# LITERACY Online

THE PROMISE (AND PERIL) OF READING AND WRITING WITH COMPUTERS

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# Contents

## Computing as Writing

We have seen how the computer as hypertext can broaden our understanding of text as a fluid structure of verbal and visual elements. As we learn to read interactive fiction, we gain a new insight into the more pragmatic forms of electronic writing, such as textual databases and electronic messaging. Finally, we see that the computer itself can be best understood as a new technology for reading and writing. In all its various uses, including scientific and industrial ones, the computer reads and writes symbolic information in its new and peculiar writing space. For the scientist, the machine reads and writes the language of mathematics. For industrial processing, the computer sends symbolic commands to electro-mechanical devices that control machinery. Computer programming too is a kind of writing: it is the art of writing texts that in turn write other texts. Even artificial intelligence, which is the quintessence of computer programming, is a special kind of computer writing, literally a genre of (science) fiction. Wherever and however we use computers, we are turning the world into a digital text; we are textualizing the world. All the computer can ever do is to read and write text, if we take the word *text* to mean in the largest sense all systems of discrete symbols. I find this an exciting prospect because it places our work with computers and writing at the center of the computer revolution. We as humanists know and care about reading and writing, and it is therefore our responsibility to help make sense and to make good use of this new technology of literacy.

## Notes

1. There is a fuller discussion of the electronic writing space (with the example "Afternoon") and its impact upon critical theory in my book *Writing Space*; see also my article "Beyond Word Processing."

2. See also his "Hypertext in Literary Education, Criticism, and Scholarship."

3. These texts have been transferred by the Thesaurus Linguae Graecae under the direction of Theodor Brunner, University of California at Irvine.

4. See, for example, the September 1983 issue of *Critical Inquiry* devoted to the canon. See also Robert Scholes, "Aiming a Canon at the Curriculum," and William Bennett, *To Reclaim a Legacy*.

5. See also the final chapter of the same work (169-84).

6. See also Lanham's comprehensive article "The Electronic Word."

# Opening Hypertext: A Memoir

Theodor Holm Nelson

I think a lot about paradigms. The term in its present sense was popularized by Thomas Kuhn in his book *The Structure of Scientific Revolutions*. Let me just define *paradigm* as an idea too big to get through the door. A paradigm is so much a part of the way you think that you are not even aware of it. When I started thinking about this, I realized that the most important arguments, the most difficult arguments, are those you could call paradigm arguments, arguments where two different people are speaking inside two different paradigms, and they cannot understand what the other person is saying, or how that person could possibly believe it. Religious arguments are paradigm arguments, political arguments tend to be paradigm arguments, arguments with your parents, arguments with your children—in all these there is just no comprehending how the other people could possibly say that, or what they could mean, or what they could be thinking. Paradigm arguments are like two people wearing divers' helmets decorated with colored glass trying to see in—as if trying to see the face of the other person through prisms—even so close, the optical refractions in all directions confuse the image.

I have tried for many years to convert people to a new paradigm, not just to the idea of hypertext, but to the idea of a new literature. And it has taken me thirty years to see how difficult it is for many people even to imagine an idea of this size, let alone accept it.

We are entering a new era. Not merely where computers are ubiquitous, but where they are, like cassette players, everywhere cheap, fast, exciting, powerful, and vivid. Even the equivalent of a hot workstation of today should cost only a few hundred dollars (except for the screen). So, thinking about computers the way they are now, expensively filling desktops, is pointless. We must consider how life and the world will be when computers become articles as casual as fashion watches. So we must plan now for when every kid has the equivalent of a Sun worksta-

tion. Sure, the school systems won't be able to afford them; but the kids will have them, possibly on their lunch boxes.

However, separate "computers," with nothing to show on their wonderful screens, are no more useful than record players with no record industry. I am concerned about what that supply of information is going to be, and how it will be a part of, and support, our freedoms.

One thing I have to mention is freedom. It is my job always to mention freedom because I do not hear most speakers at computer conferences mention freedom. THE PURPOSE OF COMPUTERS IS HUMAN FREEDOM. And anybody who thinks it is the other way around—that computers are tools of oppression—is stewing in very old cliches and has not been paying attention.

I have a vision for the year 2020; I like to call it the 20/20 vision. Think of everyone at screens: a billion screens around the planet. And each person at a screen will be able to extract from a great common pool any fragment of whatever is published, with automatic royalty and no red tape.

Why automatic royalty? Why shouldn't it be free? Because designing such a system doesn't stop with the computer software. The design has to include a viable economic basis.

A greater issue is the conceptual framework, the system of order, which will provide a viable structure for people's minds and people's lives. (Ideally this system of order has to be in some way based on what we know works, especially paper publishing.)

Some kind of unified documentary universe of hypertext is historically inevitable; designers around the world are pushing toward this in software, communications, and everything else. Everywhere you hear, "Yes we are going to have shared documents in this great system." But we don't hear more about this conceptual structure of unification.

It cannot be like databases, tables of alleged facts. Today's massive and contradictory information, and people's complication overload, have brought us to the end of the usefulness of the database model. The question is what lies ahead. I think we know that it will be some form of hypertext. But what?

## Getting the Idea

To reminisce in this personal fashion at a learned conference may in some ways be inappropriate, but I thought you might like to hear some

of the odder connections in my work, and I thought you might like to share and enjoy them.

From boyhood I was a fierce intellectual, absorbed in the interconnection of all ideas. When I saw that typewriters and file cards could not possibly handle these interconnections, and that computers might, I did the only possible thing. First came my private dream of a writer's console—but because this was lonely and pointless it led to the dream of an open hypertext publishing system based on new forms of interconnection.

While my involvement with hypertext in certain ways dates from my earliest years as a schoolboy in Greenwich Village, and indirectly from college extracurriculars in theater, film, and publishing, it was as a graduate student in the fall of 1960 that I would say my actual enlightenment took place. My efforts to finish writing a book of philosophy, then called *Truth, Man, and Choice,* had fallen through, in part (I realized) because of the extreme difficulty I had organizing the ideas.

When you want to express a complex of ideas, there are many threads that you can take as governing organizational structures. So many different expository lines are possible—then the more you want to say, the more ideas you have, and the more potential expository threads need liberating. It is the choice among them—the truncation of some of these thoughts, and their continuation and forward referencing and backward referencing—that is the process of writing: picking things up and putting them down, trying to remind the reader of things you said before. In other words, you take a structured complex of thought (I like to call it a *structangle*) that you are trying to communicate, and you break it into individual sequential parts that can be put end to end, and this is a wholly artificial process, a breakdown not intrinsic to the structure of thought you are trying to convey, but based upon the fact that it has to be published eventually in a sequence.

So I was fresh from my failure to complete *Truth, Man, and Choice* when I took my first computer course. And suddenly everything I had done fell into place. In my manual for the IBM 7090 was a picture of a CRT—a cathode ray tube—hooked up to the machine for display; and in a copy of *Datamation* I saw a computer screen with a map on it; and it was perfectly clear from reading the manual (even though they were giving all these numerical examples) that the computer could handle

text; and it was perfectly clear that price was going to come down as integrated circuits became available.

Wait a minute, I thought: screen with graphics, storage of texts, cheap machines—these meant that writing no longer had to be sequential. The preposterous extrinsic activity of taking the structangle of thought and breaking it into pieces could be dismissed. It was no longer a problem.

Not only the writer's lot, but the reader's, could be uplifted. All readers could take a more sophisticated approach. The sophisticated reader picks up a book, looks perhaps at the first page, the last page, the middle, hefts the book, flips it, holds it upside down, and then begins reading the parts of interest. Yet the writer, and editor, and publisher have until now been united in a conspiracy to pretend you are going to read this book from beginning to end, to behoove would-be authors to sequence their words under this fictitious rubric. Whereas when we can produce writings for the sophisticated reader, we can throw away the sequential presentation stuff and just say, "Here's this, this, and this—go for it!" and thus create a structure best designed for that engaged reader to explore.

So in this epiphany and its aftershocks, in October or November 1960, I went very quickly through a lot of possibilities.

1. *Branching literature.* I looked at branching text and graphics as they were in 1960—then called "computer-assisted instruction"—and found nothing of interest for a general literature. People were doing good things for teaching skills, for teaching arithmetic, but what good did these do for education: education as the presentation of concepts, education as the intercomparing of alternative points of view? Nothing. In education we want to understand opposite and conflicting points of view, in depth, as expounded by those who believe them. The problem with a survey course, even today, is the approach "Well, Jung said this, and Freud said that, and Adler said that," presented evenhandedly, in boring fashion, without the passion and conviction with which an advocate would present it. So in my mind I propounded my first computer project, "The Thousand Theories Program." It would present a thousand different viewpoints about the whole realm of human knowledge. That project became hypertext.

As I thought of branching documents in the fall of 1960, over the course of several weeks I had a fourfold vision. First, there would be

new documents, a new literary genre, of branching, nonsequential writings on the computer screen. Second, these branching documents would constitute a great new literature, but they would subsume the old, since all existing books of paper would be transferred to the new computer medium as well. In other words, all literature would go online and extend to a new branching generality. Third, there would be a new delivery system, a distributed network of relatively small computers that concentrated on acquiring, storing, and feeding these materials from and to users. Fourth, this would be a franchised delivery system, licensing its specialized storage and delivery software to vendors throughout the world, with copyright supported by an automatic royalty system.

I am surprised to say it still looks to me as if this is what will happen.[1]

2. *Organizing, visualizing, and intercomparing ideas.* As I said earlier, the process of writing—a primary example of organizing thought—is complex. We need screen tools not just for seeing bare outlines, as today's software allows, but for intercomparing alternative structures. And here we have scarcely begun in 1990, let alone in 1960.

It was obvious that word processing and outline processing (which I started imagining immediately) were helpful but inadequate. What relevance does writing a sequential document have? We want deep understanding. We want version control. We want to be able to write one version, then bring out of that a transmogrification, a new unfolding, another structure. Then we want to see how this deep structure in the second draft relates to the structure in the first draft. This problem of intercomparing alternative structures goes beyond mere sequence; it seemed to me fundamental. We must be able to intercompare things in depth, whether or not they are sequential. This is the problem—deep intercomparison among complex structures.

So my first design, which became by stages the Xanadu project, was a system for presenting deep alternatives in the organization of the same material.[2] That was to be my term project thirty years ago, actually only being finished now.[3]

3. *Constructs.* I began to ask, What overall structures might be useful as ways to organize things? For instance, outlines as we know them are a construct. We need constructs for intercomparison and

outlining, and for the parallel visualization of alternatives and comparisons of all kinds.

## The Handle in the Rock

I had crossed enough fields, and looked at the lives of enough innovators, to know that I was onto something. I knew I was the first in the world to be onto this. I had enough vision to recognize a handle when I saw it sticking out of a rock. This was like Arthur's sword in the stone; but it was not the handle of a weapon, it was the handle of some other great tool, one I would need in all my academic and creative work.

The wild surmise on a peak in Darien, Balboa looking at the Pacific: "Holy smoke!" I saw this as the vehicle that would allow me to do more work faster, and thus satisfy all my ambitions.

So I decided I would not try to finish another book until I had the tools—proper, decent tools to allow the deep comparison of complex structures on the computer screen. I thought it would take from three to six months. And these same deep intercomparison tools (I call them *thinkertoys*) would be necessary for holding hypertext. I thought that hypertext would replace the printed word by 1962. As I said in *Literary Machines,* I mistook a clear view for a short distance.

There were no decent tools by 1962, or by 1982, and indeed they do not yet exist on earth—good strong writing systems with deep intercomparison of versions. Instead we have trivial word processing, outline processing, desktop publishing; and the important stuff—intercomparison tools and structures like those I have called *zippered lists*—is ignored, not comprehended, and not yet built.

## Selecting the Word

I kept on designing, in my various garrets. By 1964 I realized the historical importance of choosing the right word for this new kind of text that would reshape the world.

Now, I hold with Mark Twain that the difference between the right word and the almost-right word is the difference between the lightning and the lightning bug. There are so many ways the choice of a phrase can slant people's thinking, and I wanted to help them think

right. Suppose we made up some stupid word like *teachotechnics* or *showmanshipnogogy*? It would seem to be a branch of something else, not the new field of its own that seemed so clear to me.

Then I thought of the right word. *Hypertext* was an audacious choice: *hyper-* has a bad odor in some fields and can suggest agitation and pathology, as it does in medicine and psychology. But in other sciences *hyper-* connotes extension and generality, as in the mathematical *hyperspace,* and this was the connotation I wanted to give the idea.

In the fall of 1965 I published the first papers with the word *hypertext* and gave my first paper. It was before the Association for Computing Machinery in Cleveland. This was starting at the top, and it got a great reception. Briefly.

From there it was downhill, downhill for years, and then decades; perhaps largely, I now realize, because no one understood the idea. I now see this deep misunderstanding as a paradigm problem, and confusion as predestined; but in those days I could not understand why others did not understand.

Occasionally, in the present day, people come up to me and say they were inspired by that first talk in Cleveland. But at the time, I didn't hear about it.

Indeed, I didn't realize during those early years that people may have thought I was clinically insane. And, if paranoia is to believe what others do not believe, then clearly I was paranoid. That definition leaves us two cures: on the one hand, the paranoid can be persuaded to accept the views of everyone else. That is the low road. Or, on the other hand, by the paranoid's effort and persistence he can persuade others to adopt the same view, thus freeing himself of the malady. This was my therapy of choice.

## The Problems in the 1960s and 1970s

I put aside the overall vision of the future hypertext literature, and the problems it might create, although they frequently came into my thoughts. In the 1960s I concentrated on two issues: what separate hypertexts would be like, and the kinds of organizing constructs that might create some manner of orderliness.

In my first paper, in 1965, I concentrated on the organizing constructs. (I also hoped these might improve the prospect for a

unifying literature.) In particular, I came up with structures I called *zippered lists,* which I described in my first paper (but never implemented as such). Zippered lists have been with me since, as an idea both for organizing and for visualizing.

After that, in the late sixties, I concentrated on hypertexts that individuals could produce—that is, individual works or chunks with jumps between them on the screen. This is roughly where most of the field is now—facilitating individual hypertexts that take over the whole system (such as Hypercard).

Around 1967 I began to see that the real problem was different. The real problem is not merely the creation of organizing constructs, or the individual hypertext unit, but how to merge into a coherent and unified literature the many different hypertextual and hypermedia objects being created, and to comprise these many contributions—created under different rules, with different graphics, with different styles of interaction—into a unified literature, a unifying system that we may all access through whatever machine we use.

Throughout the seventies, the issue that crowded my mind was how to design this overall structured literature in which many hypertexts, documents, and authors could participate—how to devise some system of order that put every contribution on an equitable basis with every other—unlike most of the other computer-based text and media of that time, and now. In the paper world we have this equitable basis: because books are compatible, they can be read with the same equipment, and they meld into a common literature.

This too redounds to the issue of freedom. Look at the petty tyrants on the networks of today—the sysops on the computer bulletin boards, the leaders of electronic conferences who delete whatever they don't like. Who chose them? Who baptized these particular guys as the arbiters of taste and propriety? At least in the magazine world, editors tend to have some principled basis for operation that others know of in advance. In tomorrow's electronic literature, we must have a system to which all participants are welcome whether or not anyone likes their contributions.

And so it is with paper: you can publish books and send them where you will. Paper literature at large is open, though some of its byways are not. What is to be the electronic equivalent?

## Personal Computers

In the late seventies came personal computers. (I needn't regale you with the so-called personal computer revolution.) As luck would have it, I had just published a book, called *Computer Lib,* that predicted personal computing and the explosion of computer graphics, and the accuracy of my predictions surprised many people. Many of them are still coming true.

My involvement with the so-called personal computer revolution remains a bittersweet experience for me, because only part of the dream came through, even with the great interest in hypertext today. I've been compared by Stuart Brand to Thomas Paine; I've also been compared to Leon Trotsky. In every revolution, you see, there is someone who says, "Wait a minute! We haven't gone far enough! Don't stop now, or we betray our principles!"

And I say that the purpose of computers is human freedom. But who has yet been made free by computers?

The revolution most important to me will be the revolution in access to ideas: a grand open hypertext system that will let anyone explore all the ideas there are in the world, as expounded by those who believe in them and with all the color and vitality that belong to that exposition.

I suppose I am an elitist, because I think highly intellectual controversies are important. I'm also a populist, because I think everyone has the right to take the elitist approach to ideas: start where you want to start and do your own thing. I want to give, to every kid, the same privileges, the same freedom of ideas, that Bertrand Russell had as a kid, and Bucky Fuller had, and I had—to every kid, everywhere. I want to make the world safe for smart children, so that all children are safe to be smart.

## The Xanagroup

*Computer Lib,* and the notoriety it brought, brought also coworkers. In 1979 an unusual group came together to build the world repository I've been talking about.

The group included some remarkable people: especially Roger Gregory, a former mathematics graduate student from the University

of Michigan, irascible technocritic and generalist. Mark Miller, one of the more remarkable minds of our time, as a Yale student read every word of *Computer Lib,* and he lectured a seminar at Swarthmore on historical version intercomparison, from a page in my book I thought no one had ever read. He is now the key designer of tomorrow's Xanadu system. Another who worked with the team for a time was K. Eric Drexler, the physicist who predicts nanotechnology in his book *Engines of Creation.*

I had done the best I could with the design of the Xanadu system to that point. What I really did, it turned out, was find the people who could come in and take it over.

For the first part of the summer of 1979, we sat on a porch in Swarthmore, Pennsylvania, considering the question Is it mathematically possible to supply billions of readers at screens with the exact paragraph, sentence, fragment, illustration, or footnote, photograph, or piece of movie that each requires, immediately? Even if the number of the stored documents and the number of the links between them grow into trillions? And this was a fundamental question.

I am not a mathematician; those guys were. And after two months spent looking at every possible method we could propose, we came to the conclusion Yes, it could be done. This was a heavy responsibility.

Had that not been the case, we would have disbanded, shaken hands, and said "Well, that great hope is out of the question; let's look for something smaller to do with our lives."

But no. It was determined that this was feasible, and then we argued about the structure of such a system, and we agreed on how it should work and the meaning of freedom in such a system. We agreed specifically on the rights of the user—for example, that no one can see or keep a record of your reading and that you may publish freely. Fundamentals. We arrived at complete agreement—astonishing for the most captious group of people I ever met, unable to agree on what to have for dinner. Yet we agreed on all of this. Then they said something that shook me to my core: they said, "OK, Ted—we understand what has to be done; go away."

Years ensued. We worked hard and survived. And in 1988, half of the Xanadu project—Xanadu Operating Company (XOC), the branch of the project concerned with developing the software—was bought by mighty Autodesk, Inc., for an undisclosed sum. And since

then the group—substantially the same group, a decade later—has been working on a product to embody these principles.

## A Generalized Structure for Electronic Literature

The conceptual structure of an information system is perhaps its most vital aspect. This is more true for a system that must hold and supply millions of documents and their interconnections. Now I want to redefine the terms *document* and *literature*. As a moralist of words, I want the redefinitions to be faithful to the old meanings and yet open the door to the future. So let me define a *document* as an information package created by someone at a given time. This is subtly erosive of the computer notion of databases. A database is a collection of information that's allegedly true, and people talk about "all knowledge in a database." I leave the representation of knowledge to the artificial intelligencers; let them try. Meanwhile I know what a document is, and storing these documents and giving people rapid access to them—this is our focus, and it is an immediate and powerful goal for us all.

A document is a package of information; it has a creator, a date of creation, and presumably a point of view.

So now let's take the word *literature* and see again if we can re-understand it, in a way that does justice to its old meaning and opens the door to tomorrow. I say that literature is a connected system of documents. So the literature in biomechanical engineering, the literature in literary criticism, the literature in sociology—each of these is a literature because the connections within it are dense. And all writing taken together is a literature, too, albeit with less dense connections. So we can think of individual literatures as galaxies and of all literature as the universe or, as I prefer to say, the *docuverse*.

Very well. How can we expand literature to the world of tomorrow? Literature (I have noticed—and this seems to be a new insight for people) is a debugged system. Literature has been working well for thousands of years. By this I mean the system of studying and storing individual documents and following their interconnections. This person quotes that person; each point of view is perfectly expressed in principle by its owner because that person gets to express it any way they want.

Even so we must have a way of unifying under a common accessibility the so-called information explosion. Sure, there are all these

books and all these magazines—but are you reading more this year than last year? Probably not, because you have an absolute number of hours. And how long can you spend in the stacks?

The real issue is literature—all literature. The problem is to create a unifying and principled basis for the interconnection of everything that everyone says, to maintain the integrity of each document, and yet to allow everything to be deeply interconnected. So the issue is one of *grand hypertext,* as I call it, and of the literature of tomorrow, and of how to create a conceptual framework satisfactory for indefinite growth.

I would like to propose a sort of Gaia hypothesis of literature: that a literature, or all literature, is a living system that maintains stability and brings needed things to the surface, just as (according to Lovelock's thesis) Gaia brings to the surface of the water those calciferous blooms that are required to adjust the temperature of the planet. These blooms, although never before suspected, now appear as white splotches in the Atlantic Ocean when viewed from space. So too may the literary system bring to the surface those issues that the time is right to concentrate on. But these are speculations.

In this grand vision the document is the central concept. The integrity of that original document is vital, but people everywhere have to be able in their turn to use it any way they wish, to quote from it and arrange it for their use—just as when you buy a book you can cut it up and rearrange the pieces. You must be able to do that electronically.

How do we reconcile this cutting up with the integrity of the original? That is, I think, the fundamental idea of the Xanadu project.

## Transclusion

Our unifying structure in the Xanadu project maintains the integrity of all original materials and yet allows individuals to quote and anthologize in any way they wish. How can we do it? The answer we call *transclusion,* a simple idea, like *quotation* but not quite.

When you cite something, you ordinarily insert a copy of the quoted material from the original, or quoted, document into the new, or quoting, document. In the Xanadu model we use transclusion instead:

now you have a hidden pointer in the data structure of the second document, which points to the original and tells the computer-based reading machine where to get it. So the material is not copied from the original; it remains in the documentary space of the original and is brought anew from the original to each reader.

Let us see what this does in various contexts.

1. *Copyright.* This system allows all the appropriate desiderata of copyright to be achieved: one, payment for the originator; two, credit for the originator; three, nothing is misquoted; four, nothing is out of context. How could I mean nothing is out of context? Well, the inquiring user may immediately ask for the context of the original and see it. (This has to be interactive—you can't have the context of every quotation hovering in the background of your own document, but if the material is taken as needed from the original, then the context is as easily obtained as the quotation.)

So that's what transclusion does for copyright. It makes the copyright system work without complication, and with the freest arbitrary usage. Now you may create, through transclusion, any anthology you wish, using any sort of quotation, rearranged any way in your own document. Thus anyone is free to revise anything without affecting the integrity of the original and without permission, since no copy is made until the reader buys the copies through the automatic reading machine.

2. *Versioning by the owner.* If you are the originator of a document and create a second version, that second version is a transclusion of all the original parts you wish to retain, put into that new order, plus any new material. So readers of the new version can compare it side by side with their notes on the old version, seeing all the differences. The old remains accessible, and the integrity and intercorrespondence of both is maintained.

3. *Versioning by anyone else* (celluloid overlays). Anyone, even a stranger, may also revise this document. The revised version, also consisting of transclusions and new material, becomes then that stranger's version of the document.

Thus each new version is like a celluloid overlay, varying the document's contents without modifying its original storage. This is how we maintain, with utter clarity of origin and convenience, the sources of every fragment: transcluding all the portions that are still

there and making whatever changes the new context requires. (Note that the principal difference between changes by the document's owner and changes by the stranger concern ownership of the account: the original owner has a right to the original name and author-name unmodified, the stranger must find another designation.)

## Open Hypertext Publishing

Hope for the future lies in the accessibility of open hypermedia publishing. Not only may anyone publish a document and any reader draw out any part, as mentioned in our 20/20 vision, but anyone may publish connections to any part, visible wherever they are attached. Some authors may find this disconcerting. But it is fair. If I can put footnotes on other people's documents, then they can put them on mine (though I may not always look forward to such exchanges).

It is entirely possible that without open hypermedia publishing we are dead, for, as Eric Drexler argues in *Engines of Creation,* so many technological dangers in the future will mean there is only a narrow keyhole of survival for the human race and for the planet. In this struggle to save the planet, I believe nations and corporations must confront each other and work out serious negotiations, especially those concerning toxic waste, rain forests, and endangered species. Small-scale examples of tough negotiations may be seen in arms control, international whaling, and union-management relations. In each of these, we see natural interests balanced by complex schedules; good faith negotiations, such as union negotiations, require a complex understanding with many comparisons in great detail of lists of wants and proposed concessions. In such a world, the ability to intercompare these matters is a fundamental issue. I believe this today as much as I did when I began my first hypertext design some thirty years ago.

The purpose of computers is human freedom, and so the purpose of hypertext is overview and understanding; and this, by the way, is why I disapprove of any hypertext (like Michael Joyce's "Afternoon" discussed by Jay Bolter) that does not show you the interconnective structure.

Our objective at the Xanadu project has been not to fulfill the needs of industry, or to make things happen a little faster or more efficiently. Ours has been the only proper objective: to make a new

world. Don't think of the universal electronic docuverse, of open hypertext publishing with transclusion, as my dream; it's your dream too, if you will only feel it. I want you to see, to feel in your gut, what open hypertext publishing can do for the life of the mind, and perhaps for the life of the planet. Open hypertext publishing is the manifest destiny of free society. It is fair, it is powerful, and it is coming.

## Notes

1. For further information see my book *Literary Machines* from Mindful Press, 3020 Bridgeway #295, Sausalito CA 94965.

2. "Xanadu" is a trademark of the author for computer software and services, licensed to Autodesk, Inc.

3. For information on the current status of Xanadu software, contact XOC, Inc., 550 California Ave., Palo Alto, CA 94306.

# Discussion

TUMAN. While hypertext undermines the boundaries that have traditionally separated author, reader, and text, a hand-crafted hypertext like Joyce's "Afternoon" seems only to explore a small and relatively safe part of this new territory. What happens when such an author-controlled work gets placed within a larger hypertext publishing system like Xanadu, where it becomes as easy to make links outside as inside the original story, when Joyce's paths become only one possible set of options available to the reader? Doesn't such a possibility or eventuality lead to a more radical rethinking of literacy than you have indicated?

BOLTER. The territory explored by "Afternoon" is neither small nor particularly safe. It is true that episodes in this hypertext are fixed by the author, but there is still enormous room for the reader to wander, to reread, and to misread creatively. "Afternoon" already illustrates the principle lesson of hypertext: to write is to reorder the elements of a writing system. "Afternoon" is a writing system whose elements are verbal episodes ranging in length from a single word to several sentences. The reader of a hypertext becomes a writer because he or she can construct the text within constraints imposed by the system. We could allow the reader to construct the text at a different grain—to add new links or to modify the verbal texts. Interesting hypertexts would result, but they would be no more or less valid as literary texts.

We can think of a spectrum that runs from conventional printed texts (which are purely linear and allow the reader to interact only figuratively, not operatively) through texts like "Afternoon" to texts that allow the reader to intervene and rewrite at any level of structure. None of these is better than the other—any more than we could say that loosely structured Homeric poetry (the product of an oral tradition that was flexible and to some degree interactive) is better than the highly linear narrative structures of Virgil's or Milton's epics. Any point along the spectrum can produce compelling results. Elec-

tronic technology permits the author to vary the level of reader interaction, allowing the reader various degrees of freedom.

But the reader's freedom can never be absolute. The rhetoric of hypertext (and all of us who work in hypertext are guilty of this exaggeration) tends to be a rhetoric of liberation. We sometimes talk as if the goal of electronic writing is to set the reader free from all arbitrary fixity and stability of the print culture. In fact, hypertext simply entangles the reader in nets (or networks) of a different order. Readers are tempted to believe themselves free of all control, only to be caught by two kinds of constraints—the constraints of the computer system and the constraints of the writing system the computer embodies. The computer system aims to be transparent, but it can never achieve that goal. The reader must interact with the computer in some way (typing, moving the mouse, or speaking into a microphone) and therefore must know and obey the rules of interaction. The writing system may be any combination of words, graphics, and video. But, as semiotics and postmodern theory in general have shown us, all such verbal and graphic writing must function in terms of codes and conventions. The reader can neither ignore nor circumvent these codes and conventions.

Like all previous forms of writing, hypertext depends upon the interaction of many such codes. A system like Xanadu would put many millions of verbal and visual texts at the reader's disposal. The reader turns into a writer by using links to connect fragments of these texts into new patterns. The hypertextual reading is both operationally and figuratively dependent upon the written tradition; it is simply that the written tradition is much larger in Xanadu than it ever was in a printed library. The whole point of Xanadu (and hypertext in general) is to tie each reader/writer more firmly into the textual tradition.

McCORDUCK. Having now read "Afternoon" a few times, and in a few different ways, I agree completely with Jay that the territory explored by the story is neither small nor safe. The same is true for the disk version of Jay's own *Writing Space*. I am also learning to write with the hypertext tool *Storyspace*, which certainly turns your head around!

TUMAN. We are used to talking about reading largely in vertical terms of higher or deeper levels of understanding—contrasting, for example, a shallow, superficial reading with one that is probing,

profound. Does the advent of hypertext, and its largely horizontal language of links, paths, and webs suggested by both Bolter and Nelson, signal the advent of a new geography of understanding?

PROVENZO. The advent of hypertext, not only hierarchically but also symbolically, signals the advent of a new geography of understanding. Landow and others can address the hierarchical issues most effectively—let me explore the symbolic side.

It should be noted that with the Gutenberg revolution, the technology of the book made it possible to create and disseminate new ideas. Architecture was transformed, for example, by the creation of pattern books that could be cheaply reproduced and widely circulated. Symbolic representations, while certainly not new in their association with written language, became redefined and transformed. Changes in typography and the symbolic function and presentation of text date back to the earliest years of printing. Italic printing, for example, has its origins during this period. According to legend, the great Venetian humanist and printer Aldus Mantius developed italic type so he could compress more text onto a single page. The design for italic was based on models of cursive handwriting then in use in the papal chancery.

Italic typefaces are significant because they provide a standard typeface with a second dimension. Thus an italic type accompanying a standard, more linear, roman face has imbedded in it a secondary message. The introduction and use of italics may seem a trivial issue. In fact it represents a small but important example of how the new technology of print transformed the process of writing. While, technically, italic handwriting was possible before the invention of print, it was not developed. Even if it had been, it would not have been practical. When italic is written by calligraphers today, it represents merely a particular style of writing. *It is not typically used to offset or emphasize a specific point or concept in a text, as is the case in this sentence.*

The introduction of new graphic means of presentation—ones made possible by the print and typographic revolution of the fifteenth and sixteenth centuries—reflects a radical reconceptualization of the meaning of text. The implication of these changes across different fields was profound.

Examples of new iconic forms emerging as part of contemporary computer culture include forms as diverse as the Space Invader

Warriors from the arcade game, Mario from the Nintendo game system, and the various icons and symbols included as part of the Macintosh system (the "trash can" and so on). I am convinced that iconic and symbolic forms as exciting as those that emerged from the Renaissance will come into being through the use of hypertext and hypermedia.

A simple example demonstrating this point could, for example, take place through the creation of electronic rebuses. A rebus is a representation of a word or phrase by pictures and/or symbols. The popular television game *Concentration* uses rebuses as the basis for its puzzles. Rebuses were widely included in children's game and activity books during the nineteenth century. Hypertext has the potential to reinvent the rebus as a form. Imagine, for example, a word processor that creates a rebus every time you write something. It might have a screen with a small narrow window at the base showing the word or sentence being written and its symbolic representation immediately above it. Animation and color could be added. Using a hypertext-based rebus writer one could write "I saw the brown dog jump, and then jump even higher." The symbolic representation of the construction could include words, rebus constructions, symbols, and animations. Imagine such a system being given to a grade-schooler: as a classroom word processor, one that might include a system for putting anything written into the computer into a synthesized speech package that could be played back, or as yet another window that presents the sentence in a phonetic form such as the Initial Teaching Alphabet. Using hypertext techniques, a system such as this is not only a possibility but would be relatively easy to execute.

Systems such as a computerized rebus writer are relatively primitive compared to what will probably emerge for use as part of hypertext systems during the next ten or fifteen years. It is perfectly plausible to imagine symbolic/iconic writing systems being developed for the composition of poetry. The sort of elaborate word and special textual presentations that are found in the work of poets such as e. e. cummings will probably go through a further process of evolution and development. Verbs will literally become active—where appropriate, migrating across the computer. Exclamation points will explode as they emphasize their point. A word like *unfold* may literally do what it says. Or one like *disappear* may literally disappear. Sound will be

incorporated into textual and visual materials. Thus, the reader will not only see the "brown dog" jump higher and higher, he will hear him bark at the moon as well. Text, visual representations, and sound will combine to give new meaning to the phrase *to be literate*.

# Literacy Online

## The Promise (and Peril) of Reading and Writing with Computers

MYRON C. TUMAN, *Editor*

**Pittsburgh Series in Composition, Literacy, and Culture**

"A thus far unsurpassed collection of studies investigating in depth how the computer is transforming thought and societal structures in ways, some good and some threatening, which are irreversible but not beyond intelligent control. The authors of this prophetic book show how computers, far more strongly than writing or print, call for critical literacy." **—Walter J. Ong, S.J.,** *University Professor Emeritus of Humanities, Saint Louis University*

In the midst of ideological debates in the 1980s concerning literacy, an entirely different kind of revolution in the practice of literacy was occurring. Everyone—students, teachers, authors, and their readers—was starting to use computers to compose texts. The very notions of "reading" and "writing" were being altered with the use of online library catalogues, computer databases, and electronic mail. With access to laser printing and desktop publishing software, writers were also able to control not only what they said but how it looked.

Just what are we to make of these and other new computer-related "reading" and "writing" activities? In what way are such computer-based activities likely to affect not just how we read and write but what we mean by these terms, and thus what we mean by "literacy" itself? *Literacy Online* brings together ten writers from diverse academic and professional backgrounds to address five issues dealing with computers and the redefinition of literacy.

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