

The Implications of Electronic Information for the Sociology of Knowledge¹

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¹The arguments in this paper are drawn from *The Electronic Word: Democracy, Technology, and the Arts*, forthcoming from the University of Chicago Press, 1993.

Abstract

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This paper argues that the fundamental "operating system" for the humanities is changing from the book to the digital multimedia computer screen. It outlines the consequences of this move for the creation, performance, teaching, and study of literature, music, and the visual arts. It concludes with a suggestion for how this movement from page to digital display might inform the administrative changes forced upon the university by the current shortage of money.

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THE IMPLICATIONS OF ELECTRONIC INFORMATION FOR THE
SOCIOLOGY OF KNOWLEDGE²

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The Agenda for Group III has been set by the conference organizers as follows:

1. *How will electronic information affect the organization of humanistic knowledge and the social basis of its production and dissemination? For example, might the combination of electronic information resources with interdisciplinary and multicultural scholarship affect the formal organization of knowledge, whether in learned societies at the national level or in specific departments on individual campuses?*
2. *How will undergraduate teaching be affected by the ready availability of electronic information?*
3. *Will graduate training change as graduate students become more adept at using electronic tools?*

I will address these three questions in the order set.

When we ask, as in the topic set for this group, what are "the implications of electronic information for the sociology of knowledge," I take it that we are asking these questions:

- What cultural assumptions does electronic information bring with it?
- What basic means of thinking and working together does electronic information call into question?

²The arguments in this paper are drawn from *The Electronic Word: Democracy, Technology, and the Arts*, forthcoming from the University of Chicago Press, 1993.

- What does electronic information reveal about *how knowledge is held* under our present system?
- How will humanistic information be held in a digital electronic universe?

We're talking, then, to use a phrase we will all understand, about *the operating system of the humanities*. Before we begin, let's focus our discussion in two ways.

1. By "electronic information" I take it that we mean *digital* electronic information. Great confusion has been generated in the past thirty years by the failure to make this crucial distinction. *Analog* electronic information affects us mightily--as in broadcast television--but it lacks the essential ingredient of digital electronic information: the common signal base for word, sound, and image.
 2. In this paper we are reflecting upon the humanities--the creation, criticism, teaching, and archiving of the arts and letters. None of us need reminding how enzymatic digital computation has been for the physical sciences. Such a story would be, indeed, almost *the* history of the sciences since 1945. New fields of inquiry such as chaos theory have been *created by* the computer, and established fields have been revolutionized, first by digital computation and now by digital visualization. Although there are obviously overlaps, the humanities are being radicalized by digital computation in a different way from the sciences. It is that different way that I consider here.
1. *How will electronic information affect the organization of humanistic knowledge and the social basis of its production and dissemination?*

The basic operating system for humanistic knowledge from the Renaissance until the present has been the codex book. Two forces converged at that time to establish it as the central system, one technological and one ideological. The technology of print created in the codex book a vehicle of miraculous versatility from which have descended alembicated variants like broadsides, magazines, even scholarly conference proceedings. Onto this technological marvel the humanist ideology grafted the concept of the authoritative text. Humanistic scholarship existed to rescue, edit, and annotate the great texts of antiquity and to publish them in definitive editions. Cultural authority flowed from these texts and thus their dissemination mattered; the great humanistic efforts to found grammar schools, write textbooks, and establish libraries institutional and private, sought to insure such dissemination. This dual explosion of a technology of expression and an operating system of cultural authority gained additional force at every point, as we all know, by the translation of the Bible into the vernacular languages and its "publication," its democratization, in the new form. This heroic democratization, with all its triumphs and mortal perils, can be followed in the career of William Tyndale, the principal, if unacknowledged, translator of the King James Version.

We still operate under this system and take for granted its rules. Books are stored in libraries, taught in schools, carry on learned debate, enshrine the truth, as we have been given to know it. After books have been printed and bound, they are unchangeable. Thus the idea of a single author can be protected. Because books can be *physical* property, they can be *intellectual* property, protected by some version of copyright law. Thus the *career* of authorship becomes possible. And books create a natural authority: you can quarrel with them but only marginally or by writing another book. If you are dealing with the *ipsissima verba* of God, as in the Bible, you cannot quarrel with the Author at all. (The quarrel about *interpretation* will continue, presumably, until Domesday.) Books have always been centered in the word; illustrations can be reproduced, but they require a different radical of expression, one which has almost always been much more expensive than setting text; color has always been an expensive ornament, not an essence. Sounds cannot be reproduced at all.

"We are coming to the end of the culture of the book," O. B. Hardison has written. "Books are still produced and read in prodigious numbers, and they will continue to be as far into the future as one can imagine. However, they do not command the center of the cultural stage. Modern culture is taking shapes that are more various and more complicated than the book-centered culture it is succeeding."³ What happens when this occurs, when humanistic knowledge moves from book to screen? The operating system changes fundamentally. Texts are not fixed in print but projected on a phosphor screen in volatile form. They can be amended, emended, rewritten, reformatted, set in another typeface, all with a few keystrokes. The whole system of cultural authority we inherited from Renaissance Humanism thus evaporates, literally, at a stroke. The "Great Book," the authoritative text, was built on the fixity of print technology. That fixity no longer operates. The reader defined by print--the engrossed admiration of the humanist scholar reading Cicero--now becomes quite another person. He can quarrel with the text, and not marginally, or next year

³O. B. Hardison, *Disappearing Through the Skylight: Culture and Technology in the Twentieth Century* (Penguin Books, 1989), p. 264.

in another book, but right now, integrally. The reader thus becomes an author. Author and authority are both transformed.

The possibility of such instantaneous disagreement changes the time-scale of humanistic debate. We can compare the old diastole and systole with the new by juxtaposing the stately pace of humanistic publication--years to write a book, a year at least to publish it, years to review it, more years for it to affect the debate--with online special interest groups, where the interchange happens daily. To change the time-scale of humanistic knowledge affects its essence, not only its pace. It changes, to take the simplest example, the paradigmatic expressive form from the essay (another Renaissance creation) to online conversation (a return, on a faster time scale, of the paradigmatic medieval form, the letter).

And, as we have now all discovered, the protective carapace of copyright law simply cannot apply. Copyright law was created to regulate a market in printed books. Because digital information has physical expression but no physical embodiment, it cannot be owned in the same way as a printed book. You can eat your cake, give it away, and still have it too. A new marketplace must be devised. The new digital bounty, by denying the laws of substance, changes fundamentally both the career and the cultural authority of authorship. For properties in the humanities, existing copyright law seeks to focus on a central question--*substantial similarity*. To make such a distinction, you need a *substance*. Electronic text, unlike books, has none. Copyright law must have a fixed text, with a fixed order. Such an order is an integral part of a literary text and essential for making the comparisons copyright litigation always involves. Yet a digital electronic text, because of its intrinsic volatility, can leave the order up to the reader.

As a brilliant recent book, *Writing Space*, by the classical scholar Jay Bolter, has made clear,⁴ the natural form of electronic expression is not linear but hypertextual. Hypertext leaves the organization up to the user. Beginnings, middles, and ends are what he or she makes them out to be. The final "reading" order represents a do-it-yourself collage, a set of user-selected variations, around a central theme. The idea of beginning-middle-end--the fundamental Aristotelian laws of artistic creation and indeed of rational thought itself--is called into question. Narrative and logical order, in such a world, are not fixed in the text but a boundary-condition which the reader can apply when and how she wants to. This change in the fundamental nature of narrative structure, and of the human "reason" a common reader is assumed to possess, subverts utterly the kinds of textual comparisons any copyright jury can be expected to understand.

⁴Jay David Bolter, *Writing Space: The Computer, Hypertext, and the History of Writing* (Earlbaum Associates, 1991).

Consider for a moment a mock trial in which I participated at the 1991 "Digital World" meeting. The case at bar: An academic "author" decides to develop a multimedia program on gangs in the inner city. As one segment of this program, he uses, without permission (it was requested but denied), the famous gang knife-fight scene from the film *West Side Story*. (In the *Romeo and Juliet* original, this is the duel between Tybalt and Romeo [Act III, Scene 1].) The scene is short, and forms part of a program segment on gang fights which is much longer. A "reader" of the program need not look at this scene at all, or need not look at all of it. It may not even be noticed. Each "reader" makes his way through the program in an idiosyncratic way--no central guidance. How much of the "substance" of the program does the borrowed segment represent? Is it prominent, because it comes from a famous movie, or *de minimis*, because it lurks in a corner easy to overlook? In a program basically scholarly in nature, can it be reckoned "fair use"? If the "substance" is not fixed in book form, nor the "reader's" trajectory of attention implied, the true nature of the taking simply cannot be measured.

Electronic information, then, affects the organization of humanistic knowledge and the social basis of its production in some fundamental ways.

- It changes the central humanistic *artifact* (the CPU, we might call it) from printed book to digital display.
- It changes what we mean by *author*.
- It undermines the basic idea of *originality* last glorified by the Romantic Movement.
- It changes what we mean by *text*.
- It radically compromises the cultural *authority* of the text.
- It metamorphoses the *marketplace* of humanistic inquiry in ways so radical we can scarcely yet find our way.
- It *desubstantializes* the arts and letters (and perhaps other areas of humanistic production) in much the same way that the information society has desubstantialized the industrial revolution.

The operating system we inherited from the Renaissance, then, undergoes digital metamorphosis: book, author, authoritative text, book market, library, all become something else. But this metamorphosis only begins the digital transformation. Consider the central part of the humanistic enterprise, the arts and letters themselves. We can do this in three parts. First, we'll consider the current state of their new expressive medium--what people now call "multimedia." Second, we'll sample the state of play in music, the visual arts, and letters. Third, we'll ponder the implications for the arts of their new fundamental boundary condition: in a digital universe, words, images, and sounds share an isomorphic representative code.

(1) *The current state of multimedia.* If the basic mode of cultural expression is moving from the book to some electronic form, what does this form look like? Do not confuse it with broadcast television. Broadcast TV is an analog form, a fundamentally different affair. I have no doubt that Nicholas Negroponte is right in prophesying its imminent, and let's hope, eminent, demise. This new expressive form that is replacing the book is emerging from a cluster of technologies which people now call, for better or worse, "multimedia." In trying to explain it, I am severely constrained because I am trying to explain in print, to people who have internalized print into an unalterable condition of human life, a fundamentally different medium. There ought to be, in every such presentation, a demonstration. But circumstances do not permit it, so we must try to explain a dynamic medium in a static one, an imagistic medium in words only, a hypertextual one in linear text, a color one in black and white, a speaking one in the echoing voice of prose style.

How, thus constrained as we are by putting new wines into an old bottle, can I describe the current expressive vehicle for the humanities? It is a composite of techniques. Start with an electronic screen. This screen can do everything that a computer can do. It can display and manipulate type. Unlike print, it permits the reader to change the display from one typeface to another, for ornamental effect, for expressive effect, or simply to enlarge it for easier reading. (The ability to magnify print has to date been thought simply an aid for the near-blind, but it goes much further than that. How many books have vanished down the oubliette because of minute type? I first read the poetry of Edmund Spenser in type 1/32nd of an inch high, and it took me half a dozen years to get back to the poetry.) Thus type becomes, instead of the famous crystal goblet of Victorian typesetting theory, an expressive parameter in itself, an iconic surface that interacts continually with the words which it bodies forth.

This new self-conscious expressive dimension isn't just a visual joke, like a ransom note assembled from a dozen different typefaces. It introduces a fundamentally different meaning for literacy itself. The late Eric Havelock, the great Hellenist, argued that the Greek alphabet enfranchised modern literacy because it was simple enough to be internalized in early childhood. The reader thus looked *through* the words on the page to the thoughts expressed. Thought was, thus, unmediated--or at least made to seem so. (Greek and ancient Latin manuscript notation, written without word spaces, was of course much less transparent than modern type, or even than a fine Renaissance italic hand, but the principle remains.) This transparent medium was for humanism what Newtonian physics was for science--a fundamental paradigm. Pure conceptual thought, unmediated by expression, was possible and indeed ideal. The printed page was a transparent window onto the world of thought.

The computer screen constitutes a more opaque surface altogether. We have to decide how we are going to constitute our "reality." Much more self-consciousness enters into the occasion. This self-consciousness affects "the organization of humanistic knowledge" at the most intimate level. Both author and audience, citizen and society in the world of letters, become fundamentally more self-conscious about themselves, about writing, about how social decorum is constituted. We have to do here not with an ornamental elegance but a fundamental state-change in how the social imagination works.

A multimedia "page" can manipulate printed text not only in visual scale but in conceptual scale. We can construct a text, using an outlining program, in layers, and the reader can choose which level of generality within which to read. Typographical formatting of books tries this but within very severe limits. Its basic cognitive scale is fixed, and with it the reader's time scale; the reader follows the argument on the level of generality the author has chosen to employ. With the new medium, the *scale* at which conceptual thought is pursued now becomes a user-selectable parameter. Such a scaled reading is "hypertextual," but in a particularly ordered, top-down way. It would seem to be a natural for such written discourse as the law, for example, though to my knowledge no one has yet used it for this purpose. It offers some obvious pedagogical applications, but here, too, it has not yet been exploited.

In the new expressive medium, text can also be in color. We see in magazine formats and advertisements how such a text might look, but we dismiss it as a possible vehicle for conceptual thought. I don't think we should. It seems far different in the context of, for example, a digital magazine published on a CD-ROM. We have proverbialized black and white expression as a guarantee of the truth ("I've got it down here in black-and-white!"), but the proverbs can't hide the technological base of this metaphysical verity. "Black and white," like print technology as a whole, works by sensory exclusion; there is nothing intrinsically truthful about such a technique.

Freedom of the press, the cynical proverb hath it, means owning a printing press. Now, through desktop publishing programs, such ownership has been radically democratized. This democratization indeed constitutes a revolution in "the social basis of . . . production and dissemination" for humanistic knowledge. But desktop publishing brings other changes as well. In a print world, we think of print as fixed, "cold type" even when it has been produced by photography. You *set* it. In a desktop publishing world, you *flow* type. The fundamental metaphor shifts from static to dynamic. This "liquidity" of our basic alphabet will affect in profound ways how we think about reading, about literacy itself. What becomes, for example, of the stability of spelling, punctuation, and syntax? Will we return to the chaotic days of Elizabethan orthography?

But all these changes, enzymatic though they are, only hint at the fundamental change that screen brings to page: a radical alteration in the alphabet/icon ratio of ordinary discursive prose. In a desktop publishing program, you not only "flow" your text, you usually flow it around pictures. To find the critical machinery needed to analyze such an alphabetic/iconic convention, we have to go to previously marginal expressive conventions like shape poetry. (We might also, if our humanistic respectability didn't forbid it, consider the new genre of "serious" comic book.) Such a mixture of word and image is not utterly new, to be sure, but digital expression poses it with a resurgent force. The new humanistic "page" can reproduce images as easily as text, and it can manipulate them to an equal depth. And the white space is free. The playing field for word and image thus finds a miraculous enlargement. We can now process images as easily as we do words, and this ability has called forth horrified perturbations of dismay. Because we have thought photographs, like "black-and-white" words, to be unalterable talismans of truth, like long-time prisoners we shudder when our chains are removed. But all these fixities are technological conventions, not eternal truths.

Our allegiance to the truths of alphabetic expression, in the humanistic world especially, has become so strong that we denigrate iconic communication as "comic book culture." But the power of the visual cortex to organize experience, not to mention the power of visual art to render it joyful, surely indicates that this prejudice must dissipate. We are in for a complete renegotiation of the relationship between verbal and visual thinking. This renegotiation, like the others we have considered, goes deep. The two sides of the brain are being brought into a new--and, perhaps we may find, more balanced--relationship. This rebalancing finds its scientific counterpart in the emergent discipline of "visualization," the use of computer graphics to think through, conceptualize, problems rather than simply to illustrate solutions arrived at through other means. I am not sure what an imagistic, or iconic, or iconographic, "organization of humanistic knowledge" will look like, but it will certainly be different from our present one. Perhaps we should look to the patterns of thought built up by logographic languages like Chinese or Japanese for guidance. At all events, "visual thinking" will become much more than an oxymoron, or even a paradox. The growth stock, in such a new humanistic world, will have to be the visual arts and art history, will it not?

Classical rhetoric spoke often of the "colors of rhetoric" and we are now equipped to literalize this metaphor. But with even greater urgency it urged the power of the "speaking picture." We can now literalize that ideal too, for we can on the multimedia "page" add sound to word and image. Even entry-level computers can now add the spoken word to the written text. Soon it will be a common mix. Voice, written word, image. And music too. It is hard to wrap your mind around such a complex sensory mix, but I don't see why it should dismay us--although it does remind one a little of the Greek rhapsodic performance which so disconcerted Plato!

So. We have an expressive surface which can mix word, written and spoken, with image and music. A Wagnerian *Gesamtkunstwerk* for the common reader. To this rich expressive surface, now add a dynamic digital video signal--that is, mix in movies as well as still photos. The "capture boards" which enable us to do this, although some impoverished English professors still cannot afford them, have been steadily declining in price. Thus the history of film and television's dynamic imagery becomes available, part of our new system of humanistic "production and dissemination." The film and television world's treatment of its rich archive has always been a scandal, but a digital universe makes it worse than that--a financial blunder. The VCR democratized the history of film and television, stormed the archival Bastille, as it were. Now a further democratization offers itself: the digitization of filmic record into an archival form where it can be stored more safely and dispensed more widely and at less expense. More than all this, though, the digitization of our visual archive, both still and moving, democratizes it still further, for it offers the power to reconfigure, to reconstitute.

At this point, the great cookie monster of humanistic angst, broadcast TV, has entered our new expressive surface. Once we digitize it for a computer screen, we can manipulate it as easily as we manipulate every other digital signal. We can invert beginnings, middles, and endings to make up new stories. We can use the basic art form of our time, collage, to our heart's content. Talk about zapping the commercials--we can zap the programs! Thus we disarm the monster than threatens to devour us. Surely even Neal Postman could not object to this.

The multimedia developers have chosen as their "God-term" the word *interactivity*, and rightly so. At the deepest level, humanistic expression, and the means which disseminate it, have moved from a static to a dynamic medium. Is this not, as well, a fundamental movement of Western art in our time? One thinks of the Italian Futurist Marinetti's exploding a printed text into its visual components. A building for us now is not a timeless monument but, like the *Centre Pompidou*, for example, a structure built to change and interact with its environment and its inhabitants. From the sculpture garden we move to Christo's *Running Fence*, and to Happenings. From the gallery Madonna we move to Jean Tinguely's interactive junk-machines. From the tranquil landscapes of Poussin and Lorrain, we move to the minimalist paintings and room environments of Robert Irwin, where not only surfaces and walls and colors but the very nature and palpability of light itself change as we watch, and gaze, and ponder, and enter *into* the surface. And from there, to continually changing, algorithmically composed computer "paintings."

The multimedia developers keep claiming that they have created a form so new that neither they nor anyone else knows what to make of it. But the aesthetic we need to interpret the new expressive surface that humanism now wields can be found just here, in the history of the visual arts from Futurism and Dada to the present. Scale-change, repetition, collage, chance-based creation, volatility, interchange of reader and writer, creator and perceiver, the radical democratization of signage, etc.--all these and more reveal the extraordinary fact that the visual arts have, once again, miraculously imagined an expressive explosion before it took place, before digital electronic means made it possible. People who develop the kinds of arguments I am sketching out are always reproached with being "futuristic," prophets of a sci-fi future that stable feet-on-the-ground people should beware of. Two answers present themselves to this ever-green reproach. First, the new multimedia humanistic expressive surface *already exists*. None of these expressive possibilities is rare or unknown or undeveloped, some of them are quite cheap, and all of them are getting cheaper. But the stronger argument for this new expressive surface, and distribution system, for humanistic expression is never brought forward--the very history of the twentieth-century arts. If the digital revolution has not really happened to the humanities, if the changes I have been charting have not occurred, then the history of twentieth-century art is a meaningless aberration. It may be so, but it takes some temerity to make such a claim.

(2) *The state of play in music, the visual arts, and letters.* The arts are "humanistic information" in one of its most basic forms. How, in creation, performance, and teaching, have they been digitally transformed? We might find our footing in the performing arts by considering music. Over half of the music performed in America these days has a digital base. Recording and playback are entirely digitized, with the consequences for listener-directed reconfiguration that the compact disc has made familiar to us all. Musical publication has been vastly democratized by electronic means. The nature of musical instruments has been fundamentally changed. There seem to be only three basic ones: the electronic keyboard, horn, and drum pad. From these, all the sounds that carefully tuned brass and magically varnished wood create can now issue. These sounds are not yet identical to those made by acoustical instruments, but the transformation has nevertheless occurred. Musical composition now proceeds as a collage, specific sounds or bits of performed music are "sampled" into a single piece of music. Often the sampling proceeds, as John Cage predicted it would, from the world of ordinary, nonmusical sounds. It needs no extraordinary mother-wit to extrapolate from these state-changes to the alterations required in music education.

In such a digital electronic world, "the social basis of production and dissemination" has indeed changed. "Musical talent" in such a world means something quite different from that in the world created by the Renaissance. The physical talents and training necessary for performance have been radically democratized in range and altered in kind. And the "performance" of a piece of music resembles far more the act of writing than the high-wire act of professional concertizing. The digital performer depends, as does the writer, on a rush of power created by time-scale. As a writer, I work for twenty hours to create what you read in one; the power comes from the compression of effort and design that writing allows. That compression now can occur in musical *performance*. And the performance, the act of dissemination, now occurs in private as well as in public; since the signal is digitized from the beginning, to replay it at home is as "authentic" as to replay it in a concert hall. All of this sampling, collaging, and replaying creates horrendous copyright confusion, of course.

In the visual arts, let me single out two exemplary transformations. I take the first one directly off the screen upon which I now project these words. Like many other people, I use a screen-darkener program called *After Dark*. It takes over when the muse deserts me. After the keystrokes have stopped for a specified time, to protect the screen from burn-in it creates, through various algorithms, wonderful moving visual patterns on my screen. Some are narrative and cute, one or two even cutesy--prowling cats, flying toasters, and the like. The most beautiful ones, however, draw abstract patterns of ever-changing catenary curves, boxes, ever-vanishing and reappearing perspectives, Mondrians, and so on. They rival the best conventional geometrical abstractions done with oils on canvas. I happened the other day to look at a reproduction of a real Mondrian: it wasn't the color differences that I noticed, but the *absence of motion*. Will this not happen to anyone who is used to a dynamic visual medium? What of how we look at still pictures? How we teach about them? Research them? Will not all of these change radically? (You can see the changes in research techniques peeping through in conventional art history here and there. Consider, for example, the resurvey of the Rembrandt *oeuvre* now underway. Does such a survey not, as a programmatic assumption, transfer the final reality of "Rembrandt" to a dynamic creative energy we choose to call by the artist's name, while the individual pictures become simply print-outs, temporary static expressions of a dynamic center?)

After Dark has always included means for the user to vary the patterns, combine them according to taste, repaint them as it were. These opportunities have not gone unremarked, and customizing the *After Dark* patterns is now a cottage industry. In such a world of viewer customization, conventional still "paintings" will never be the same. The time dimension they lack will be keenly felt, just as the noises Tinguely's machines make in a gallery make us *feel* the disturbed ritual silence of a conventional gallery. And much of the artistic "originality" we have been brought up to admire in this breathless silence now comes from a new, algorithmic creator. If a painting is a kind of humanistic knowledge, as I hope we can agree it is, then we have a new way of organizing and disseminating it.

As a second heuristic example, let me discuss for a moment what I will call "virtual architecture." This genre has always existed--plans, sketches, and renderings of an architect's unbuilt work. In very rare cases, like that of Frank Lloyd Wright, designs unbuilt during the architect's lifetime are built later, as a cultural *homage*. Now the "social basis of production" has changed here too. Instead of huge rooms full of drafting-table drudges working out half-inch details with pen and ink, we have a computer-graphics program within which the building can be designed, and then reconfigured at will, to be printed out, with whatever scaling manipulation needed. And then, through the simulation technique called "virtual reality,"⁵ we can "walk" through a simulation of the building's three-dimensional space. This is no blue-sky affair; in Japan, kitchen planners sell their designs to housewives this way. These techniques are being extended to larger civic spaces. Thus architectural design is radically democratized. Architects without clients can yet "build," and clients without architects can yet "design." All of us, not only those with acute powers of spatial reconstruction, can walk through these unbuilt architectural, and civic, spaces and see how we like them. Again, the critic can become a creator. These computer-assisted design techniques represent an extraordinary metamorphosis in the sociology of architectural design; they fulfill and genuinely empower the "behavioral design" movement which has beaten so often in vain upon the cold glass edges of the International Style.

⁵Howard Rheingold, *Virtual Reality: The Revolutionary Technology of Computer-Generated Artificial Worlds* (Summit, 1991).

In the literary world, the patterns of postmodern fiction have anticipated electronic display, too. Postmodern narrative patterns are hypertextual rather than linear. The typographical manipulations in Kenneth Burke's *Flowerishes* or Derrida's *Glas* remind us of Marinetti and the Italian Futurists at the beginning of the century. But the real revolution in the production and dissemination of fiction has come in participatory forms, in video games, theme parks, and museum simulations. We discount these in the academy because, like the novel when it first began, they are an emergent popular art rather than *belles lettres*. When we talk about "democratizing" literary experience, we usually mean taking our regular seminars and teaching them to audiences which normally don't or can't attend them. This is a fine thing to do, but the real, the radical democratization of literary experience is taking place elsewhere, in the re-recreational areas I've just noted and, indeed, in the almost universal use of dramatic simulation for all the processes in the world of work.

And not only in the world of work. We might reflect for a moment on the implications of computer simulation for writing history. New powers of data searching and sifting only begin the story. Historical events can be reenacted, with the "reader" acting either as participant--"making" history--or as interpreter--"writing" history by choosing among various possible weightings of character and event. We can, dyslogistically, call this the "fictionalizing" of history or view it eulogistically, as an alternative to Ranke's positivistic history "as it really happened." Interactive videodiscs like the CBS program on the San Francisco earthquake, or more complex programs like the IBM *Columbus*, supply the raw materials from which a student can construct her own historical essays in video form. The use of illustrative live video clips now often accessed in medical texts through light pen bar codes surely will be used for historical illustration and citation. (A reader who wants an illustration of a particular heart operation uses the light pen to call up a real-time video of that operation on a video monitor.) But this is an interim technology. The mature one will interpolate live video clips into the historical text; we can do this now on a moderately sophisticated home computer. But looming larger than these specific technologies is the whole idea of historical simulation as a basic learning technique. Again, broadscale democratization.

(3) *An isomorphic representative code for words, images, and sounds.* In a digital universe, word, sound, and image share a common notation. They are, at a fundamental level, *convertible into one another*. I have a program which traces drawings and makes them into music. You can make music from any imagistic source this way--it has been done with hospital charts, to pluck a pleasingly *outré* example from the current scene. And you can move the other way, derive images from music. Plato dreamed of a common mathematical basis for the Forms. Digital notation creates it, or something very like. And Mandelbrot seems to have found another digital path to this goal, finding the key to visual form in the arts in the self-similar fractal patterns described by chaos theory. Thus the arts draw together, and together with mathematics, in a truly wondrous way. What does this convergence mean? We don't altogether know yet, but certainly the traditional areas of creativity now overlap, with consequences for the democratization of the arts, and for the academic organization within which they are taught. How can we keep apart the practice of arts with common methods of input and a common digital base? Here are grounds for a genuine revolution in the "social basis of production." How can we keep apart the study of these arts? How long can we keep the teaching of these arts in separate departments? Here are grounds for a genuine revolution in the "social basis of dissemination."

It is time for another internal summary. We have seen that digital expression has changed in fundamental ways what art *is*, how it is *created*, and how it is *disseminated*. We have seen that the common digital base brings the arts into a fundamentally new relationship, one that transforms how they are studied and taught. We have seen that, if you wish to study how electronic information affects the sociology of humanistic inquiry, you must start by pondering the enormous changes that have occurred in the arts and letters that constitute the core of that inquiry. It makes no sense to talk about how digitization has transformed our scholarship and teaching about the humanities without confronting the massive changes that have come to the humanities themselves.

Having done that, at least in a preliminary way, let's switch our gaze from the organization, production, and dissemination of the humanities themselves to the academic humanism which studies and teaches them. What the "humanities" *are* nowadays is largely what the Renaissance humanists defined them to be: to study "humankind" is to study the great texts, literary, historical, and philosophical, and to a lesser degree the art and music that accompany them. We have grown so accustomed to this definition of "humanism" that we have failed to see how narrow it has become. The narrow focus is a product of rhetorical education. The rhetorical *paideia* which governed Western education until the explosion of the modern subjects a century and a half ago taught through a centripetal system. Every type of inquiry was included in the corpus of great texts, and the formal system of study and performance built on them. History was studied through formal speeches recreating famous historical occasions. Psychology was studied through acts of personification. Political science was studied through the dynamics of verbal persuasion. Thus to study these texts *in this way* was to study all that pertained to humankind. All the great subjects were drawn inward into the verbal center. Needless to say, we proceed nowadays on the opposite system, a centrifugal one in which new subjects are continually being thrown out into discrete orbits.

As a result of this rhetorical centripetality, the name "humanism" for the narrow study of the arts and letters in their "high" or at least formal aspects, claims far more than it should. It claims a theoretical centrality it no longer possesses. Either this centrality must be renounced or we must include in the humanities some fundamental areas of inquiry which we now omit. These omissions, as I see it, constitute the great suppressed agenda of the humanities, not the current race-gender-class obsessions. Let me discuss three segments of this suppressed agenda: behavioral biology, behavioral neuroscience, and the study of nonlinear systems--what is now called "chaos theory." I choose these because, instead of being drawn into "humanism" by conceptual affinity, as ought to have happened, they are now being *driven into collision with it* by the logic of digital technology. I must address this up-to-now unremarked technological pressure because it constitutes the most profound way in which--to return once again to the agenda of this session--digital technology is affecting "the organization of humanistic knowledge."

Electronic technology has prompted so hostile a response from the humanities establishment because it creates a different literacy from our customary print-based one. As we have seen, electronic "text" mixes word, sound, and image in new ways. It thus draws on different areas of the brain, and lays down different neural pathways within it. In so doing, it affects "the organization of humanistic knowledge" at the most fundamental organic level. Jane Healy has argued, in a thoughtful recent book⁶ that we are educating a generation of children whose brains lack the neural networks needed for higher-level cognitive processing. Their brains have not received the social and verbal stimulation needed during the brain's critical periods of development. The villains rounded up for this impoverishment--broadcast TV, high-decibel rock music, the decline of family nurturance, drugs--also include the new alphabet/image ratio I have been discussing. No one I know thinks the electronic universe will *go away*. If we are to understand the "literacy" it creates, we will have to school ourselves in the work now being done by behavioral neuroscience, which teaches us how the brain processes the various components of that new literacy. Humanist inquiry of all sorts depends on such an understanding. Nothing less than human reason itself stands at risk. Electronic technology is driving the humanities toward learning how our knowledge is organized at the neural level--the "sociology" of neuroanatomy.

Digital information drives the humanities toward behavioral biology as well as toward behavioral neuroscience. I must now make an argument essential if we are to understand how digital information affects the sociology of humanist inquiry --that is, the social matrix within which that inquiry proceeds. But to do so, I will have to use a very high compression ratio--about 100/1. Bear with me.

⁶Jane Healy, *Endangered Minds: Why Children Don't Think and What We Can Do About It* (Simon & Schuster, 1990).

It is apparent, I think, to anyone who has worked in the computer world that the spirit of play and game works there more strongly than it does in the world of print. We have to do here with a fundamental change in motivational balance. The three basic areas of human motivation--game, play, and purpose--are mixed in different ways by different technologies. The history of that mixture--genetic, evolutionary, behavioral--is what behavioral biology studies. As more and more of our communications become digitally based, we will more and more need to master a new mix of human motive. The humanities come into vital play because they exist to balance and remix human motive, to infuse the world of purpose with the world of play and game. Behavioral biology gives humanistic inquiry its evolutionary history--a history we desperately need in order to understand the new motivational mix that humanistic expression will now embody. Thus, in the effort to devise a new sociology of knowledge for digital communication, electronic technology drives humanistic inquiry toward behavioral biology as well as behavioral neuroscience.

As if this weren't difficult enough, we must confront a third area of inquiry which the digital computer has made essential to humanistic inquiry: chaos theory.⁷ Whatever else it may be, the new mixture of word, image, and sound that digital communication brings with it will be radically nonlinear, associative, discontinuous, interactive. As postmodern art has predicted, such communications procedures will depend heavily on scale-changes. As it happens, we now have a new way of thinking about such nonlinear systems of organization, and especially about scale-changes. It is called "chaos theory." It may be, according to this way of thinking, that the arts are nonlinear systems. Mandelbrot argues that the forms of visual art constitute one such system. Certainly if you are trying to write the intellectual history of a computer network, you will have to use chaos theory to do it. When we think about the "organization" of *anything* in the world of digital communication, we will go greatly astray if we apply to it Newtonian patterns of thought. It is fatally easy to do this. We thus touch here a potential reorchestration of intellectual history itself.

For example, might the combination of electronic information resources with interdisciplinary and multicultural scholarship affect the formal organization of knowledge, whether in learned societies at the national level or in specific departments on individual campuses?

We've pondered, in considering Jane Healy's work, whether electronic text actually forms the brain in different ways from printed text. Looking toward the other Working Groups in this conference, might we not scale such a question up to network level? This reordering of how the brain is affected by verbal, imagistic, and auditory input during its formative stages must model in little, must it not, how we will communicate about the humanities at the digital-library network level? May it not be the case that the nature of scholarly communication, of how we write and read about the humanities, as well as create and socialize them, will be similarly altered? That our scholarly communication will mix words, images, and sounds in the same way that digital "artistic" texts do? Gregory Ulmer has written a provocative book on this subject.⁸ He argues that we must invent a new mode of scholarly conversation based on the new mix of word and moving image. Will not such a

⁷James Gleick, *Chaos: Making a New Science* (Viking, 1987).

⁸Gregory Ulmer, *Teletheory: Grammatology in the Age of Video* (Routledge, 1989).

new mix inevitably become part of how digital library networks process information? Might scholarly communication become *iconic* in ways never seen before? It is fun to think about.

Learned societies, like academic departments and at about the same time, were formed as part of an academic specialization based on print communication. They started journals. Now we have special interest groups communicating online. Do these SIGs not constitute the "learned societies" of the digital future? Their communication is already radically hypertextual--discontinuous, associative, based on oral conversation rather than print. SIGs are fissiparous. They form and re-form continually, work on the formative edge of interdisciplinary inquiry. They model, too, the way multicultural perspectives invade and invigorate traditional professional specializations. Print publication encourages disciplinary differences by its very fixity and by the time-scale of its scholarly interchange. Computer-based "publication" works the other way, encourages the mixture of fields, of perspectives, of "publication" channels, which lies at the heart of both interdisciplinary and multicultural scholarship. Both the "national society" and the "national meeting" are more print-based than we customarily think. It seems unlikely that they will remain unchanged in a digital universe.

2. *How will undergraduate teaching be affected by the ready availability of electronic information?*

Let's start with the idea of a "class." I'll use an example close to home, my Shakespeare class. I give it every year. I always recommend additional reading which the students never do. Partly they are lazy, but partly they can't get to the library, for they work at outside jobs for 20–30 hours a week and commute from pillar to post. Each year's class exists in a temporal, conceptual, and social vacuum. They don't know what previous classes have done before them. They don't know how other instructors teach their sections of the same class. They seldom know each other before they take the class. They never read each other's work--though sometimes they appropriate it in felonious ways. I read all their work myself, and mark it up extensively, often to their dismay. A few of them take me up on my rewrite options but most don't, and hence don't learn anything much from my revisions, since they are not *made* to take them into account. They thus have an audience they know, but it is a desperately narrow one.

Imagine what would happen were I to add an electronic library to this class. Students access it by modem or through a CD-ROM or whatever. On it, they read papers--good, bad, and indifferent--submitted in earlier sections on the topics I suggest. They read scholarly articles--good, bad, and indifferent--on these same topics. They read before-and-after examples of prose style revision. A revision program is available for them to use--licensed by me to UCLA, since it depends on my own textbooks! They can do searches of the Shakespearean texts, also available online, when they study patterns of imagery, rhetorical figuration, etc. They can make *Quicktime*© movie excerpts from the videos of the plays and use them to illustrate their papers. (The papers will not be "papers," of course, but "texts" of a different sort.) They needn't go to the campus library to do any of this. They can access this library wherever and whenever they find time to do their academic work. All their work--papers, exams, stylistic analyses--is "published" in the electronic library. You got a "C" and feel robbed? Read some "A" papers to see what went wrong. Read some other papers, just to see what kind of work your competitors are producing. Lots of other neat things happen in such a universe. But you can fill in the blanks yourself.

Such a course--here is the vital point--now *has a history*. Students join a tradition. It is easy to imagine how quickly the internets *between* such courses would develop. We can see a pattern in the hypertextual literary curriculum developed by George Landow and his colleagues at Brown University.⁹ The isolation of the course, not only in *time*, but in *discipline*, is broken. The course *constitutes a society*, and it is a continuing one. The students become citizens of a commonwealth and act like citizens--they publish their work for their fellow scholars. The mesmeric fixation on the instructor as the only reader and grader is broken.

⁹George Landow, *Hypertext: The Convergence of Contemporary Critical Theory and Technology* (Johns Hopkins, 1992).

Now imagine another course--the independent study or "honors" course. A student in my Shakespeare course is interested in music and wonders what I mean when I keep using analogies between musical ornament and verbal ornament. When I talk about sonata form vs. theme-and-variations in a lecture on the *Sonnets*, she comes in and asks for a fuller explanation. Could she do a special study with me on this topic? Well, I'm not a musicologist. What do I do now? "Next time Prof. Winter teaches his Haydn, Mozart, and Beethoven course, you ought to take it." I'm certainly not competent to teach such a course. In a multimedia environment, I'd pursue a different route. "Sure, I'll do this course with you. We'll construct it around Winter's wonderful new multimedia programs on Beethoven's *Ninth Symphony*, Stravinsky's *Rite of Spring*, Mozart's *Dissonant String Quartet*, and Bach's *Brandenburg Concertos*. You can play them all on the equipment in the music school or the library. Using them, you can teach yourself the fundamentals of music harmony, find out all you need to know about classical sonata form, learn about what happened to music when sonata form no longer predominated, and so on. You can play these pieces' theme and motif at a time, dissect them, learn how the orchestra is constructed, what the instruments are, etc." I am, with Winter's help, perfectly competent to teach such a course. Such a procedure not only generates new kinds of disciplinary relationships; if used widely it would save money for both student and school.

Now, the classroom itself. The "electronic classrooms" in use now, at least the ones which give each student a computer, have generated some preliminary generalizations. Just as "author" and "authority" change meaning in electronic text, they change meaning in the classroom. The professor ceases to be the cynosure of every eye: some authority passes to the group constituted by the electronic network. You can of course use such a configuration for self-paced learning, but I would use it for verbal analysis. Multimedia environments allow you to anatomize what "reading" a literary text really means. This pedagogy would revolutionize how I teach Shakespeare. (Again, in suggesting how, I run up against the difficulties of discussing a broadband medium with the narrowband one of print.)

Now the textbook. Let me take another example from my backyard. Let us consider the dreariest textbook of all, the Freshman Composition Handbook. You all know them. Heavy. Shiny coated paper. Pyroxylin, peanut-butter-sandwich-proof cover. Imagine instead an online program available to everyone who teaches, and everyone who takes, the course. The apoplexy that comp handbooks always generate now finds more than marginal expression. Stupid examples are critiqued as such; better ones are found. Teachers contribute their experience on how the book works, or doesn't work, in action. The textbook, rather than fixed in an edition, is a continually changing, evolutionary document. It is fed by all the people who use it, and continually made and remade by them.

And what about the literary texts themselves? It is easy to imagine (copyright problems aside) the classic literary texts all put on a single CD-ROM, and a device to display them which the student carries with her. What we don't often remark is the manipulative power such a student now possesses. Textual searching power, obviously. But also power to reconfigure. Imagine for a moment students *brought up* on the multimedia electronic "texts" I have been discussing. They are accustomed to interacting with texts, playing games with them. Won't they want to do this with *Paradise Lost*? And what will happen if they do? Will poems written in a print-based world be compromised? Will poems which emerged from an oral world, as with so much Greek and Latin literature, be rejuvenated and re-presented in a more historically correct way? And what about the student's license to re-create as well as read? If Marcel Duchamp can moustache the *Mona Lisa*, why can't they? Once again, questions of cultural authority.

Now the "major." If electronic text threatens the present disciplinary boundaries in the humanities, it threatens the major in the same way. I don't have space to discuss this question now, but it is developed at length in *The Electronic Word*, the book from which this

paper draws its argument.¹⁰ The major is constructed, at least when it retains any disciplinary integrity, on a hierarchical and historical basis. Such means of organization and dissemination, as we have seen, do not last long in a digital domain.

Now the curriculum, or at least two words about it. First, the debate about the university curriculum has centered, in the last century, on what to do about a "core" curriculum in a fragmented and disciplinary world. Various "core curricula" have been devised and, in some times and places, taken over the first two--or even, at St. John's, all four--undergraduate years. We have, in all these programs, hearkened back to a linear course of study. For all kinds of reasons, practical and theoretical, such a pre-planned program has rarely worked. What digital networks suggest is a new core constituted hypertextually, on a nonlinear basis. None of the obstacles to the traditional core curriculum apply.

Second, the current streetfight about the undergraduate curriculum--Great Books or Politically Correct Books--ignores the probability that our "texts" won't be books at all. Both sides base their arguments on the fixity of print, and the assumptions that fixity induces in us. Thus they both, and the curricular debate they generate, depart from obsolete, indeed otiose, operating principles.

3. *Will graduate training change as graduate students become more adept at using electronic tools?*

This is the wrong question. It presumes, as do many of the questions framed for this conference, that digital communications changes our tools but not our products. In framing the proper question, and an answer to it, I'll stick again to my own backyard. The crucial question for graduate training in literature is not whether students will become skillful in online searches and database manipulations, important though that is. We should be asking rather whether the subject they study will continue to exist. I taught a graduate seminar last year called "The Death of Literature." The class took its name from Alvin Kernan's recent book,¹¹ wherein he argues that electronic communication, with some help from theory, is killing literature, at least print-based literature. The class considered three other new books that, in very different ways, debated the same proposition. I myself don't think literature will die, but clearly it will change as it moves from page to screen. Graduate programs in English ought to be considering that movement. I know of none that does. Even as we are

¹⁰See footnote 1.

¹¹Alvin Kernan, *The Death of Literature* (Yale, 1990).

conducting "literacy" campaigns based on a print-based literacy which is, as Hardison argues, disappearing up the skylight, so we are educating graduate students to read and teach literature in the same print-based way in which literature will no longer be written or read. We are indeed, to borrow Charles Horton Cooley's wonderful phrase for ossified instruction, educating "clerks of a forgotten mood."

I cannot help thinking that the same thing is happening in other fields of humanistic inquiry. It certainly seems to be so in music and the fine arts. Surely someone ought at least to be *talking about* this vital metamorphosis.

4. *Conclusion*

When we speak of the "sociology of knowledge," we ponder how knowledge is held. I think that matrix of cultural grasp which such a phrase seeks to describe, at least for the humanities, is now dominated by three convergent forces: technology, theory, and democracy. Technology--digital communications technology--we have now considered. "Theory"--by which I mean the postmodern critique, whether pursued in literary studies, art history, linguistics, or the law--lies outside our present discussion, though it informs it at every point. (I have, after all, argued that the aesthetics of electronic expression were laid out by twentieth-century visual art before the computer was invented.) What of democracy? Clearly higher education has been democratized in the United States since World War II. We need not debate that. Does electronic technology constitute an exclusionary force, as many people now argue? Certainly in some ways it does. Inner-city schools have fewer computers than Andover and Exeter. Colleges and universities vary widely in their computer resources and their dissemination. But in the long run, indeed in the short run too, I would argue, digital technology *democratizes* the arts and letters, rather than the reverse. Simply by opening discourse out from a strictly verbal base, it enfranchises not only the left-handed but the right-brained of all sorts. It will have, in my field, an extraordinary impact on what we still call "remedial" training. It opens out both artistic composition and performance to people formerly excluded from it, and it has enormously expanded the audience for artistic and learned expression of all sorts. Our discussion of the "access" question has been far too narrowly based, and far too unimaginative.

When I read down the list of the participants in this conference a few spear-carriers like me turn up, but most of you are movers, shakers, and decision-makers. How, you may well ask, does such theorizing as I have been doing affect your daily decision-making life? Here is a quick list of some decisions which, according to the arguments posed in this paper, are affected by the digitization of the humanities.

The fundamental change in operating system which the humanities are now undergoing

- affects libraries because it affects books, and in the most intimate way.
- affects, therefore, library buildings and the budgets thereof.
- affects all the issues of intellectual property.
- affects professional specializations and departmental structures, and therefore university administrative structures at all levels.
- affects "access" in all its aspects, especially in the most profound ones, access to creation and performance of humanistic works, as well as learning about them.
- affects "literacy," literacy programs, and every social impact they exert.
- affects the neural pathways of the brain, and how they are being irreversibly laid down; thus it affects whether students will be able to pursue any intellectual work which requires the higher processes of symbolic thought.
- affects a "class" and how it works.
- affects what a "classroom" is and how it works.
- affects what a "textbook" is and how it works.
- affects the undergraduate "major."
- affects what the undergraduate curriculum will become.
- affects what traditional graduate disciplines will study as well as how they will study it.

In *The Aims of Education*, Whitehead argues that higher education should always be concerned with "the insistent present."

This list constitutes a pretty insistent present, it seems to me. I've tried to sketch out a theoretical context to explain or at least contain the items on it, but there is nothing theoretical about the list itself.

So hard does the current budget crisis press upon universities that many participants will come to this conference, I suspect, like so many cancer surgeons fresh from the operating table. Cut. Cut. Cut. What does this change in the humanistic operating system have to do with all this surgery? Let me close by suggesting a connection.

When you talk about digital technology, someone will always dismiss it as "futuristic." None of the technology I have talked about is *futuristic*. It all exists now. It is the *cutting* that involves planning for the future. Why not use the occasion for some long-term planning in terms of this new operating system for the humanities we have been discussing? The planning I read about at my own institution and others like it amounts to keeping on the same way, with as few changes as possible. Review departments, drop the weak ones--but don't rethink what a department is. Ditto "programs." Review majors, drop the weak or obscure ones, but don't rethink what a "major" is. Review courses, cut out frivolous and ornamental ones, but don't rethink what a "course" is. Ditto graduate programs. Nothing new or promising can emerge from any of this fire-fighting.

The short-term approach--how do I keep on doing what I have been doing in the ways I have been doing it, but with much less money?--hasn't worked for the rest of American enterprise. Why should it work for us? It has all been done over and over in America in the last two decades, in the automobile industry, the steel industry, the railroads, the farm machinery business--the list goes on and on. Department stores are worrying about which departments to phase out while the traditional idea of a department store is drifting down the stream of mercantile history. In the academy we are prisoners of the same inert patterns of thinking that have dominated the rest of American corporate enterprise. There is nothing "futuristic" about trying to break out of these patterns; it is the most insistent present one can possibly imagine. It will be our own fault, not the fault of our funders, if we continue to imitate the Post Office and worry about moving letters around in an electronic way, when it is not only the delivery system but the "letters" themselves which have fundamentally changed.