "Tips," "Options," and "Close" (dgd-filt@visar.com, 2000). Another parody, apparently by a British user, mocks both the instability of the Microsoft Windows operating system and its often unexpected hidden settings. On a panel labeled "Hidden Settings (Not to be edited)," one discovers a series of options that purports to explain difficulties users encounter every day. The first line has a box containing a check next to "Crash every 2 Hours," the "2" and "11 Hours," appearing within option boxes, and the following lines contain in similar format the instructions to crash after 5000 "bytes of unsaved changes." Other factory-set options include those for "Save," which produces "incredibly large files" and Auto Recovery
that "takes Bloody Ages." The final factory-set option involves "Annoy me with the sodding paper clip" either constantly or "when I least expect it."

Cartoons published worldwide, which show how much computing has become part of our everyday lives, similarly present users' attitudes toward personal computers. In a brilliant four-panel Doonesbury cartoon, Gerry Trudeau conveys the frustrations of people who installed Windows 95. In the first panel, which shows the communal nature of personal computing by so-called early adaptors, Mike approaches two co-workers, one of whom is seated at a PC and is told, "We're loading in the new Windows 95 operating system," and when he asks in the next panel how it's going, the bearded, bespectacled man seated at the computer replies, "Don't know yet. I'm still trying to clear enough memory for it." In the third panel, in which the three men appear in white silhouette against black background, we receive the software installer's message: "Attention User: You call this capacity? Reboot when you're ready to play"—a fine parody of the error messages those trying to install Windows 95 on older machines often received! The final panel effectively dramatizes the way users came to fear both their PCs and the company that created their operating systems as the man seated at the computer exclaims, "Son of a . . . It's dissing my hard drive!" only to be cautioned by the man behind him, "Back off, Hank. Don't want to make it lose face . . ." Yet other cartoons satirize Microsoft's monopolistic practices. In Bill Arend's Foxtrot the older of two brothers comes upon his sibling sitting at a computer "reading about a big Windows source code leak," 600 Mb of which are "all over the internet." In the third panel the younger brother points out that people probably have already guessed "some of what's in it," after which the final panel shows the parody code onscreen:

BEGIN
IF browser_type= "Internet_Explorer"
THEN smooth.sailingELSE
IF (browser_type= "Netscape") AND
"justice_department NOT looking"
THEN
REPEAT
Crash (random)

Computer cartoons have many other subjects, including crashes that destroy home and office work, the youth of skilled computer users, overblown claims about the World Wide Web, annoying animated graphics, and suggestions that the devil invented computing—or at least is a heavy user: an Italian cartoon of the 1980s shows a devil seated at a computer terminal in Hades. Some parodies mock the user's expectations more than they satirize software manufacturers' products. In another parody that presents a fantasy version of Microsoft Word, the drop-down menu labeled "Tools" contains the following options: "Undo stupid changes," "Take Back Flippant Comment," "Create Brilliant Idea," "Extend Deadline," "Read Bosses' Minds," "Terminate Smart-ass IT Technician," "Increase Salary," "Reclaim Wasted
Evenings,” “Extend Weekend,” and, finally, “Find Perfect Mate.” This parody, which says more about Microsoft users than about the company, suggests that the cyber-space myth and the dotcom crash derive in large part from our secret desires that computers make our lives better without much effort on our part.

19. Janet Murray asserts the importance of agency in true interactivity: “Because of the vague and pervasive use of the term interactivity, the pleasure of agency in electronic environments is often confused with the mere ability to move a joystick or click on a mouse. But activity alone is not agency . . . As an aesthetic pleasure, as an experience to be savored for its own sake, it is . . . more commonly available in the structured activities we call games” (128–29).


21. Scott Blake’s Bar Code Jesus (1999) plays interestingly with computer-related codes as the basis of a visual reality composed of the images we see on a computer screen. In this piece, Blake manipulates the ubiquitous bar code (as opposed to the far “deeper” machine code) to take us in stages from a recognizable image to the codes that produce it. The viewer first encounters a fairly low-resolution image of the face of Jesus, above which appears a panel that permits the viewer to zoom in seven states or stages, enlarging a portion of the image in its frame each time. Diving into the image with the control panel transforms if from a recognizable face to three successive images that resemble mosaic until, at the fifth level, one arrives at barcodes. The next two zooms resolve the image barcodes until the viewer arrives at one-inch-high vertical lines (bars) and the number associated with each. In an animated version, the zooming in and out occurs at a dizzying pace. The playfulness of the project appears in the fact that these barcodes would not actually produce an image when read by a computer; Blake is just using their visual appearance as building blocks.


Chapter 2. Hypertext and Critical Theory

1. I am thinking of Richard Rorty’s description in Philosophy and the Mirror of Nature, 378, of edifying philosophy as a conversation: “To see keeping a conversation going as a sufficient aim of philosophy, to see wisdom as consisting in the ability to sustain a conversation, is to see human beings as generators of new descriptions rather than beings one hopes to be able to describe accurately. To see the aim of philosophy as truth—namely, the truth about the terms which provide ultimate compensations for all human inquiries and activities—is to see human beings as objects rather than subjects, as existing en-soi rather than as both pour-soi and en-soi, as both described objects and describing subjects.” To a large extent, Rorty can be thought of as the philosopher of hypertextuality.

2. Examples include GodSpeed Instant Bible Search Program from Kingdom Age Software in San Diego, California, and the Dallas Seminary CD-Word Project, which builds upon Guide™, a hypertext system developed by OWL. International
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