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Interactivity, Interconnectivity and Media

Interactivity, Interconnectivity and Media

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Abstract

The opening article in the special issue, Interactivity, Interconnectivity, and Media, takes the high ground in examining the largest and most far-reaching cultural issues associated with the building and maintenance of knowledge.

challenged

The book with its long development and well understood conventions is being challenged by hypermedia with its as yet unformed conventions for use, while vested interests vie for power and control of information dissemination and storage. Traditional issues of standardization, verification and authenticity solved by the institutions of the book are reopened as issues by hypermedia. Language itself is being reexamined.

Much is at stake, as the cultural transition from paper to screen will involve all disciplines in developing new rhetorical rules, behavioral conventions and evaluation modes.

All institutions will need to prepare their constituents for a hyperactive data world.

Loss of an Empire/Gaining Another?

Dietmar Winkler

A new technology sometimes creates more than it destroys. Sometimes, it destroys more than it creates. But it is never one-sided.[1]

Umberto Eco, with great humor and charm, points to the fact that people who read their powerbooks in bathtubs are at risk of electric shock.

At the same time, in 1996, championing the traditional book and enlisting Aristotle and Kant to confront its electronic future, he piped his lecture through electronic means from Bologna, in Italy, to Bergen, Norway and from there, via satellite, to places such as Louvain, Pavia and Oxford. Slyly, he takes advantage of the modes of information transfer to reach a greater, more diverse audience with one lecture than if he had been denied this electronic advantage.

In San Francisco, Edward Tufte makes a statement on the book as the best form by which to transmit statistical information. However any electronic mapping program will locate, with pinpoint accuracy, the address of a citizen living on a dirt road in the smallest of towns anywhere in the United States — and will do so within seconds.

Who is right, who is wrong?

1
From "Informing Ourselves to Death," a speech by Neil Postman delivered to the German Informatics Society, October 11, 1990, Stuttgart, Germany.

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Visible Language 31.2
Winkler,116-125

In the last analysis, the debate over hypermedia and the traditional book boils down to the shifting power paradigm, with lively debate over the tradition for accruing and storing knowledge. The manuscript tradition has not been challenged throughout the millenia of its existence; neither have the language conventions embedded in it,

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and the complementary processes through which knowledge is stored and transferred.

There is a good chance that, as power shifts, the baton will pass back and forth until a social contract is massaged from the deliberations — through trial and error — a contract that will bind members to protocols, provide expectations for conduct and invent processes for verification or self-responsibility or trust, and the intellectual skills for synthesis, sense-making, outcome-foreshadowing and valuation.

The debate is a welcome investigation into aspects of language and knowledge that would have stayed dormant, or been overlooked, or even been taken for granted. These views can surface only because of the power confrontation between the singular history of the manuscript and tradition of the book, which got us where we are now, and the chancy impermanence of hypermedia, which might get us somewhere in the future — but then again might not.

There are two worthy groups of opponents: those who rally around the cultural tradition because their lives are profoundly bound to its values, and who fear the destruction and loss of a culture built over many epochs; and those who are deeply committed to new horizons, and do not look back at human evolution but forward to new human futures. In the middle is a very large group identifiable by shrill doomsday rhetoric or intensified techno-babble.

There is of course power in each of the extreme positions. To reject technology on the grounds that it is dehumanizing sets up a debate that Lewis Mumford would have enjoyed. He was very much on the side of those who feel that technologies are worthwhile only if they empower humans to live autonomous lives. It is quite clear that both book and hypermedia have the ability to shape autonomous individuals.

To reject the book and embrace hypermedia transforms one immediately into an adventurer, a futurist, a chance-taker. The cultural stake in risk-taking is decidedly high. Those who have followed history are justifiably cautious about revolutionary technologies, because not all inventions turned out to be the remedies they expected.

The verifiability and fidelity of material have concerned scholars of all epochs. Buffoons, plagiarists and liars have worked alongside decent, honest searchers and scholars, and one suspects that the percentage of the dishonest has remained constant. Therefore, the fear that a fraudulent, interloping concept could dilute the quality of scholarly discourse to nothingness is more likely unfounded.

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It is the discourse that is one of the few devices through which verification can occur, and the book/hypermedia debate is providing the ideal platform for language specialists, sociologists, behaviorists, technologists, designers, artists and writers. And if hypermedia is good at anything, it is the ability to bring together for discussion diverse groups of people. But, like all media, it does that for the most specific and high-minded as well as for the most inconsequential. It finds ways to gather interest groups of experts, novices, amateurs and scholars of all ages, genders and nationalities, and gives each participant a direct voice. With that ability comes the responsibility to use it, and to use it wisely.

Therefore, the debate is not about the good or evil of book or hypermedia. It is really about the power lodged in language. Of course, those who are empowered by their social strata to comprehend the language system and language rules (which in turn obligates them to defend the tradition) are immediately challenged. Being in power means having to repress any challenge. Not to do so means relinquishing territory all together or sharing it with other concepts. But, reviewing the history of media, many battles have been fought with the result that each medium has found or developed its appropriate niche and survived all prognostications. The power could not be wrested into one media arena — it had to be shared.

A rather young electronic technology is challenging the traditional control and power of the book. The institutional fear is that it will destroy language and its culture-building infra-structure. Therefore, proposals come forth to make hypermedia behave very much in the tradition of the book. But if hypermedia restricts itself and emulates the book, then it cannot escape the book's limitations and the traditional ways of organizing concepts.

It must dawn on scholars that the two-dimensional format of the book must have severely restricted the visual presentation of multi-dimensional concepts, and also hampered understanding and transmission of knowledge. Hypermedia, as it is observed now, can only be a shadow of its future potential. Using the evolution of photography as a guide, it becomes clear that hypermedia must escape the initial culturally-assigned role of following the rules of the book — as photography had to reject its first role of mimicking painting.

It will take decades before hypermedia metamorphoses into its own form of visual expression. Through history, society has been aware of the limitations of language and the yoke of its conventions. Therefore, society has always invited either artist and poet, or visionary and inventor, to circumvent the rules, allowing for and tolerating the act of transcending language limitations. It is this creative act through which hypermedia's new metaphors begin to lift the veil from knowledge, revealing and disclosing new points for understanding.

One interesting aspect about the power of language is its capacity to gain strength through rules of prohibition — what can and cannot be done, what is allowable and what is transgression. When anything is challenged, the circumstance provides for an immediate discourse; the new is brought into a process of validation based on traditional criteria. They are in many ways inappropriate, because the ideal traditional model usually has little in common with the contexts, concerns and contents of an idealized transitional or revolutionary model.

Another fact about power: to exist and function, it requires massive cultural support. The book's power stems from its total integration into the cultural and social infrastructure. This power is not a privilege that can be either preserved forever or automatically removed. Preservation or removal is facilitated by a valuation by the greater number of constituents of a civilization — consensually arrived at, people voting with their feet, gravitating toward that which seems appropriate or sensible for the times. Thus emerges the social contract that binds individuals to the web of arteries running through the whole social organism; in return, they are assured that the organism will satisfy their anticipations and expectations.

Although this is conjecture, hypermedia will not be rejected by cultures or become culturally destructive as was the case with the early Esperanto experiments. Instead, hypermedia will provide new ways to encode complexities, allow for presentations of dynamic, constantly shifting data and give scholars the opportunity to develop multidimensional models to understand complexification rather than only simplification. The change from book to hypermedia culture will be seamless, virtually unnoticeable. It will take as much time as the traditional systems of education, law, medicine or science will need to reorganize themselves to respond to the hypermedia culture. Each of the major

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disciplines will actively participate in developing the new rhetorical rules, behavioral conventions and evaluation modes. Humans adapt to any tool, no matter how awkward; the human spirit

extends beyond the limitations of body and mind. Tightrope walkers, stilt-dancers, unicyclists, hang-glider flyers, skateboarders without much thought, even of gravity, perform their feats to the amazement of all.

The battle is about product (book) or process (hypermedia), and who controls one or both. The tradition of the manuscript, its single voice, its linearity, its identifiable word craftsmanship (or lack thereof), its multiplication to assure distribution and therefore wide opportunity for verification, are being challenged — but not necessarily destroyed. There is a distinct concern about the possibility that information and knowledge will become less reliable. Meanwhile, very few have the time, ability or inclination to verify intellectual resources. Most humans are schooled to adopt a viewpoint without challenge. Questions about verifiability are serious, especially in this time of hyper-data-generation — more in one day than an expert has time to absorb.

If reliability turns out to be a problem, then the fact that it takes a good four to six years for a revolutionary idea to hit the bookshelf is most likely moot, and the whole problem must be resolved from the bottom up. One can anticipate that all institutions will make efforts to prepare their constituents for this hyperactive data world. As happens with the stock market, where decisions are based on both intuitive sensing of data and cognitive evaluation, schools will have to rethink and refocus the traditional learn-

es

ing technologies to gear them for individuals who come to synthesis through the most lucid, critical thinking.

Unlike Europe, where, for example, the introduction of CDs made tape cassettes totally unavailable, America loves to invent myths and then to live with them. That is why computers, multi-channel cable television, CDs, sit side-by-side with river gambling boats, state lotteries, psychic readers, film and rock stars and virtual puppies. What makes the United States interesting is its wholehearted embrace of the new technology without discarding any of the earlier versions. This might be a function of the aggregate, because industry can support a greater variety for its 250 million populace, keeping all forms of media intact and functioning.

The emerging interdisciplinary debate must start with the empowerment and autonomy of the individual citizen, then grow into a vision of the culture-building support system that will enable deep insight and understanding. And it will also accomodate, gently, the lighter side of human beings and especially Americans, who are inclined to entertain themselves to the extreme.

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edu ation

Abstract

Intelligibility has emerged as a persistent difficulty in interactive multimedia and hypermedia. While much discussion has focused on screen design and readability, intelligibility is a deeper problem that the hypertext literature has disregarded. Before literacy was widespread, The Art of Memory was widely used as a method for retaining information. This mnemonic method, both visual and symbolic, was used to map new information onto familiar and symbolically significant structures which provided frames for the organization and interrelations within informational clusters.

More than computer metaphor, The Art of Memory is presented to offer insight into intelligibility. It is offered as a model for the non-text based organization of multimedia presentation: one that can provide semantic contexts within which communications are intelligible.

Hypertext & The Art of Memory

Peter Storkerson & Janine Wong

Introduction

We are in an age of hypermedia. Contemporary communication is often fragmented, and comes to us collaged by its very density and its multiple media including text, sound, image and motion. Individual communication is losing its identity, and our focus is moving from the isolated work to the network. This transformation from text to hypertext is proceeding, as we increasingly rely on symbolic manipulation and recombination to construct economic and cultural life. Understanding fragmented and linked communication is more than an academic matter.

The hypermedia of contemporary communication is not quite the hypertext envisioned by its pioneers, nor the hypertext of postmodern literary criticism, in which the linearity of text is equated with the power of authorship and the break-up of the linear text is equated with the liberation of the reader. Current hypertext is multimedia, and it includes a range of communications from books to Automated Teller Machine transactions.

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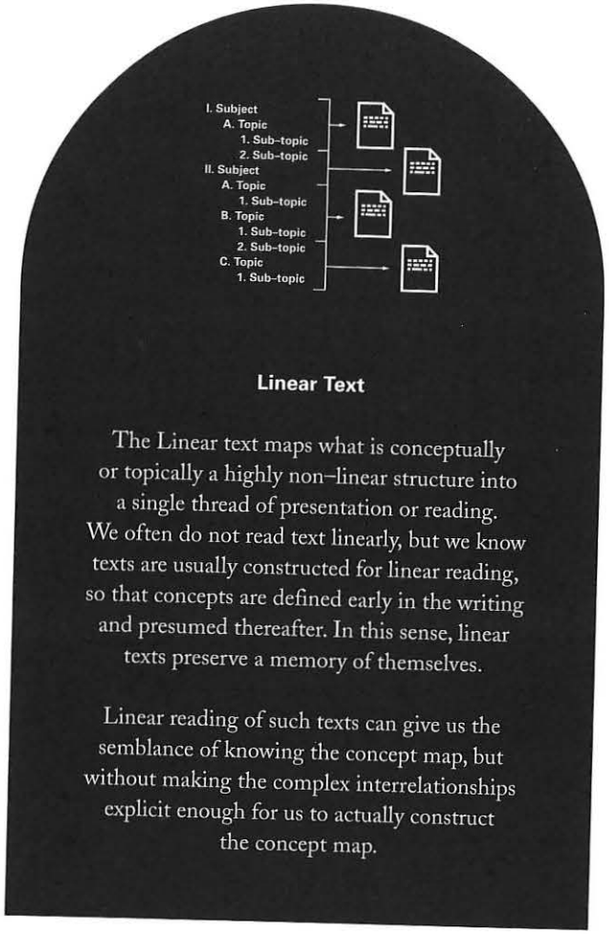
Storkerson, 126-157

Hidden underneath the litcrit discussions lie more subtle and difficult questions of intelligibility. As competent readers, we handle linear texts by taking notes, reordering and analyzing writings for our own needs. In reading current hypertext: web pages or interactive computer games and applications, our tasks also include figuring out what is notable and for what purpose we might use it. These problems are often referred to in terms of navigation and orientation (what is it? how can I get around it?).



Linear Text

The Linear text maps what is conceptually or topically a highly non-linear structure into a single thread of presentation or reading. We often do not read text linearly, but we know texts are usually constructed for linear reading, so that concepts are defined early in the writing and presumed thereafter. In this sense, linear texts preserve a memory of themselves.

Linear reading of such texts can give us the semblance of knowing the concept map, but without making the complex interrelationships explicit enough for us to actually construct the concept map.

We are literate readers: accustomed to genres which encode the reader, author and purpose of the communication into their forms; we are accustomed to the outline as our model of intelligible structure in printed texts. That sense of outline enables us to linearly traverse complex structures (we go from I.b.2. directly to II.A.1). To that model, hypertext adds the topical link-node diagram which is offered as an intelligible data structure. Current media add the situated speech of conversation, image, sequence, motion and structures of interaction. These are different and new: there are few genres that provide us with the expectations we need to navigate and orient ourselves.

The Art of Memory, a mnemonic tradition that began in ancient Greece and persisted through the Middle Ages, the Renaissance and into the seventeenth century gives us an account of how people could hold and organize thoughts, making of themselves walking books without using the written word. It may also point toward ways for developing visual and narrative models of intelligibility to apply to new media.

We are concerned with five basic points:

1. The notion of hypertext should include interactive media in general including multimedia.
2. Intelligibility is the most fundamental problem of all multimedia.
3. The computer age notion of information is a cultural construct that presents both a means and a barrier to understanding hypermedia.
4. The application of postmodern literary theory to hypertext has often involved critical confusions and is misapplied beyond hypertext based literature.
5. The Art of Memory provides us with a way to open questions of intelligibility through structure, visible form, metaphor and narrative.

Hypertext is as much a term for understanding as it is an objective phenomenon. It is perhaps the best ready-made method for considering the problems of interactive media. The history of hypertext has been shaped by theories and attitudes that are already realized in the work produced. Many characteristics of hypertext are socially constructed; the common understandings make communications intelligible. It is important to work toward constructing those common understandings. When we consider "common understandings," we know that they may not be universally held and are often distinctly not those of leading thinkers. Common understandings are often not explicitly documented; they are vague, inferred and debatable. For example, this article asserts that computer information is commonly understood to be disembodied, scientific and objective. To the contrary, Richard Coyne, in *Designing Information Technology in the Postmodern Age* asserts that "...the operative philosophy of the computer world is not logical positivism, or even analytical philosophy, but liberal pragmatism...Neither is the computer world inhuman, driven by a kind of 'techno-rationalism.'"[1] The computer world may no longer be considered scientific and authoritarian

1
Coyne, Richard. 1995. **Designing Information Technology in the Postmodern Age**. Cambridge: MIT Press, preface, XI.

by its developers, but it once was and it has been popularly thought of that way until very recently. These issues open up a number of questions. Whose beliefs shape media like hypertext? Are outmoded opinions still important? Does the malleability of beliefs make artifacts like hypermedia malleable, or will hypermedia remain fixed in some respects by the body of products produced?

While it is quite beyond this paper to discuss these possibilities, they are relevant questions. Will change be revolutionary, continuous or will the forms remain fixed? We have some historical precedents: cars, bicycles and radio electronics all show the tendency to change in ways that resemble plate tectonics, i.e., to coalesce from a period of fluidity into a fixed form which remains until stresses force a change, which results in another period of general or special quake and confusion, coalescing into another period of fixity. The modern bicycle took shape near 1880, and has changed little since. Broadcast has three major periods: am, fm and television. Cable and digital appear to be the fourth and fifth. We are certainly in a quake zone within communication, and the ability to form the next stage will be a matter of social power, and a matter of establishing a set of concepts adequate to analyze current pressures.

Within this context, it is not possible to be definitive about the proper interpretation of hypertext and its nature, but, again in the words of Richard Coyne, to "open up a space" in which questions and possibilities can be organized and discussed.

Hypertext & The Art of Memory

Hypertext & Computer Use: Data, Texts, Programs

Despite the novelty of hypertext, it comes with cultural heritage: the culture of the computer as a scientific tool, and the culture of postmodern literary criticism. Our model of hypertext comes as much from these two cultures as from any inbuilt characteristics. This is part of the hypertext problem.

The notion of hypertext arose within the context of computer communication: data-based, complexly interrelated, and fast, as we operate the machine not to produce a physical output, but to read its states as it processes. Hypertext is a natural and intuitive extension and evolution out of computer information codes – particularly ASCII – and of computer databases. From this, hypertext as a notion gets three of its major characteristics: 1) its bias toward text (letters and numbers), 2) its reuse or recombination of text and 3) navigation of text data by pointers or links.

How is text different from image? In Western culture, there is a very large literature discussing the relationships between text and image and a historical tendency to see the two as distinct and often opposing forms.[2] Within this literature, text and image are often opposed on the basis of our greater ability to parse text grammatically, and thus to pin down its meaning. Nelson Goodman in particular, has distinguished text from image by its single system coding, i.e., language, and our agreements on the meanings of words. In images, by contrast, there are often not only multiple readings, but there are not necessarily any set rules for deciding which aspects of the image are to be considered. Thus, if it is a painting, we may or may not consider the brush strokes or the

2
Sources providing detailed discussions include Mitchell, W.J. T. 1986. **Iconology**. Chicago, University of Chicago Press. Stafford, Barbara Maria. 1994. **Artful Science**. Cambridge, MIT Press. Gombrich, E.H. 1996. **The Essential Gombrich**. Phaidon. Langer, Suzanne K. 1967. **Philosophy in a New Key**. Cambridge; Harvard University Press.

texture of the canvas as relevant to the content. If that is the case, the text can be rendered by any duplication of the symbols on any sort of medium, while the only reproduction of an image is the image itself.[3]

By and large, computers operate on images without parsing them; e.g., copying them pixel by pixel, by region, etc., without hierarchy or relation beyond belonging in the set or file. (Images can be coded for example in medical data or satellite gathered images.) In contrast, within text, we presume coding. Computer languages are built using grammars of textual and numerical symbols which can be analyzed in the same way we solve mathematical formulae. Diagrams and formulae actually operate in a middle ground. Formulae look like language but operate via graphical transpositions — move a divisor across the equal sign and it becomes a multiplier. Diagrams look like pictures, but language-like rules govern their interpretation. Thus, we often see the rendering of numerical data and propositions in diagrams as literal: a diagram can be correct or incorrect, and two different looking diagrams can be identical in the information they convey. Similarly, an image can generally agree or disagree with a description: this person has two eyes. But no two different pictures can be deemed logically identical, and in general, the translation from language (e.g., story) to image is an "adaptation," or "interpretation," which is to say a translation into a different medium in which there are no precise correspondences, only certain overlaps.

What distinguishes text is not only the set data that is deemed relevant, but also that the rules for interpreting make it possible to disassemble the data, into sentences, phrases, clauses and words – with presumably discrete meanings – and then to reassemble it again. These ideal types: text as precise or "digital," and image as "analogue" are often the standards by which we form our expectations, and they establish the validity and credibility of images and texts.

Text conditions image

One interesting wrinkle is that markup languages like HTML, the language used on the internet, employ coded instructions governing appearance. These provide a computer-related approach for looking at visual effects in language-like terms, offering a possible route to building visual taxonomies.

3
See Goodman, Nelson. 1976. **Languages of Art**. Indianapolis: Hackett Pub Co. 1978. **Ways of Worldmaking**. Hackett Pub Co.

Computers add yet more layers between setting and communicative essence like screen size, rendition in greyscale or color. Creating for the computer includes designing for a variety of different output devices and readers all of which will look different to the user, but all of which are expected to present the same information to that user. The computer makes obvious what has always been true. "...the central point about electronic textuality — its fundamental distinction from the object on which it is read."[4]

4
Landow, George. 1994. **Hypertext Theory**. Baltimore: Johns Hopkins University Press, 4.

Computer information

We are more likely to think of computer text as impersonal information. The symbols computers manipulate are often machine-generated: data, shaped by programs and produced as output. Even our language biases us toward seeing computer data as objective, non-human and certainly not as human narrative. We tend to see such output as information that appears independent of author and of receiver — something discovered. Email, news groups and web pages may be reintroducing authorship and narrative, but they do so within a space of computer information that did not exist until very recently.

We can see this bias toward text, toward impersonal writing and reading environments and toward a belief in the universality of knowledge in the writings, including this essay on computer style sheets:

Since the beginning of the Web just a few short years ago, HTML designers have had to serve two audiences. On the one hand, the prime audience for web pages is, rather obviously, people. Yet the HTML language syntax is geared more towards creating machine-readable text rather than text meant to look good for readers. For example, there are HTML commands for declaring that a text chunk is a definition, an ordered list, or a table; there aren't commands for setting margins or font.[4]

Here is the search for universal knowledge: Computers and hypertext were often seen as ways of building universal objective knowledge systems. Early architects of Hypertext theory saw hypertext as providing a method for constructing a universal environment for human information use, e.g., Ted Nelson's Xanadu:

...the Xanadu system provides a universal data structure to which all other data may be mapped ... *(Nelson, 1987, 1) But*

the developers have much more in mind than a computer data structure. They see writers and readers throughout as working in the same conceptual space.[5] *[emphasis added]*

Let us stop here to ask a question "What is the relationship between data and knowledge?" We think of knowledge as being something closer to idea, or concept. How would we order such terms as data, information and knowledge, and let us add wisdom. We could order them on a line: data is stuff, information is data selected and arranged according to some principle or goal, knowledge is the principle or goal known through the information. Here, we move from the most concrete to greater levels of abstraction, into which lower levels fold. This is the process by which perception becomes cognition, and by which events are glued into larger structures. When we come to wisdom, we have lost direct touch with the most concrete levels. Thus, we have two poles: concrete and abstract which we traverse up by concept formation and back by verification. The uses of terms like information and data elide or disregard this characteristic. They beg the question of whether computers can think by presenting it as a non-question.

In the 1945 *Atlantic* article "As We May Think," Vanevar Busch was concerned with the explosive growth of research and information, and within it, our inability to process as its limitation. His solution to the information glut was greater human efficiency with the aid of the "memex."

... Consider a future device for individual use, which is a sort of mechanized private file and library. It needs a name, and to coin one at random, "memex" will do. A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility...[6]

Thus, within at least that early computer information model we see tendencies to look at text as autonomous information, and the implicit view that packets of information have an integrity like standardized components used to make novel entities rather like modular housing. By the same token, a person is a human information processor.

The human processor is machine-like, which is to say logical or rule governed, but it links information by rules of association. In his article, Busch defines "association."

The human mind does not work that way [alphabetically]. It operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain. It has other characteristics, of course; trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory. Yet the speed of action, the intricacy of trails, the detail of mental pictures, is awe-inspiring beyond all else in nature.[7]

Hypertext, then, is information organizable according to the operative rules of the human brain: a technical solution of the perceived need to increase the efficiency of the human information processor.

The term "association" has two aspects: the lack of a narrator and the problem of deriving concepts from data. Hypertext lacks the author who selects, arranges and edits the text (here the data) to build a structure of interrelated ideas or concepts, thus making it information. The crux of the problem, then is how to find or make the glue that bonds these separate texts together into larger coherent and intelligible units. In this context, Busch uses the notion of "association" which has a long history in Anglo-American philosophy. It argues that we build knowledge by associating things together. Unfortunately, when we build breadth of knowledge, we must also build depth; in order to make sense of all of the data we have collected, we need to provide a concept that orders it. This barrier has dogged association theory. By contrast, Gestalt psychologists emphasize that for us, the concept is a container for the data and often of a fundamentally different category from the data. Developmental psychologists, like L.S. Vygotsky[8] come at this problem from two different directions: that our notions of things become more differentiated, and that the ability to form ideas is not a spontaneous process at all but is socially passed from adults to children. Association theory fails to deal with these issues. Within that theory, having knowledge grows more directly out of data possession rather than concept formation.

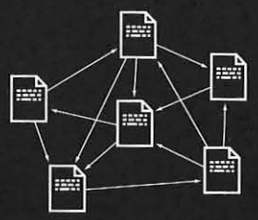
Another aspect is the distinction between observation and message reception. Within the computer, information exists both as data to be interpreted and as messages or programming. First, information is the universal stuff of which everything is made. Without information (or data), there is nothing to work on. But within computers, information has another connotation as well. Information includes all of the

5 Bolter, Jeff. 1991. **Writing Space**. Hillsdale, New Jersey: Lawrence Erlbaum, 102-103.

6 Busch, Vannevar. 1945. **As We May Think**. *The Atlantic Monthly*, July.

7 Busch, **As We May Think**.

8 L.S. Vygotsky, was a developmental psychologist active in Russia during the 1930's who first came to light in the United States through the work of a student, A.R. Luria. Vygotsky's work mirrored and opposed much of Piaget's work in child development. Vygotsky's theories, particularly of language development, and his concept of the "zone of proximal development" have become increasingly recognized within American psychology as it has turned away from behaviorism.



A Model of Hypertext

Hypertext is the non-hierarchical linking of texts navigated by the user. Often, but not always, such texts have one or two entry points, however they could be entered at any point. Once hypertexts achieve an adequate level of complexity, it is unlikely that any reader will find all of the text, and different interpretation will almost invariably result from different orders of reading. Often, each text presents a single concept or topic. Since the order of reading cannot be presumed, hypertexts have greater difficulty presenting a memory of themselves, and thus, of building a presentation through time or of providing an orientation to the whole.

messages passed back and forth to trigger all of the computer's operations. In these two respects, computer information is different from human information.

Markup languages like HTML contain text mixed with instructions on how to treat that text – instructions and data mixed. They are not alone in this. Word processor files use markup languages, and all files contain headers and other information telling where they begin and end and how to interpret them. On the computer, there is often no difference in form between instruction and data.

Within the computer, information often has no occasion, no point or time of origin or syntactic or semantic context. When we ask a friend a question, we know where we are, have an idea of what he or she knows, how the answer might relate to the larger conversation we are having, etc. This "postmark" often overshadows the information telling us whether it is truthful, ironic or a joke. Computer information often carries no such postmarks, which, as we know, is partly why it can be dangerous.

Information processing

We can draw some initial contrasts between computer information and human information processing. For us, information is most often a relationship of foreground and background. The background is what we know or presume to be true, against which something contrasts. Information is something that relates strategically to a set of expectations: it creates, confirms or refutes them. Information is semantic: data that has some significance to a story. We acquire new information against a background of experience and we process it by checking it against that background. Computers do not have such a systematic routine for accepting new information: computer data does not exist with reference to stories.

For people, information often involves the matter of inspection, interpretation and decision making. It involves shifting the conceptual frame. My friend's car in the driveway is a sure sign that he has returned from his vacation. That is a link made by me, a story I am making using evidentiary material. Thus, information belongs to the receiver. As a viewer, *I* inspect the information and *I* ask what it means to *me*. A law becomes information when I ask myself why it was enacted, and decide whether I will comply with it. If the data do not seem to cohere, it is I who must fish around for or create a new concept by which to order and glue the data.

Information also can and often does operate as message, as when I read the sign and react without conscious consideration. At the same time, if your messages can anticipate my interpretive questions and elicit a response, they can manipulate or program me. If you are able to enforce an interpretive frame, we have distorted communication of the sort Frankfurt school philosopher Jürgen Habermas addresses.[9]

9
See Habermas, Jürgen. 1987. **The Theory of Communicative Action**. Boston: Beacon Press, or 1991. **Communication and the Evolution of Society**. Cambridge: Polity Press.

Finally, unlike computer information, manmade text is produced in a particular place and time and has perceiveable markers to that place and time. Historically, it has been produced as narrative, a stream of words from speaker to hearer or writer to reader. Information is as reliable as the writer himself. This occasioning of text is characteristic of pre-computer communications, and it is being reasserted in forms like email and newsgroups.

Summary on interpretation

Computers are a particular technical and cultural formation. We have beliefs about them that condition our use of them. Within computers, programs determine the interpretive frames according to pre-planned, rule-based procedures, which are typically predetermined or closed rather than open ended. Since Hypertext emerged from computer information, Hypermedia models of communications have been very much influenced by computer ideology, toward models of information that are objectified and decontextualized.

Thus, the computer model of information when applied to humans is tendentious in three respects: 1) information as data versus as a figure–ground relationship, 2) information as programming, versus as an output of interpretation, 3) information as objective reality, versus information as narrative. Most particularly, these models fail to adequately engage the most important question: intelligibility.

In short, tendencies have converged to produce an ironically naive view of information and interpretation within hypertext theory. These include the ideology of computers as scientific: particularly in terms of the apparent clarity and objectivity of computer data, the belief in the possibility of universal knowledge, the confusion between text and work. The view of information they present is mechanical, not human. Not only have these been the views of readers; they have also been the views of the creators of hypermedia communications, and in that sense they are self-fulfilling.

Hypertext and Litcrit

If intelligibility is the primary problem within hypermedia, part of the intelligibility problem comes from the novelty of hypermedia, but an important part also comes from the understandings hypermedia producers bring to the field. This problem stems in part from analytical deficits: a bias toward text, and within that a computer-based theory of information and a tradition of literary criticism which is too narrow, too much based on traditional forms, to understand the breadth and novelty of hypermedia.

Hypertext literary theory developed as postmodern literary criticism joined software environments like "Owl" and "Story Space" in which hypertext manipulation is possible. There was considerable convenience to this marriage. Hypertext linking enables multiple texts to be joined. Postmodern theories are concerned with the ways multiple texts come together to form larger communications, and how they presume or live out larger unstated cultural forms. *"For example, like much recent work by poststructuralists, such as Roland Barthes and Jacques Derrida, hypertext reconceives conventional, long-held assumptions about authors and readers and the texts they write and read. Electronic linking, which provides one of the defining features of hypertext, also embodies Julia Kristeva's notions of intertextuality, Mikhail Bakhtin's emphasis upon multivocality, Michel Foucault's conception of networks of power, and Gilles Deleuze and Félix Guattari's ideas of rhizomatic, "nomad thought." The very idea of hypertextuality seems to have taken form at approximately the same time that poststructuralism developed...both grow out of dissatisfaction with the related phenomena of the printed book, and hierarchical thought."*[10]

10 Landow, **Hypertext Theory**, 1.

This is also, fundamentally a text, and here I mean a word-oriented tradition. Leaving aside such visual examples as Barthes' *Camera Lucida*, the deconstructions of Max Kosloff, Susan Sontag and Christian Metz, the majority of litcrit has focused on text, both as the object of study and as a mode for studying other things: in which subject matters are "texts," as in Stanley Fish's "Is There a Text in this Class?"[11]

Particularly among computer based hypertext authors, there is generally little reference to any mode other than text, and there seems to be a presumption that the methods of text can be applied to images. The hypertext authoring environment Story Space, for example, does not allow for even minimal visual manipulation of text or layout outside of the link-node mapping.

"Essentially, one must do for visual information what one already does far more easily for verbal information – store it in a central repository (database) so that one can share it among many readers by means of a network"...[12] More easily, indeed. Image taxonomy is turning out to be a very difficult proposition. Sometimes, the best method is to flash images in rapid succession and rely on visual recognition rather than an ordered taxonomy.

Given the text bias of hypertext litcrit, there is an often displayed elision or confusion that concerns text and information. It is between two meanings of the term text:

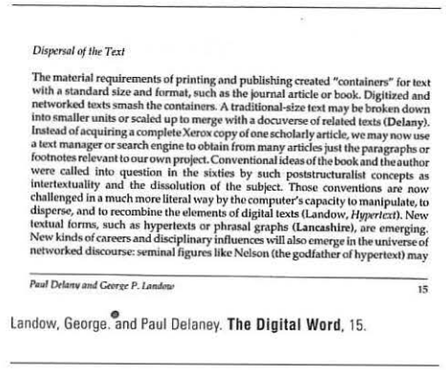
1. The text as the physical setting of words and lines
2. The text as the intelligible thing being written, the meaning or more properly content behind the empirical text setting.

Both exist and are linked together because the physical setting only exists as text insofar as it is read and interpreted, but that intelligible text is only available through the reading of the physical text. Some authors call this the distinction between the physical text, and the "work" as the thing we find in the reading. "Work" has its problems since it indicates a closed entity, yet many postmodern theorists break down the edges between texts. Often, the same word – text – is used without differentiation and this leads to confusion.

In the introduction to *The Digital Word*, Paul Delaney and George Landow describe "the dispersal of the text" through the computer's ability to disperse and recombine texts. This paragraph makes sense when the text being dispersed is what we have called the work, while the recombining and manipulation is of texts as physical settings or as "documents," the files or internet web "pages" which form the fundamental units of computer communications. Landow and Delaney are certainly aware of the distinction between text and work, but it is easy for a reader to miss. Many others write as if manipulating text documents were the same thing as manipulating the work, unless, of course, we presume that there is some larger "work" of which all texts are parts, and this is what the notion of social "intertextuality" suggests.

11
Fish, Stanley. 1980. **Is There a Text in this Class**. Cambridge: Harvard University Press.

12
Landow, **Hypertext Theory**, 11.



Dispersal of the Text

The material requirements of printing and publishing created "containers" for text with a standard size and format, such as the journal article or book. Digitized and networked texts smash the containers. A traditional-size text may be broken down into smaller units or scaled up to merge with a docuverse of related texts (Delany). Instead of acquiring a complete Xerox copy of one scholarly article, we may now use a text manager or search engine to obtain from many articles just the paragraphs or footnotes relevant to our own project. Conventional ideas of the book and the author were called into question in the sixties by such poststructuralist concepts as intertextuality and the dissolution of the subject. Those conventions are now challenged in a much more literal way by the computer's capacity to manipulate, to disperse, and to recombine the elements of digital texts (Landow, *Hypertext*). New textual forms, such as hypertexts or phrasal graphs (Lancashire), are emerging. New kinds of careers and disciplinary influences will also emerge in the universe of networked discourse: seminal figures like Nelson (the godfather of hypertext) may

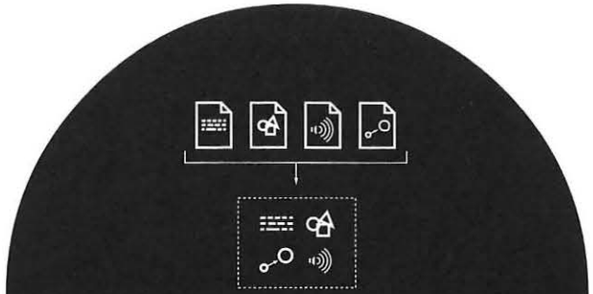
Paul Delany and George P. Landow 15

Landow, George. and Paul Delaney. **The Digital Word**, 15.

Texts stand in front of the work. We have to be able to find the work through the texts before we can manipulate it. Manipulating the texts is not the same thing as manipulating the work, and manipulating the texts before the work has been set forth often obscures it. Thus, we return to the central problem of hypertext, making it intelligible.

This confusion of text and work is an ironic error, particularly given the "fundamental distinction [of the textuality] from the object on which it is read." This conclusion comes from reading through the screen to the metaphorical piece of paper behind it, when the "work" is actually the communication which is behind that piece of paper.

To return to Stanley Fish, the book *Is There a Text in this Class*, revolves around that question in its two meanings, i.e., "Is there a textbook used?" and "Does this class have an agenda or cant?" Similarly, Fish considers experiments, intended and otherwise in which lists of names, words or other markings on blackboards are interpreted in radically different ways by different classes, e.g., as poems or lists of saints. The different interpretations Fish reports are conditioned by the different classes as "interpretive communities" based on subjects (religion, English). Fish's work stresses the multivocality of language, that it can be interpreted in many different ways. But is language infinitely interpretable? If so, why are hypermedia so often disorienting or unintelligible?



Multimedia

Text, image, sound, motion and sequence or animation are combined within a single presentation to form multimedia. Multimedia can include user interaction, as when the screen state changes in accordance with user commands.

In Fish's cases, students already possess senses of "work" which they apply to the empirical texts that they see. These are classroom blackboards seen in classes, which are well understood settings in which there are particular expectations. These expectations follow rules regarding occasion, in this case, classes. As signs in public places, they might have different meanings, though there too, we have interpretive rules which artists like Jenny Holzer exploit. Imagine yourself seeing a street sign flashing a list of names or words. What are the questions you would ask yourself as to what this meant? How would you reevaluate after each new word? Thus, how would you be searching for the interpretive rules?

Similarly, Hypertext litcrit is often concerned with revolutionizing traditional forms: novels or poems and is operating against a known print culture:

Technologies like that of book printing and the institutions coupled to it, such as literature and the university, thus constituted a historically very powerful formation, which in the Europe of the age of Goethe became the condition of possibility for literary criticism: To authoritarian and hierarchical forms, hypertext adds another

liberating one: If linear and hierarchical structures dominate current writing, the computer now adds a third, the network , as a visible and operative structure.[13]

1. A text is what you read, the words and phrases that you see before your eyes and the meanings they produce in your head.
2. A text is a message, imbued with the values and intentions of a specific writer/genre/culture.
3. A text is a fixed sequence of constituents (beginning, middle, end) that cannot change.

13 Bolter, **Writing Space**, 113.

Many theorists write of traditional literary structures not in terms of intelligibility, i.e., how stories make sense, but in terms of power. Thus, traditional book writing stresses hierarchy, author, linearity of the text and the book publishing industry. Against this backdrop, computer hypertext can liberate by destroying the individual work, the single author, by empowering the reader to reorganize and tell his own story, and by allowing for collaboration on a project. So it is argued.

What does hypertext fiction look like? It looks very much like meta-fiction. When a genre becomes well enough known, it becomes possible to write meta-works. The Rock'n Roll live album presents the old hit in a new way, often as variations on the original. Hypertext fiction is about the problem of its own reading.

Hypertext functions by the displacement or inflection of normal reading; readers already possess a sense of how the root novel should work, so they look for it, just as listeners bring their knowledge of the recorded songs to rock concerts.

What happens when a problematic story structure is presented in hypertext?

In fiction the story determines and hides behind the plot, which produces the action, whereas in cybertext, the plot itself is hidden, and so the discursive causality is reversed: action determines (or searches in vain for) the plot, which if found does not produce anything interesting, only (barely) closure.[14]

Here, the distinction between the text and the work shows itself. Hypertext theory writes of hypertext fiction as a rearrangement of the text to alter the work (given that we already have a good idea of how we think the work is structured, an idea that comes from a four hundred year history of traditional novels). We are students in Stanley Fish's class.

14 Aarseth, Espin. *Nonlinearity and Literary Form*. In Landow, **Hypertext Theory**, 74.

But what if we do not already know or think we know the song, or even what a rock and roll song is, i.e., if we do not have a conception of the genre being inflected? How, then, can we get to the work if we don't have the empirical text in its totality and order? In hypertext novels, it is not the intelligible work that is being manipulated, but the physical text on the page through which we read it. Do we imagine that the manipulation of the text in one way will result in a parallel manipulation of the work?

Our experience with hypermedia seems to indicate that without a pre-defined conception of the work, e.g., the plot line of a story, we may have little hope of making sense out of hyper-recombinance. This is a particular problem when we attempt to use hypertext to build a new form.

Summary:

Litcrit, and computer information

The interest here is not in a general criticism or debunking of postmodern literary theory. Hypertext litcrit is criticized to argue that it is best applied to established genres like fiction, and not necessarily applicable to emerging genres or to hypermedia as a whole. Unfortunately, the preponderance of hypermedia theory has been developed according to this model. Like the computer-based information model, it is partial. Both models presume the intelligibility that needs to be constructed. In order to explicate the limitations posed by the way both of these approaches are based solely on text will require a fuller discussion of the history of image use.

Visual Models: The Art of Memory

There are models other than computer information and literary criticism in hypermedia production. These include the use of metaphors to create a sense of the whole, e.g., stage and dramatic metaphors. Kevin Lynch's model of urban structure including its paths, nodes, edges, sections, landmarks and various architectural metaphors can operate to present us with images of the structure of the information. In addition, graphic designers have tried to apply principles of iconography, page layout, color theory and graphic organization. In fact, the use of the notion of metaphor is common in computer parlance, though what we see is usually simile (looks like) rather than metaphor (acts like).

Approaches from the arts have broadened the conception of hypertext, introducing vision, sound, sequence and motion creating hypermedia for a much larger audience. But without a common theory or base, the use of multiple media is often eclectic and ad hoc. The available techniques have often not been adequate to address the intelligibility issue: the ability to see the presentation as a whole and to see its relationship to the outside world.

The problem of seeing and retaining complex information is older than print. The ancients did not rely on print in the way that we do. Rather, they had to memorize or retain information, not just principles but often long narratives, which had to be delivered accurately, on demand, over periods of years. The principle ancient mnemonic device was called "The Art of Memory." The Art of Memory was essentially metaphorical or analogic, and visual rather than textual. It provided a system of memorization using a set of principles

quite distinct from what we know as rote memorization. While much that has been written on it has focused on its use and power, the emphasis here is on a theory of memorability based on intelligibility through visual structures as concept maps. We can examine The Art of Memory for aids in developing modern hypermedia. It gives us insight into the structure of what Vanevar Busch called "association." It also provides systematic ways of talking about intelligibility in multimedia. It relates to visualization, it is very much concerned with the acquisition of new knowledge, it plays upon methods that we use informally, and it is a tradition that survives today.

But before we proceed, one warning is in order. The Art of Memory is a mnemonic tradition with roots in archaic Greek civilization. It seems to have been handed down orally. As a result, the source texts are fragmentary. Some were lost, and those that remain seem likely to have been written for people who were expected to already know the basic methods. They do not seem to have had a theory of The Art of Memory. Instead they had rules governing practise given in figurative language and we will have to grope for theoretical bases that would satisfy us. Studying these texts leaves us with the distinct impression that in these non-modern cultures, visualization was in itself an important method of theory building. It may have been more important than text.

What is The Art of Memory

The artificial memory is established from places and images … the stock definition to be forever repeated down the ages. A locus is a place easily grasped by the memory, such as a house, an intercolumnar space, a corner, an arch or the like. Images are forms, marks or simulacra [formae, notue, simulacra] of what we wish to remember. For instance if we wish to recall the genus of a horse, of a lion, of an eagle, we must place their images on definite loci.

The art of memory is like an inner writing. Those who know the letters of the alphabet can write down what is dictated to them and read out what they have written. Likewise those who have learned mnemonics can set in place what they have heard and deliver it from memory. 'For the places are very much like wax tablets or papyrus, the images like the letters, the arrangement and disposition of the images like the script, and the delivery is like the reading.'

If we wish to remember much material we must equip ourselves with a large number of places. It is essential that the places form a series and be remembered in their order, so that we can start from any locus in the series and move either backwards or forwards from it. If we see a number of our acquaintances standing in a row, it makes no difference to us whether we tell their names beginning with the person standing at the head of the line, the foot or in the middle. So with memory loci. 'If these have been arranged in order, the result will be that, reminded by the images, we can repeat orally what we have committed to the loci, proceeding in either direction from any locus we please.'[15]

So quotes Francis Yates from one of the classical texts in which The Art of Memory was discussed. The methods were often architectural, utilizing a building or space as a template within which memories could be stored. Memories can be constructed for words or things: things being what is to be remembered, and words being the precise set of words to be used in presenting them. One would be mastery of the subject, while the other would allow reliable presentation of a speech. Clearly, it is most desirable to have both.

Both architectural locations and images used for memory have specifications in terms of appropriateness. *'Memory loci should not be too much like one another, for instance too many intercolumnar spaces are not good, for their resemblance to one another will be confusing. They should be of moderate size, not too large, for this renders images placed on them vague, and not too small…not too brightly lighted…nor too dark…'*[16] In short, the spaces should be such as would be conducive to viewing.

Images are a different mater. This discussion follows a series of questions regarding why some images are so sharp while others are so vague that they hardly stimulate memory at all? Images that are striking, active, clear, beautiful or ugly are memorable.

One example goes considerably beyond these very general descriptions.

The first is an example of a 'memory for things' image. We have to suppose that we are the counsel for the defense in a law suit. 'The prosecutor has said that the defendant killed a man by poison, has charged that the motive of the crime was to gain an inheritance, and declared that there are many witnesses and accessories to this act.' We are forming a memory system about the whole case and we

15
Yates, Francis. 1994. **The Art of Memory**. London: Trafalgar Square, 6.

16
Yates, **The Art of Memory**, 7.

shall wish to put in our first memory locus an image to remind us of the accusation against our client. This is the image.

We shall imagine the man in question as lying ill in bed, if we know him personally. If we do not know him, we shall yet take some one to be our invalid, but not a man of the lowest class, so that he may come to mind at once. And we shall place the defendant at the bedside, holding in his right hand a cup, in his left, tablets, and on the fourth finger, a ram's testicles. In this way we can have in memory the man who was poisoned, the witnesses, and the inheritance.

The cup would remind of the poisoning, the tablets of the will or the inheritance, and the testicles of the ram through verbal similarity with testes of the witnesses. The sick man is to be like the man himself, or like someone else whom we know (though not one of the anonymous lower classes). In the following loci we would put other counts in the charge, or the details of the rest of the case, and if we have properly imprinted the places and images we shall easily be able to remember any point that we wish to recall.[17]

Taken as a representative of images that are vivid and memorable, we see the following characteristics:

Analogy: the structural relations in the image can be transferred to the situation.

Mapability: the constituents of the image can be mapped onto individual constituents of the situation.

Coherence: the image has a unity of order that can be used to interpret the situation.

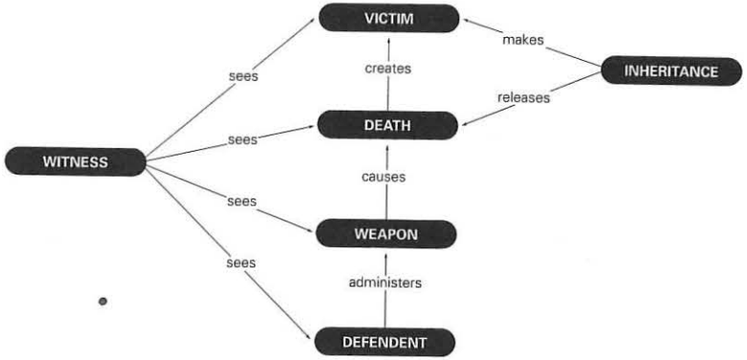
Significance: the image projects a significance or content which can be transferred to the situation.

Rhetoric: in sum, the image constructs the situation according to its template, enabling us to see the empirical situation as a mirror of a created one.

Thus, we have something considerably greater than any apparently arbitrary mnemonic device. The image presents a rhetorical frame for the interpretation of the events which makes an intelligible theory of the case. But that frame does not function in the literal sense. Rather, it is a concept structure that both the image and the situation can be used to invoke. It arranges poisoning, inheritance, victimization, knowledge. In the image we have materials of a concept map. Here is one way of drawing a concept map: a link node diagram with the links marked. It provides us with a map of the configuration and connections of the entities in such a way

17
Yates, **The Art of Memory**, 11.

that we can imagine various points of view from which to look at it. The links also indicate change over time, pointing at the dynamic or narrative aspects. This concept map can be applied to both the image and the events in the case, providing a common meaning or theory for both. The theory arranges and selects the details to be included, giving each a meaning. The



empirical details are concrete objects that we use for interpretation. Here mnemonics and interpretation are closely linked in the unity of an image with its sense of structure, and its potential narrative. The image provides the concept map and provides specific positions or "mappings" for all of the significant facts of the case. Thus, the image functions allegorically and diagrammatically, summarizing that allegory in a single image which simultaneously carries the essential elements in a physical configuration that suggests a narrative of events in the case.

We notice also that some of the signs are natural, i.e., the sick man as evidence of harm being done and poison as the potential for doing harm, while others are learned symbols — the ram's testicles to signify witnesses. The concrete aspects of the image link concepts to the world of experience, while the concepts make the world of experience intelligible. But, as viewers we must interpret the image by examining it for its possible meanings.

Image and word in the pre-modern world

Certainly, the written word is at a disadvantage in essentially oral cultures. Ivan Illich documents that in the twelfth century, reading was a visceral, physical action, in which words were read aloud with expressive intonation.

In a tradition of one and a half millennia, the sounding are echoed by the resonance of the moving lips and tongue. The reader's ears pay attention, and strain to catch what the reader's mouth gives forth. In this manner the sequence of letters translates directly into body movements and patterns of nerve impulses. The lines are a sound track picked up by the mouth and voiced by the reader for his own ear. By reading, the page is literally embodied, incorporated.

The modern reader conceives of the page as a plate that inks the mind, and of the mind as a screen onto which the page is projected and from which, at a flip, it can fade. For the monastic reader, … reading is a much less phantasmagoric and much more carnal activity: the reader understands the lines by moving to their beat, remembers them by recapturing their rhythm, and thinks of them in terms of putting them into his mouth and chewing. No wonder that pre-university monasteries are described to us in various sources as the dwelling places of mumblers and munchers.[18]

This view sees writing as a path to reading, and reading as a method of recreating oral discourse. The cognitive setting remains discourse as an activity: physical speaking.

18
Illich, Ivan. **The Vineyard of the Text**, 54

It is easy for us to misinterpret mnemonics like the art of memory and attribute its use simply to illiteracy. For the ancient Greeks and Romans, spoken narrative was a dominant method of transmission. Not only was it required for transmission, it was the method by which students retained works. Their goal was not only to repeat them, but to be able to recall their sections in different orders. In short, they needed to be able to grasp texts entirely in memory. This was not just a matter of study, but played an integral role in rhetoric, the face-to-face public presentation and argumentation by which political and legal questions were settled and by which ceremonies were played out. All of this is true, but it neglects what is perhaps most telling: what enabled the art of memory to work and to work well.

Francis Yates provides accounts of the mnemonic feats of the classical period:

We think of memory feats which are recorded of the ancients, of how the elder Seneca, a teacher of rhetoric, could repeat two thousand names in the order in which they had been given; and when a class of two hundred students or more spoke each in turn a line of poetry, he could recite all the lines in reverse order, beginning from the last one said and going right back to the first.[19]

19
Yates, **The Art of Memory**, 31.

This in itself seems to us mindless, it fails to distinguish between grasping in totality and parroting rote. But, the role of memorization in antiquity reflects some underlying characteristics which we can observe. Cicero's *De Oratore*, book III will suffice. Cicero's writings on rhetoric, speaking effectively and convincingly, belongs to a Greek tradition. He is one of a handful of authors who serve as authorities on rhetoric through the middle ages. *De Oratore* is organized as an inquiry and didact between Cicero and his son. Here is an early exchange on the nature of evidence:

C. JUN. *What is an argument?*

C. SEN. *A plausible device to obtain belief.*

C. JUN. *How then do you distinguish between the two kinds of arguments you speak of?*

C. SEN. *Arguments thought of without using a system I term arguments from outside, for instance the evidence of witnesses.*

C. JUN. *What do you mean by internal arguments?*

C. SEN. *Those inherent in the actual facts of the case.*

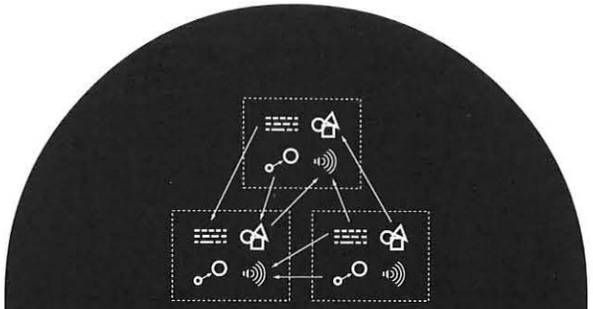
C. JUN. *What kinds of evidence are there?*

C. SEN. *Divine and human. Divine evidence is for instance oracles, auspices, prophecies, the answers of priests and augurs and diviners; human evidence is what is viewed in the light of authority and inclination and things said either freely or under compulsion — the evidence that includes written documents, pledges, promises, statements made on oath or under examination.*

C. JUN. *What do you mean by internal arguments?*

C. SEN. *Those that are inherent in the facts themselves, [sometimes derived from the whole, sometimes from parts, sometimes from their designation, sometimes from things in some way related to the point under investigation and to the whole of the subject under discussion; sometimes definition is employed, sometimes enumeration of the parts, sometimes etymology…*

While this is a methodical description, it lacks a sense of system or hierarchy. We see an undifferentiated pile or list. There may be containers: authority, empirical fact and



Hypermedia

Hypermedia is the combination of multimedia presentation and hypertext navigation. The challenge is in the selection among media for different aspects of the communication, and the use of the expanded set of tools to provide for the orientation that hypertext alone lacks.

necessity, opposition and similarity, but one does not have a sense that these are clearly ordered by a larger discourse that defines the relations between them. For instance, do we know if this is an exhaustive set? Without a theoretical structure, we cannot know. Authorities rather than logic define the set.

Within the writings of antiquity, systematization is sometimes if not often at issue. We would need an underlying set of concepts to bring the concepts under discussion under a common organizing principle. Once we know such a principle, we do not need to memorize the concepts we are discussing, because they are implied by the theory.

Within this tradition, the notion of image, on the other hand, has a fundamentally theoretical cast. Aristotle approached the problem of image in this way:
Aristotle's theory of memory and reminiscence is based on the theory of knowledge which he expounds in his De anima. The perceptions brought in by the five senses are first treated or worked upon by the faculty of imagination, and it is the images so formed which became the material of the intellectual faculty. Imagination is the interme-

diary between perception and thought. Thus while all knowledge is ultimately derived from sense impressions it is not on these in the raw that thought works but after they have been treated by, or absorbed into, the imaginative faculty. It is the image making part of the soul which makes the work of the higher processes of thought possible. Hence 'the soul never thinks without a mental picture,' 'the thinking faculty thinks of its forms in mental pictures,' no one could ever learn or understand anything, if he had not the faculty of perception; even when he thinks speculatively, he must have some mental picture with which to think.[20]

20
Yate, **The Art of Memory**, 32.

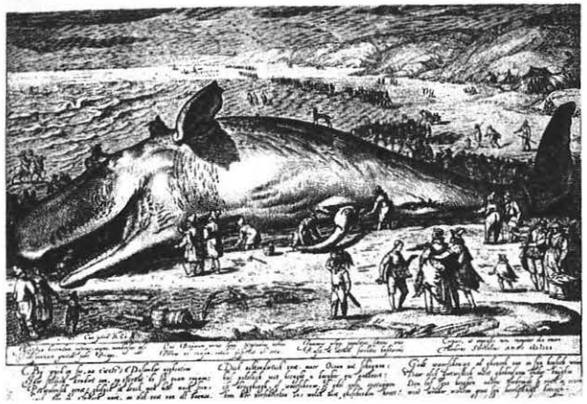
The notion of image or mental picture here is very much like our notion of theory: it brings together the various things we are looking at in a clear set of relations and that is its key to memory and to thinking. In our time, we would say that by bringing a set of facts or concepts under a single theory we can determine their extent, how they are related to each other and with a new concept we can relate them to other things in the world. The Art of Memory provides intelligible structure by its semantic and diagrammatic visualization.

One obvious but perhaps confusing difference between modern thought and what we see in the art of memory comes out of different cultural beliefs about the sources of knowledge. Our sense is often that we build new theories or ideas out of the facts that we collect. If we are asked what a computer is, we of beginning by examining it. But this belief is always borne out in practice. Our understandings of computers, for example, are shaped by myriad metaphors, or models defined elsewhere that we apply in order to interpret. Similarly, words grow by developing new figurative uses by which we understand new situations through comparisons with older ones: "I *dropped* the board." "I *dropped* the class."

Nevertheless, the notion of ordering in premodern texts has less the sense of organic internal relation than it does for us, and very often the sense of the order strikes us as being imposed from the outside, as well as being visual. The sources of knowledge in these texts are more often based on speculation and authority than on experiment: the ancient world is static, and it is one dealt with on the basis of limited knowledge. There is, thus, a tendency to build down structures of signification from that which is constant and believed to be essential, particularly religion, astronomy, metaphysics and

...nose structures as interpretive tools.
...mentary tendency to see the concrete
...nd the essential one through it. This ten-
...culiar to Greece and to Rome. Within the
...dition this tendency shifts in a number of stages.
...k of Jacob Matham shows us the cusp between the
...e world as interpretation and as observation.

The inscription suppresses the conventional hyperbolic formulas used by Screvelius. It designates the animal a sperm whale, rather than the more common monstrum. Van Mander's subtext is an attack on publications such as a booklet on the whale stranded at Berkheij in1598, that take the whale for a portent demanding interpretation. In conjunction



Jacob Matham, The Whale stranded at Wijk aan see. In Küchler, Suzanne and Walter Mellion. **Images of Memory**. Smithsonian, 1991.

with Van Mander's views, Matham's prints illustrate the dual possibility of pictorial description and neutral beholding. The Beached Whales of 1598 and 1601 alert us to the distinction between observation and interpretation; they apply Golzius' burin-hand in order to enrich description, making enhanced appeal to the beholder's receptiveness to visual information. Their polemical purpose is the stripping away of what we might call the hermeneutic impulse, which they supplant with an epistemological one. The substitution of wonder at God's artifice for the anxiety to divine his intents.[21]

21
Kücher, Suzanne and Walter Mellion. 1991. **Images of Memory**. Washington D.C.: Smithsonian, 21.

If we filter out those cultural aspects of the ancient and medieval world, we can recognize a contemporary counterpart to the mapping of the Art of Memory in graphic design. Like the art of memory, graphic design is often diagrammatic, mnemonic, semantic and rhetorical. Visual design as we know it uses a variety of rhetorical devices to contextualize, organize and symbolize, creating the potential for visual conceptual structures. It makes reference to concepts through the juxtaposition of concrete entities. When we look at graphic design in this way, it bears a closer resemblance to the mnemonic and interpretive images of the ancient and middle ages than it does to the art that comes later. Unfortunately, much design, particularly on the web, shows little if any conception of that diagrammatic function, opting solely for the expressive.

The utilization of diagrammatic structures

To summarize, one aspect of the Art of Memory is the use of external structures to systematize material. These structures may seem unrelated and arbitrary to us, and they may seem overly tied to authoritarian or rote systems of knowledge, but once understood, it is clear that they perform familiar and contemporary functions: 1)to provide concept mappings of the varied items under inspection, and to transform them from a collection into an interrelated system, 2) to give that system a unity or identity so that it can be discussed both by analysis, and with reference to other systems or objects, 3) to provide for the significance of that system in a larger scheme of things, 4) finally, by presenting images, ideas are given unity in a clear and concrete tangible existence. These four aspects support the more general approach of creating memorabilty through intelligibility.

Application

According to Walter Mellion and Suzanne Küchler:

What has yet to be attempted is an account binding mnemonic functions to processes of representation. While Yates refrains from asking what is involved in the translation from mental images to pictures artificed by the hand, Bartlett and other cognitive psychologists leave ambiguous the place of images in the formation of the schemata that organize memory.[22]

22
Küchler, **Images of Memory**, 4.

Part of the goal here has been a linkage between visual form and concept. It is not by any means a definition of intelligibility as a whole which refers to the total setting of a piece of information or a communication including the social setting or exchange in which a communication takes place, its relationship to the sender, to the receiver, and to the activity in which it participates, or to larger social and cultural issues. It can be a non sequitur on any or all of these levels.

The user's sense of intelligibility in terms of navigation and orientation with which we began is really a diagnostic used when we cannot understand what is in front of us. At the same time, our orientational sense of size and structure, and our understandings of navigational strategies need only have an oblique relationship to the "actual" structures behind the screen; we drive confidently when we think we know where we are going, even if we are surprised to find out where we go. The Art of Memory demonstrates our need for conceptual/material identities by which we can order our experiences, even if those identities are arbitrary, and it demonstrates the ability of visual media to encapsulate conceptual identities and the interrelations that comprise them.

Within existing forms, our need for orientation is reduced because we bring the mental images and expectations that make navigation and orientation possible. Both as readers and as creators, we know what novels, essays, newspaper articles and advertisements are: we know how to indicate orientation and navigation and how to read them.

The Art of Memory, provides us with a different perspective on visual tools and some of the goals for intelligibility within new forms. Critical issues include: presenting the whole as a concept or identity, disclosing structure as an interrelation of parts, making the links visible, disclosing the qualities of the links, indicating hierarchy.

Within pre-existing forms, the relations between visible signs and their significances are clear while in new situations they will not be: for example, page numbers that make sense in books, but seem inexplicably useless in computerized books. Thus, sign and symbol systems that worked in old forms will not necessarily work in new ones, not so much because of inherent differences of media as due to the lack of symbolic culture.

Most important, it indicates that visualization is more than a matter of decoration, and that it is important to understand visualization and particularly visual rhetoric as integral to communication content. Unfortunately, much of the research and writing devoted to interpretation is medium specific (literature studies about texts, deconstruction of images). False dichotomies are often drawn separating the media. Mixed media are not new, but in the new computer environment mixed media are becoming the rule. The Art of Memory indicates that visualization need not be looked at as something external or less important than text or words.

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How do you provide a legitimate educational experience outside the space and time constraints of the traditonal classroom? The book is one obvious answer. So is a traditional correspondence course. More recently interactive television has become a mainstay for many campuses attempting to deliver distance learning. Now we have the Internet.

This article will explore how this latest medium is the same as — and differs from — past methods. It will draw on the experiences of the author and colleagues in developing and teaching in UMass Dartmouth's unique "CyberEd" program which has used the Internet — primarily the World Wide Web and email — to deliver a wide range of course materials in an interactive format that encourages student/student and student/faculty exchanges both asynchronously and synchronously. This article briefly delineates the philosophical foundations of this program; the attempts to implement those foundation principles within the constraints of current Internet technology; anecdotal examples gleaned from the preparation and presentation of course materials and some conclusions that can be inferred from these experiences.

Abstract

Exploring the Special Communications Experiences of Online Education

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Visible Language 31:2
Stone, 158-181

Introduction

CyberEd began at the University of Massachusetts Dartmouth because Robert Waxler, the Dean of Continuing Education, asked if we could use the Internet to deliver a course. The most critical point in answering that question came right at the outset when Professor Richard Upchurch changed our focus from technology use to educational goals.

Our basic goal boils down to providing access to a viable educational experience for persons whose professional and personal lives make it impossible — or highly inconvenient — to pursue a university education that follows a traditional classroom schedule.

The initial focus on this and a related subset of pedagogical goals set the base that we repeatedly return to as we continue to explore the delivery of classes over the Internet to students all over the world. It helped us avoid the pitfall of being dazzled by the new technology and trying to bend our needs to fit its limitations. Obviously you must do this to some degree, but it's a matter of focus and emphasis, and for us the focus has been on the education/communications goals.

We now have three semesters of experience behind us and have offered twenty-three classes in subjects as diverse as writing, music, design, personal finance, history, statistics, political science and astronomy.

While the subjects have been diverse, the philosophical base has remained constant and the communications problems are all the same, at least in their gross features. From these experiences we have learned to identify and cope with the communication challenge of this new medium. What we've learned is broadly applicable to a wide spectrum of instructional modes ranging from supplementing the traditional class with asynchronous communications or Internet resource exploration, to hybrid models combining CyberEd with other instructional modalities. In this article I explore what those

problems are, how we have attempted to solve them using existing Internet technology and what we have learned in that experience.

Let me say at the outset that these are primarily communication problems and most of them focus on using the written word in place of the spoken word. But the written word takes on a different form on the computer screen than on the familiar printed page, and instructional issues take on new dimensions in a medium that now more closely resembles a global brain than it does Marshall McLuhan's famous "global village."

Our educational goals are hardly unique. They are the same ones you will find in many traditional classrooms today. We want to encourage:

1 active (as opposed to passive) learning
2 student/faculty interaction on an apprentice/master footing
3 student exploration of diverse resources and viewpoints
4 student/student interaction to enhance explorative learning

Nearly all our courses are credit courses at either the undergraduate or graduate level, and nearly all are taught by the same faculty who teach the same course in the traditional on-campus classoom. Since this is an operational program with students who are paying for these courses just as they would any other, the first goal has been to deliver the instructional material effectively — not to prove that everything can (or should) be done over the Internet. So in some courses conventional media, such as textbooks, have been employed.

Developing CyberEd has been a collaborative experience. The pedagogical and technical foundations were established during 1994-95 by Professor Upchurch in using the Web in his on-campus computer classes. Other faculty involved have contributed their ideas as the system evolved. Al Deluca, a professsional writing graduate student, has helped greatly, assisting faculty and bridging the gap between educational goals and the new technology. John Brayton, an undergraduate student in computer science, has had the responsibility of keeping all the required software and hardware running.

For the purpose of this article, however, I believe it would be best to focus on the "Web Craft" course I developed and teach. Although it is a non-credit course, it has served as a testbed for developing a standard template and methodology that is now being applied to new courses for the

fall '96 semester. It works well as a testbed because the body of information to be conveyed ranges from objective coding of documents, to more subjective design issues, to a broadly subjective view of the long-range impact of this new medium.

The course grew out of a credit course on Web design offered in the fall semester of 1995 and team taught with Professor Upchurch (Computer and Information Sciences) and Professor Dietmar Winkler (Design). I brought to this team the skills and perspective of a professional writer. While the non-credit course focuses first on the learning of HTML, the mark-up language used to create documents for distribution and viewing on the World Wide Web, Web Craft incorporates many of the broader features of the earlier full credit course. Since this body of knowledge is compacted into seven weeks, students who complete the course successfully report that they spend at least ten to twelve hours a week on it.

The short course length and its obvious appeal to an Internet-based audience has meant there have always been plenty of students, and so I was able to offer the course four times over the past six months, revising both content and methodology each time. Class size has been larger than what we consider ideal for a CyberEd course, but because I was able (in fact, eager) to devote extra time to the course, I don't believe the large class size was a handicap. I put in time commensurate with teaching two smaller classes, although for what I believe are sound instructional reasons I left the actual class large. Enrollments have been in the twenty-five to fifty range and there have been some unexpected benefits to these larger numbers that suggest some strategies that might be applied to other classes. From a faculty-load standpoint, however, I would expect the average CyberEd class to be between ten and twenty students if meaningful faculty/student interaction is to take place.

This last point is important. Many people assume — and some institutions are going this route — that classes taught over the Internet can involve hundreds of students and one faculty member. This is not the basic thrust of CyberEd. We believe faculty/student interaction needs to remain high for effective education and that means class sizes need to remain low.

The communications challenge

One of the most difficult things about this new medium is to come up with genuinely new ways of applying its unique strengths. Some people may be able to do this with intuitive leaps. My own approach has been to start with the familiar, identify the key communications/education goals associated with it, then look for a way to accomplish those goals while solving our two basic problems relating to access:

1 How do we communicate with students who may be on the other side of the planet?
2 How do we create a shared class experience when students are all "going to class" at different times?

Once we have examined an element of the traditional learning experience we try to stay focused on the fundamental goals advanced by that particular activity. At the same time we try to avoid making the CyberEd experience slavishly mirror the familiar medium. That type of an approach is common when one technology replaces another, but it can lead to grotesque, almost comical situations, akin to using a horse to pull an automobile. The CyberEd experience is not the same as the experience of the traditional classroom. It cannot be, nor need it be. It can be equal to or better than the traditional methods in terms of delivering a valid learning experience.

That said, let's look at the Internet tools employed in the Web Craft course and see how they relate to traditional media, keeping in mind the underlying educational goals.

The lecture

The lecture is the most pervasive medium employed in academe today and in many cases it hasn't changed despite all the advances in communications technology during the past one hundred and fifty years. The face-to-face lecture allows the instructor to deliver timely core information content to the class providing emphasis and perspective. The communications dynamics in delivering the content this way include voice tone and volume, facial expression, the instructor's appearance and body language. More important is a bond that the instructor can develop with the class while interacting with individuals and the group. Feedback in the face-to-face environment is instantaneous (assuming the instructor is alert and sensitive to it) and so the lecture is a flexible tool which can be adapted on-the-fly to meet the needs of the moment.

Can you duplicate this experience in cyberspace? Absolutely not. Some would argue that with two-way, interactive television you could. I don't think that's true at all. Such televised lectures are only a crude approximation of the communications that takes place in the face-to-face environment. But more importantly, they are not one of the choices we have in CyberEd because they do not solve either of our major problems of space and time. This is because the two-way, televised lecture depends upon students all being in class at the same time. While it can span great distances, it really is only financially practical for linking two or more classrooms. Each classroom must be properly equipped at a cost of about $60,000 with dedicated transmission lines adding a significant usage cost. Students must be in attendance all at the same time for this delivery system to be effective.

CyberEd, on the other hand, is designed to increase access by going directly into an individual's home or office and using the same equipment (a personal computer and modem) and the same access (an ordinary telephone line connected to the Internet) that are being used by these individuals to solve an incredible number of increasingly diverse communications problems. Among other things, this means CyberEd students are usually physically alone when they "attend class." Part of our challenge is to take that essentially singular experience and turn it into a virtual experience where they share with others in the class.

So what is the CyberEd counterpart of a lecture? To lecture in CyberEd means to place a prepared body of information on the Web for students to access at their convenience. Although the technology will support limited multimedia use, this CyberEd lecture is nearly always just text and still images. I found that preparing such information for Web Craft was very similar to writing a small book. However, there were several significant differences that moved the activity for both the instructor and students in the direction of feeling more like a lecture than a book. Advantages of the traditional lecture that can be captured completely in this medium are that it too allows the instructor to deliver timely core information content to the class providing emphasis and perspective. The traditional lecture allows the instructor, most likely working from notes that have been used for years, to adjust the content at the last moment to bring in the latest

knowledge in a field. The CyberEd lecture is just as flexible.

I printed a copy of Bush's article which enabled me to sit in the Lazy-Boy recliner to read it as well as take it with me to read when I encountered down-time between meetings. Highlighting is a personal favorite way of taking notes as I like color and vividness. I also paraphrase in the margins.
I live at home — my computer lives at work. So I usually print (I fax and that stuff is expensive!) out small stuff and take it home but the big stuff I read on-screen.

While my Web Craft lectures used in the fourth class are fundamentally the same ones used in the first, I update them continuously. Publishing on the Web is not like publishing a book where it is usually only practical to make updates on an annual basis. The nearly instant revision possibilities, interlaced with the ability of students to ask questions, are what make this activity resemble the live lecture. It works like this.

My "lectures" are posted for students viewing each Tuesday morning at 8 am and students are given a week to interact with this material. They may do that in the same hour the material is posted, or any time during the course of the week, or for that matter, during the rest of the class. I review and revise the material the weekend before it is posted and sometimes these revisions take place just minutes before my 8 am "start of class" deadline.

But the process doesn't end there. The instructor delivering a traditional lecture may notice that the students are puzzled by the material. Observing this, the instructor may, on the spur of the moment, revise the lecture explaining the puzzling material from a different perspective using different examples. In CyberEd you have a similar opportunity over the course of the week. At the top and bottom of every Web "lecture" page is a hypertext link labeled "questions." When students click on this link, they are presented with a form that allows them to identify themselves and write their question. They simply click on the word "send" and the question is sent by email to the instructor.

This can take place in the space of minutes, but of course the instructor is not monitoring his or her computer twenty-four hours a day waiting for such questions. I do check my email daily and usually more frequently. I try to reply to such questions within two days at most. When I reply, I usually send the question and my answer to the entire class. This is done through an email list where a single message addressed to a single entity (in this case the address is simply "wc" for Web Craft) goes to everyone enrolled.

Since the original material is on the Web, why not reply on the Web and post your answer there? The reason

is simple. If you do so the students would never know about the question and answer unless they took the step of visiting the website every day and reviewing a page that held these questions and answers. Email is more direct. It is closer to "snail mail" or the telephone, in that it arrives at your home or office. All you have to do is go to the mailbox and pick it up. While this is an overt action, most systems alert a user to new mail messages as soon as they connect to the Internet. Even if the system didn't do this, Internet users are likely to check their email routinely, several times a day for it may contain a wide variety of communications, not simply information specific to the class.

Eudora, the email program I use, is one of the most popular on the Internet and its way of handling mail is typical of modern email programs. I have it set to check for new mail every six minutes. It does this in the background, so I don't know it is happening and can thus use my computer for other tasks. Eudora quietly alerts me if something new comes in. This has the convenience of a telephone, but is less intrusive because I can ignore the alert and look at the mail later. But I am put on notice that there's something new waiting for me.

The disadvantage to email is it tends not to be formatted as nicely as a web page and the message containing the Q&A about the class is likely to be mixed in with several other unrelated messages. This may make it difficult to find if students want to revisit it later, so we are now developing a system — and will implement it soon — where such messages are automatically sent to the entire class and with the same single action of the instructor, are also archived on the class website. Such an archive should be useful for current and future students reviewing the lectures and related class material.

One advantage to this process that should be obvious is that both the lecture and the Q&A are available at any time for the students to review. Students are not dependent upon their memory or note taking. While the material is always available online, it is also a very simple process for the students to save all this material to their own computer for printing or for reviewing at a later time. This means that they can review the "lectures" and Q&A without connecting to the Internet.

Is answering questions this way the same as a lecturer reacting to puzzled expressions and student body language during a class to adjust the content and style of their delivery? Of course not. There are distinct advantages to the classroom environment that can't be duplicated here, most obvious being all the silent (and sometimes unintended) visual and audio cues that are such an important part of face-to-face communications. But all those visual and audio cues have their downside. They can be noise that instead of enhancing the communications, interferes with it. Tone of voice, body language, dress and the obvious issues of race, gender and age prejudice are all either non-existent, or significantly less visible in the Internet exchange.

One of my favorite students in an early Web Craft class was Kerry Redshaw from Australia. Based on his writing style and other cues (I'm not sure what) I had developed an image of Kerry as a sort-of Crocodile Dundee at the keyboard. He was aggressive, bright and funny. I learned six months later in an email exchange that "he" was really a "she." I have to wonder if through some subtle combination of prejudices I would have viewed Kerry's words differently had I thought they were the words of a woman? Would that have colored my view of what was being said? We hope not, but I believe if we are completely honest with ourselves we will find that as much as we try not to prejudge people based on stereotypes ranging from sex, race and age to dress, profession and attitude as expressed in body language, these prejudgments are really a constant part of the communications process.

The Internet doesn't eliminate them. In a funny way, they may still be there in a sort of reverse engineering where, based on the scantiest of clues in a written communication, we form an image of an individual that incorporates assumptions about sex, age, race, profession or whatever. So I'm not sure that I agree with the popular saying that "on the Internet no one knows you're a dog." They may not "know" it, but they sure can imagine it! Of course, I still haven't met Kerry face-to-face. Kerry could still be a male who has decided it would be interesting to present a female persona on the Internet! Despite all this, I enjoy the highly focused nature of written communications on the Internet which I do believe gets rid of a significant portion of the "noise" present in face-to-face communications and is richer in "signal."

But there is more involved with this approach to communications. The written word, of course, has a long history. But in that history the written word is frequently a one-way street, as in the book; or a long-delayed, two-way street, as in the paper letter. Here the lecture starts out feeling like a book during the creation process, but unlike the book, it changes from being a product, to being a process where it takes on a new life as the readers interact with the author.

Writing is simply not the same as speaking. In the case of the "computer" writing involves the tactile interaction with the keyboard and the "written-in-sand" feeling of placing words on a screen where they can be changed instantly. (And disappear in a somewhat disconcerting manner when you close the software, or turn off the computer.) More importantly, writing tends to be more analytical — and less spontaneous — than speech. Writing on the computer, however, because of the easy editing capability and the ready availability of related tools, such as a dictionary, can be both more analytical and more spontaneous than the same words placed on paper.

On the computer we have a chance to repeatedly review and revise — something that is more difficult to do on paper and is nearly impossible to do well in spoken communications. For example, as I enter these words in my computer I frequently pause, select a word, copy it and paste it into another window on my screen that holds a dictionary. (This cut-and-paste procedure is quick, avoids the typing errors to which I'm prone, and serves as a check for typographical or spelling errors.) Before I had this capability I rarely consulted a dictionary. Such consultations were cumbersome and interrupted the flow of writing. In this medium they are a momentary diversion and while I seldom change a word as a result of this, reading the dictionary meaning of the word frequently helps me sharpen my focus and keep my next few sentences on track. (There's also a comfort in knowing the word I just used is the precise word I intended to use.)

Although this article is being written for print, the basic process is the same even when I am answering a written question for the student. But the written Q&A process does differ from the face-to-face one. When a specific question is asked of me in the course of a face-to-face lecture, I tend to answer it with less precision and certainty. That is

because I am not a walking textbook. I know my subject, but I also know what I don't carry in my head. In the face-to-face environment I usually feel compelled to give some sort of answer to move the process along. To answer: "I'm not sure. I'll look that up and get back to you in the next class," sort of defeats the purpose of synchronous communications. It's acceptable, but frequently not desirable. There's also an embarrassment factor — standing at the head of the class some instructors may feel they have to appear to know everything.

The asynchronous mode of communications used in CyberEd means that students never see me receive their questions and they don't expect instant answers. The embarrassment factor goes down because they don't see me go to an online resource, or reach for a book on the shelf above my computer, in order to answer their questions. The quality of my answer goes up (I hope) because I do have several choices. I can answer: from my memory, from other re sources, such as books or online documents or in the case of HTML coding, from first having tested my answer in the computer to make sure that it works! In the face-to-face environment some of the best questions may be asked by the shy student after class. It might be important for the class to hear both the question and the answer, but they don't. In the CyberEd environment, they do.

Paper is so handy and familiar; you can take it anywhere, it doesn't crash, you can scribble notes on it easily, you can read it in bed... Soon as I can, I'll get a printer! (Though it may be beneficial to be *forced* to become accustomed to working in multiple windows and so forth.)

Finally, sometimes questions in class can be distracting. They don't help the class. Quite the contrary, they divert the class, perhaps focusing on a side issue of interest to only one student. In CyberEd, when I receive a question that I feel will divert the class, perhaps containing erroneous statements that will cause confusion, then I have two choices — I can answer the student alone, not sending the Q&A to the entire class, or I can edit the diversionary information from the question and send only what I think is relevant to the class. This also is a great way to keep control of the rare student who appears to enjoy being disruptive. This process also encourages the timid student. When a Q&A goes to the entire class it does not include the name of the individual asking the question. I believe this anonymity encourages the shy person, or the students who think their questions are "dumb."

While this process is timely (within the week-long time frame of a CyberEd class) it also has an obvious permanence that is lacking in a face-to-face lecture. In a face-to-face class the question and answer may only become important to a given student long after the class is over and the exchange is at best a hazy memory. When that happens with CyberEd students, they can reference their email. If they are using a good email program, they can nearly instantly sort their mail by subject, sender, or date. They can also do a complete word search of it. But even these powerful tools aren't necessarily as convenient as being presented with a searchable archive on the Web where the archived questions can be closely linked to the "lecture."

Sometimes I will post a "lecture" to the Web on Tuesday morning and before noon a student will ask a question that makes me feel I have worded the "lecture" poorly, made a mistake or left some important information out. At that juncture only a small percentage of the class may have looked at the lecture, so there is a real advantage to immediately rewriting the problem portion, as well as answering the student's question.

Even when such questions come later in the process, they are easy to use to improve the lecture for the next class. Again, the archive is a rich resource for the instructor to review while revising a lecture. If a question calls for a revision in the lecture, you can make it. If, on the other hand, the question really provides an alternative way of looking at the information, you may want to create a hypertext link to the Q&A with a pointer that says something like: "if this isn't clear to you, read this." In this way, the information does not bog down the lecture for the student who is doing fine, but does provide some relief for the puzzled student.

This is the sort of thing experienced instructors do intuitively, reaching into their gray matter every time they repeat a face-to-face lecture. The difference here is that the Q&A carried over from one class to the next don't have to reside in the instructor's mind for intuitive inclusion in the process. (The older I get the more dubious I am that my memory retains anything close to all the relevant information.) It is a simple thing to associate the questions asked earlier with the revised lecture through hypertext so students can make the decision of whether they wish to explore them or not.

All of this obviously puts a premium on the ability of both the student and instructor to express themselves in writing. Is that bad? I don't think so. To begin with, we want students to learn how to write well and what better way to learn, than to regularly write and get feedback? (When students express themselves poorly in a question they will get notes back from me asking for clarification.) But beyond this, the obvious answer is that the face-to-face environment places a premium on the ability of both the instructor and the student to express themselves with the spoken word. I don't think you can say one is a better situation than the other. What we have to do to make either situation an effective learning tool is understand the strengths and weaknesses of the medium we are using.

While my focus here has been on the written word, it is quite easy for the lecture or Q&A to convey images, elaborate examples or even computer simulations. Images can be transferred either as email attachments or placed on the website where both instructor and student can see them. While the technical procedures for transferring computer files containing images and other computer files are within the grasp of the typical CyberEd student, the compatibility problems caused by students using different hardware and software are great, so this is done sparingly. What does happen frequently is the transfer of a simple text file, either attached to, or part of an email message.

For example, when students have problems with something they are writing I ask them to transfer either the entire piece, or at least the relevant portion, to me for review. (You can do this in a face-to-face exchange, of course, but it is difficult to do over a typical distance communication tool, such as the telephone.) When students write that they can't do something, I frequently write back and ask to see their attempt. They send it to me and I diagnose the problem and sometimes turn it into a learning experience for the entire class by circulating it on the email list. This could be done in a face-to-face class with paper copies of the student work and circulating it, but it is far easier to accomplish in this medium.

From the student's perspective

What's this all look like from the student's perspective? I've developed a small poll which I give at the start

of the fifth week of class to see how students are reacting to this new learning environment. The poll keeps changing, but it does give me some insight.

One key issue that is unresolved is whether it is more efficient and useful to read materials on screen rather than in print. The screen environment — besides saving trees — presents students with a searchable body of information that they can easily take notes from by selecting portions and copying them onto an electronic notepad or word processor. This is simple for students comfortable with a multi-window computer environment.

More important, in the Web the screen environment allows for the placement of hypertext links which encourages associative thinking. Done correctly, a Web lecture is much more than it appears to be on the surface for it can include relevant hypertext links that take students to resources created by the instructor, or created by others throughout the world. For example, in my lectures I include links to my own definitions of key Web terms used in the lecture. No one has to go to the library or dictionary to look up these words — they just click on the word to get the definition.

But I do this only in a few instances. For more general reference I include a link to an online dictionary of computer terms and abbreviations. This searchable dictionary is only a click away. In fact, with the new Java script technology you can embed a search form right in your own Web lecture page. This would mean that the top of the page, for example, might have a search form where the student can type in a word or phrase related to the lesson and right from the lecture page the data base search will be initiated. The student would then be presented with the results of the search on a separate Web page. This speeds up the process, eliminating a step or two. But even without it, the world of associated resources is incredible and rapidly expanding.

So the student's primary resource (the lecture), his or her notebook, and a host of secondary resources are all wrapped up in a single, on-screen environment. The placing of such secondary resources where the student is able to easily access them during the "lecture" speaks to one of our primary educational goals — to move in the direction of the apprentice/master relationship and away from the concept of the instructor as the font of all relevant knowledge.

These advantages of the on-screen environment are compelling, but CyberEd students are still likely to print out lectures and other materials, rather than read them on screen. Most CyberEd students tend to be in their mid-thirties or older and thus were raised and educated using print media. Here my Web Craft class is not the ideal sample because the course content tends to attract more sophisticated computer users than the other classes. Still, it is interesting to see how these students handle this problem. My unscientific sampling shows that the class is pretty evenly split between those who read everything on screen (and take notes by copying and pasting) and those who print out all the lectures and other relevant material. The anecdotal comments reveal that this is not a cut-and-dry issue. While the most common reason for wanting to print things is the convenience and portability of print media, there are many other reasons, including simply force of habit. On the other hand, one student who reads on screen does so because his computer budget just didn't include a printer!

I try to prepare my lectures for on-screen reading. What this means is that what might otherwise be an hour-long lecture gets divided into four to six subunits. I try to make each unit fit into roughly three to six screens of information. This is a compromise between "chunky" text that requires the loading over the Internet of a new file at the end of every screen of information, and presenting everything in a single, long file that requires extensive scrolling. The chunky text is more or less irritating depending on the download time involved in accessing the next screen. This varies with time of day, location and equipment, but lengthy text passages requiring much scrolling are arguably disorienting to the reader.

I printed out a copy and then read it over a blueberry muffin and a fresh cup of hazelnut coffee — I did not highlight or take notes — my food was enough to slow me down to "pay attention speed."
I read this article on screen, I am slowly trying to wean myself off of printing and then reading. The notes I took were divided between cutting and pasting into a word document and actually writing them onto paper. I try to save the paper to write down the things I want to think about when I am away from my computer, such as the questions to reflect on.

When presenting original information on-screen it's not difficult to adapt it to the screen environment. When merely porting over a print article that was written for print, breaking it up into even relatively large chunks can be more disorienting than presenting it as a single long file.

One serious distraction that many Web users complain about is not having an intuitive (or explicit) understanding of the length of a lecture or article when they see the first screen. We know the face-to-face lecture is going to go for

a certain time span established by convention. If we pick up an article or book the heft, thickness and number of pages is readily apparent. When we arrive at a Web screen that begins a lecture we don't know whether that lecture or article is 500 words, 5,000, 50,000 or 500,000. A single screen of information can be the "front cover" for a pamphlet or an encyclopedia and carries few or no clues as to which it is.

I try to attack this problem in my lectures by calling each subunit of a lecture a "page" (although the term is only roughly meaningful in the screen environment) and indicate that for this lecture this is "page 1 of 5" — or whatever. That's of some help, but we need better solutions and they are difficult to arrive at because traditional lengths, such as pages, mean little in an environment where the reader controls screen size, window size within the screen and the type font and size.

It is tempting to surrender to the printed page and to use the Web as a transport medium. If we do that, however, we lose those advantages of the on-screen environment. Of course, the good news is the students can have their cake and eat it too — and several of them do. That is, they skim material on screen, and if they feel it needs more careful scrutiny, they print it out. By doing so they haven't lost the advantages of the screen — it's still there for them to reference, copy and paste from, and pursue hyperlinks.

But the dual approach of on-screen and print use should be seen as a third alternative that creates yet another environment. Part of the power of the hypertext link is its immediacy. It encourages the kind of "associative thinking" that Vanevar Bush recognized in "As We May Think." This seminal article in the June 1945 *Atlantic Monthly* in many ways anticipated hypertext and the Web.

Hypertext, of course, has its downside as well. A few weeks into our first CyberEd class I realized that students did not know where a lesson ended. If the instructor simply makes a lot of links to related material, what do they intend? Are these links here as "FYI." Or are they an essential part of the lesson? If part of the lesson, how far should the student pursue them? If you send a student to another document on the Web, that document almost always contains other links to other related material. Your hypertext link has just moved the student from your lecture to the middle of the world's largest, most rapidly changing and most eclectic library. This can be

very exciting, for your students frequently go places you have never been and occasionally return with a real gem! But it is also unfair to send them on wild goose chases, so you have to be very specific about why you are including a link in your lecture and what use you expect the student to make of the linked material.

The major complaint I've heard about hypertext in the context of online education is that it encourages students to bounce around, never completing a thought. Done correctly, I feel it can do just the opposite — that is, encourage students to bounce around indeed and in so doing, complete a thought. But we have a lot to learn about how to use hypertext and the vast resources of the Web to good advantage.

For example, hypertext links inserted in the middle of a paragraph or sentence are a common practice on the Web. However, I feel they are almost always a distraction and are a perfect example of letting the technology lure us away from a more sensible approach. We seem to be fascinated by the prospect of linking to other resources and so, if it is doable, we do it. But I feel I have structured my lectures with complete thoughts. I don't want linked words in the middle of a sentence suddenly sending students careening off into cyberspace. I want them to stick with my thoughts as presented, then go off when I feel it is appropriate. This frequently leads me to include relevant links either in a margin paralleling the text, or at the end of the text. In so doing I am trying to say that this material is relevant, but supplementary. Where the material is genuinely meant as a part of the lecture, I will be quite explicit and write an instruction that says something such as "stop reading now, go visit this other page, then come back here."

This is part of my love/hate relationship with a medium that turns over unprecedented control to the reader/user. I think that the undisciplined use of hypertext links can be a distraction and that in employing them incorrectly we are abandoning our responsibility as educators/writers. There's a logical middle ground here, but I think it is going to be awhile before we determine exactly where it is.

My other problem with the embedded link is simpler. Such links usually appear on a reader's system in a different color, such as a bright blue or red. The words chosen to be highlighted thus are chosen because of their relationship to the linked material, not because they are of any other significance.

So this colored highlighting frequently puts an undue emphasis on these words and thus distorts the writer's message. But this is a small point. Taken in all its parts, I think the online "lecture" environment we pursue in CyberEd conveys current information in a flexible format. In using it we can quickly respond to student needs, just as in the typical classroom lecture. It has the advantages of hypertext, the readily available resources of the Web, and the written word to recommend it. I think these more than make up for what it lacks in terms of a real-time, face-to-face environment. Again, the two environments are not the same, but when you weigh the strengths and weaknesses of both there is a balance in terms of educational effectiveness.

Beyond lectures

Of course lectures are not the only thing that happens in a class — we've already mentioned spontaneous questions and answers, but what about class discussion?

Here I think a similar case can be made for the online course. Class discussions, as with the lecture and Q&A modes, depend upon the written word and the strengths and weaknesses of the written word already discussed apply to the discussion mode. But the discussion format heightens both the strengths and weaknesses already mentioned, since discussions tend to be more subjective and emotional.

Because of this, class discussions — especially those focused on opinions — can frequently be unfairly influenced by both positive and negative physical characteristics of the speakers. Here tone of voice, aggressiveness and a host of other factors are perhaps under more control than other aspects of the face-to-face class, may take on a new prominence. On the other hand, a CyberEd discussion takes place in writing. Again, something is lost in terms of spontaneity and there is a premium placed on writing skill, but something is gained in terms of the careful, more analytical structuring of an argument. It is easy enough to establish technical means — through email and/or Web forms — to provide a discussion forum.

In the Web Craft class I find our forum very interesting, but students are only encouraged to go one round — a round being a single posting in response to a question without a follow-up reply. That is, I give an outside reading assignment, then ask students to write an answer to one or more questions

relating to the reading. These are subjective and sometimes provocative questions and the answers are quite interesting.

Every student's answer is posted to the Web for every other student to see. Frequently this results in useful insights on material that had not occurred to me, and I'm sure hadn't occurred to all students. While at least half the students actively participate in these "discussions," (they're optional in my class) most students say they read what others have written. One of the reasons I like the large class is that it increases the possibility of getting some really valuable answers in this forum. I review forum answers and sometimes point out especially pertinent ones to the rest of the class.

Most of the people who write something for the forum do so during the week of any given assignment. However, the writings remain an open resource. Anyone can consult them at any time, I may reference some students' responses in a later lesson (with a hyperlink), and anyone can add to them at any time over the course of the class. Such written discussions can take place in email and they can go several rounds deep, but they really seem to lose punch and cohesiveness after a couple of rounds. In Web Craft there is only the initial posting. If students want to comment on what someone has said they are encouraged by an email link attached to the posting, to comment directly to the other student. I do not know how frequently this happens, but I suspect it is very infrequent.

I feel that the trade offs of the written discussion balance nicely against the pluses and minuses of the in-class discussion to make the CyberEd experience a different, but educationally sound one.

But if we believe students learn from students we should be able to do more. In Web Craft there is already too much happening and too little time. In other classes, however, we have done more. In Professor Raymond Dumont's professional writing course students regularly participate in peer editing. That is, students swap the initial drafts of their writing assignments and critique one another's efforts. The professor reviews both the final draft and the peer editing comments.

In the original Web design course we attempted to have students work as teams on real Web projects. This was a challenge for the students involved and we saw the usual indications that the workload for a team project was not equally shared by all students. Again, the students were limited to

written exchanges, but with a twist. With the team project some of these exchanges took place in real time — or at least in terms of the Internet, they were real time. To do this, one of the Internet tools we use is called "chat." In its most popular form (Internet Relay Chat) this is a "real time" exchange between two or more people carried out through typing words and displaying them simultaneously on the screens of all connected users. Superficially, this feels like its name implies — a chat. Because you know someone else is waiting to read your words, you tend to keep your writing informal and brief.

But a "chat" meeting is not a face-to-face meeting and should not be viewed as such. It should be seen as its own special form of exchange. It differs in several important ways, but let's just consider one of them. In a face-to-face chat the conversation does take place in real time and you don't get an opportunity to review what you want to say before the words are out and said. In an Internet "chat" you type your words and before the other participant(s) see them you may review and edit them. So while real chatting tends to be a two-step process — think, then speak. An Internet "chat" is three or more steps — think, type your words, review your words, edit what you have said, and then "speak" by hitting the key that sends your words to the other participants.

This process, of course, takes longer than a spoken conversation — even if you don't consider the delays caused by the technology itself. The resulting communications tend to be more analytical and less spontaneous. Some students are extremely irritated by the slowness of the process. My personal approach to a "chat" is to multitask — that is, I keep one eye on the chat window while using another window on the computer screen to do other things. What we seem to be learning is that "chat" is a good tool for informal communications among students in the early stages of team building and is also good for brainstorming. But when teams settle down to actually carry out a project they rely heavily on email and on posting drafts on the Web for all team members to review.

The good news here is that the technology which in the Fall of 1995 we treated as individual modes requiring separate pieces of software — the Web, email, chat, and FTP (file transfer protocol) are now integrated into a single piece of software. Even when a user chooses to use four separate pieces of software for these functions, the software itself is providing

integration between the modes. For example the Eudora email program update that was released in July of 1996 turns a Web address into a hypertext link. This means that an email message can reference something on the Web and all the reader of the message has to do is click on that link to review the reference in his or her Web software.

We started using an independent chat server, then switched to a chat mode that used the Web. This has its disadvantages. However, software being released as this is written combines the original chat software with Netscape to make it far easier to use "chat" to carry on an interactive discussion while using Netscape to view and reference material on the Web. FTP, a technical stumbling block for many students who have to use it to place files on our server, is now being incorporated into the Netscape Web browser with the same easy point-and-click interface.

As this technology continues to evolve I expect we will soon have a seamless, easy-to-use environment for several different modes of exchanging text and images. This will make distance collaboration in particular, and the CyberEd environment in general, even more powerful. We can use these varying modes now, but they require the student to be either a sophisticated computer user, or to spend too much time fussing with the technology rather than course content, so we do not always get the full benefit from them.

Multimedia

One thing we are not doing much of in CyberEd is taking advantage of the multimedia aspects of the Internet/Web environment. But we have not ignored other media entirely. The music course makes extensive use of sound files containing music created by the students and a chemistry course now under development will make use of video images of experiments. But these are the exceptions. It is practical to make such exceptions only if the exceptional medium being used is essential for conveying fundamental course information. Obviously sound is essential to a music course and much practical information can be conveyed if you show certain chemistry experiments. But sound and video are not practical at this time to simply enhance a written "lecture."

There are two basic reasons for this. First, the demands to create good video, sound or computer simulations are

far greater than the demands to create text and still images. The latter are easily within the grasp of any computer literate faculty member comfortable with a word processor and a simple graphics program. The second reason there is little use of these more advanced communications media is that today's Internet — and personal computers — can't handle them well. Video and most sound files (the MIDI files used in the music course are an exception), even when highly compressed, are transferred at an excruciatingly slow rate. Most personal computers cannot display these files without special software, and even then the motion in the video is jerky at best, and the image itself is usually presented in a window the size of a playing card.

But these technical problems are rapidly being overcome. Programs such as CUSeeMe, developed at Cornell University and enhanced by a private software company, now provide a way to inexpensively connect users at up to eight different sites with real-time audio, video, text and still images using this program and inexpensive video cameras.

However, over the typical 28.8 baud Internet connection the video transfers are at only a few frames per second (a simple flip book does a far better job at simulating motion), and the audio is distorted. An associated written "chat" program does provide effective "chat" communications and a "whiteboard" does allow persons not only to share text and graphics, but be able to simultaneously edit something displayed using the "whiteboard." This process is akin to standing at a traditional blackboard with one or more students and having everyone able to jump in, erase a portion of what's on the board and make changes.

Conclusion

We are still studying the results of the first year of CyberEd and our evidence of success remains largely anecdotal as reported by enthusiastic faculty and students in formal and informal comments. Indeed, the excitement of using a new medium is in itself a self-selective force that perhaps bring us students who are above average in ability and initiative. While this assumed high quality of students may tend to dampen the value of early conclusions, the quality of the work of students participating in CyberEd classes certainly appears to indicate that they are learning through this process.

For years we have talked about an ideal of life-long learning. This new technology may not only make that ideal a reality, but also make it more educationally effective. "CyberEd" in its objective of providing access to students whose personal and professional commitments makes attending traditional classes difficult, at the same time is tapping the vast potential of the Internet for sharing information. We usually think of Internet resources in terms of traditional library resources, but in truth it means we can draw on experts of many types whose thoughts and experiences were largely out of reach, or for various reasons have not been recorded anywhere. For example, in a course on the history of the Holocaust, the students were in email touch with survivors. Opportunities for cross-cultural exchange are significant.

I do not find the current practical restrictions of the new technology to the transmission of still images and text a serious constraint. Quite the contrary, I look with some trepidation on what we will do once our bag of technological tricks is increased to practically include sound and video. My guess is that in ten years multimedia communications from home to home will be inexpensive and commonplace. That worries me because I am afraid that when we have all this communication power we will then use the medium that is the easiest to use, and not necessarily the one that is best. We tend to assume that more input is better. We assume that a spoken word is better than a written one and that a spoken word along with a video image of the speaker is better than either.

But more data is not always better or more informative. It creates a different communications environment. When we really have all these tools to draw upon, I hope that we also will have learned to reverse Marshall McLuhan's axiom that the "medium is the message," and instead of letting the medium drive content we will first determine our content, then choose the medium which conveys it best. To do this we need a fuller understanding of the strengths and weaknesses of each medium and how different media influence the message.

On an even more fundamental level, we should all heed science fiction writer Arthur C. Clarke's warning: "Before you become too entranced with gorgeous gadgets and mesmerizing video displays, let me remind you that information is not knowledge, knowledge is not wisdom, and wisdom is not foresight. Each grows out of the other."

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Abstract

The goal of this study is to help exhibition designers incorporate interactivity into their exhibits. In order to do this, we propose **a model of interactivity** that can be used to generate concept sketches for exhibits in a broad range of subjects, and we demonstrate how this model may be applied in designing exhibits for African-American children. Our model accounts for **task, visitor motivation and cognitive mode**, looking at two alternative ways an exhibit could account for each of these components. The relative benefits of each alternative are explored and a design model which intersects task, motivation and cognitive mode in a three-dimensional matrix is proposed. This matrix yields eight distinct ways to design an interactive exhibit. In order to demonstrate how this model can be applied to design exhibits for African-American children, we present case studies illustrating some of the possible uses.

A Conceptual Model of Interactive Exhibits for African-American Children

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Rasheed and Allmendinger, 182-199

Introduction

Exhibits in African-American history museums usually consist of artifacts and graphic displays. Interactive exhibits are rare, even while they are becoming commonplace in children's museums, science and natural history museums — and in places like Chicago's Shedd Aquarium. Interactive exhibits provide museum visitors with physical learning activities. They are operated and experienced, not just viewed. During the past twenty- five years, interactive exhibits have demonstrated the power to attract children, hold their attention and stimulate conversation.

The museums best known for popularizing interactive exhibits are the Boston Children's Museum and the Exploratorium in San Francisco. In the late 1960s, Michael Spock introduced interactivity at the Boston Children's Museum in a landmark exhibit called "What's Inside?" (Edeiken, 1992). His goals were to stimulate curiosity and motivate learning, recognizing play, exploration and make-believe as important learning modes.

The Exploratorium was founded by Dr. Frank Oppenheimer in 1969 and encouraged individualized learning through direct personal experience (Delacôte, 1993). In typical exhibits, children learn about molecular movement by experimenting with a hot air balloon, or about physical motion by experimenting with a small catapult that launches a marble at

varying trajectories (Hipschman, 1980). The concept underlying the Exploratorium is that experience lies at the foundation of scientific understanding. The museum provides experiences which stimulate scientific interest, fosters a "can-do" attitude and concretizes outside instruction.

Exhibits in the Children's Museum and the Exploratorium do not depend on historical artifacts, are relatively cheap and can be made inmodestly equipped museum workshops. Both museums have been wildly successful, each spawning a new generation of similar institutions.

Ideally, interactive exhibits complement school instruction, which in this country relies mostly on formal methods: lectures, textbooks, written exercises and standardized tests. One failing: schools provide few concrete examples about how the principles that they teach apply to the real world. Interactive exhibits, on the other hand, can give encapsulated experiences that serve as anchor points for more abstraction instruction. When a teacher describes trajectory in a lecture on physical motion, a student might say: "I did that in an exhibit at the science museum." There is good evidence that children remember interactive exhibits more than others (Tukey, 1992). Concrete references are easiest to understand and function as building blocks for further learning.

Interactive exhibits are not without controversy. Shorthand (1987) states: "Children have fun... but they learn little science and acquire a good many misconceptions which at the very least fail to match [the conceptions] offered in the captions." On a more positive note, Davidson, Lee and Hein (1991) testify that interactive exhibits attract children and capture their attention and that children are learning in the process: "Our studies indicate that under the right circumstances, visitors are clearly able to synthesize information from many different sensory modalities into personal learning that they can articulate to an interviewer."

Museums know that interest and attitude are major factors in education. The best students develop enough interest in a subject that they learn about it on their own. Interactive exhibits may foster positive attitudes by providing positive experiences that children relate to specific subjects.

Mihaly Csikszentmihalyi describes positive experiences in terms of "flow" activities. Flow activities satisfy the following criteria (Csikszentmihalyi, 1990):

- Focus on a goal. Participants perform a task with a clear aim in mind.
- Provide appropriate challenge. The task at hand is neither too difficult nor too simple.
- Develop skill. Participants build expertise while doing/acting.

- Provide consistent feedback. Participants can see they are approaching the goal and that their skills are developing.
- Provide control over outcome. Participants can affect how things turn out.
- Engage totally. The activity commands the participants complete attention during the time it is performed.

In our experience, Csikszentmihalyi's flow criteria provide essential checkpoints when refining an exhibit design, but are not particularly helpful in generating initial concepts.

African-American museums

African-American museums are social-historical institutions whose mission is "rooted in the tragedies that haunt Black social experience in America, tragedies that obscure our history and separate us from ourselves, that pervert our cultural expressions and devalue our ancestral heritage and legacy." (Caither, 1989) African-American museums provide visitors with a sense of culture, history and the heroism of uncountable women, men and children who — while shaping their own lives — have contributed to the whole fabric of the nation. These museums contribute to self knowledge — a vital prerequisite for well being.

Some of the African-American museums are concerned primarily with art, and others with the interpretation of an historical site. Still others resurrect history in a way that makes us rethink old assumptions. Many of these museums are dominated by the task of collecting and preserving art, artifacts and historical documents — things of invaluable cultural importance which are in danger of being lost forever. All African American museums conduct educational programs and interpretative exercises and nearly all engage in publication.

Why is interactivity important for African-American museums? In interpretive exhibits, interactivity can augment significant artifacts by explaining workings and processes. Interactive exhibits travel well, because they are relatively cheap and do not require original artifacts. Interactivity can help relate history to things in everyday life and stimulate career interest by emphasizing ties to many disciplines.

A conceptual model of interactive exhibits

Design problems almost invariably involve compromises. Often a number of (sometimes radically) different designs all function as viable solutions to a given problem. Eating utensils are a good example. Orientals eat with chopsticks. Westerners use a knife and fork. In Africa and most of the rest of the world, people eat with their hands, while in the Arabic world, people eat from a communal plate. Each way of eating

works well within its social and utilitarian context, and no single way is clearly superior.

The practical range of solutions to most design problems can be conceptualized as a "solution space." In this section, we propose a simple model which describes the solution space of interactive exhibits.

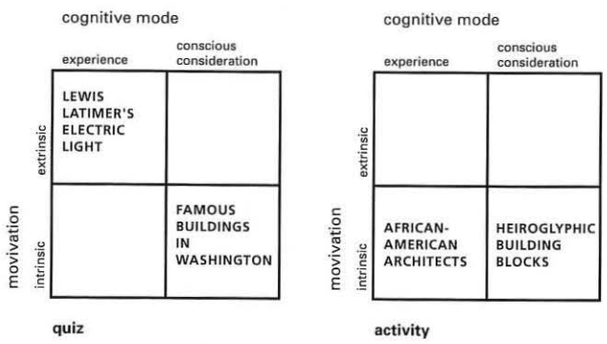
Boisvert and Slez (1995) have developed a conceptual model for exhibits based on whether concepts are simple or complex, whether the presentation is abstract or concrete and whether there is a low or high amount of interaction. This is a model of exhibits that may have important implications for designers. Their work differs from ours in that they are involved with evaluation, while we focus on design — nevertheless all of us attend to interactivity.

Successful exhibits must fulfill three criteria. They must attract visitors, hold them a sufficient amount of time and engage their attention before learning can take place (Wolf, 1985). These criteria are consecutive. It's impossible to teach visitors without engaging their attention, or to hold visitors' attention without attracting them first. Boisvert and Slez also report that interactive exhibits are effective at holding visitors and engaging their attention.

In order to attract, hold and engage visitors, a conceptual model of interactivity should center on museum visitors. After all, interactivity is about how people relate to the world. In this paper, we focus on three key visitor related considerations: cognitive mode, task and motivation. We visualize each of these considerations as two components, resulting a 2 x 2 x 2 matrix of interactive exhibits. The following sections describe each design consideration in detail.

Figure 1

Our conceptual model of interactivity exhibits a 2x2x2 matrix. This diagram also shows how our concept sketches relate to the model.



Task

Museum visitors expect exhibits will be fun and challenging. For this reason, their behavior with interactive exhibits is goal-oriented. (At the lowest level, satisfying idle curiosity is still a goal.) Interactive exhibits challenge visitors with two kinds of tasks: quizzes and activities. In quizzes, the designer presents museum visitors with one or more goals and a set of procedures. Quizzes often involve "test your knowledge" tasks like answering questions, matching, sorting, etc. In activities, visitors set their own goals. An activity-based exhibit is like a child's set of building blocks. Building blocks offer natural constraints, which are inherent in their rectilinear form. A child can decide to build a house, a bridge or a pyramid, but she cannot, for example, build a keystone arch. In activities, visitors can determine goals beforehand, or they can integrate them with the task. A child can decide that she wants to build a pyramid, and then build it. Or a child can just start building and decide that the finished structure will be a tower.

Games fall into a grey area between quizzes and activities. Most simple games are effectively quizzes, with single goals and clear-cut rules. Complex, simulation games allow players to set complex goals, and fall closer to our idea of activities.

The important distinction for exhibit designers is that quizzes demand goal understanding while activities demand both goal understanding and goal setting — an extra cognitive step. As a general rule, if a topic does not lend itself to a concrete presentation, you should think about introducing it in a quiz format, allowing visitors to concentrate on principles rather than on goal setting.

Cognitive mode

In *Things that make us smart*, Donald Norman discusses two basic cognitive modes which are especially relevant to interactivity — experiential cognition and reflective cognition. "The experiential mode leads to a state where we perceive and react to events around us efficiently and effortlessly... The reflective mode is that of comparison and contrast, of thought, of decision making. This is the mode that leads us to new ideas, novel responses" (Norman 1993, 16).

Experiential cognition allows us to interact with the world on a perceptual level, without conscious deliberation. Riding a bicycle is essentially an experiential task. When riding a bicycle, I don't think, "pedal, pedal, lean — now turn." I simply do those things. Reflection involves conscious consideration. (We use that term from now on because we feel that reflection does not imply the action inherent in concentration.)

To add two numbers, I have to think: "Six plus seven equals thirteen. Write the three down here. Now carry the one."

The difference between experience and consideration is not clear cut. When I first learned to ride a bicycle, I did have to think, "pedal, pedal, lean, now turn." When I first learned touch typing, I had to consciously consider "Where is the 'E' key and which finger do I strike it with?" Riding and typing both didn't work out very well in the consideration mode. As I learned each task, I shifted into the experience mode. I seldom revert to consideration when I'm riding a bicycle, but with typing, I do so a lot.

While there is — from a user's perspective — a clear difference between experience and consideration, the relation is actually fairly complex. Experience relates primarily to physical or perceptual tasks, while consideration relates primarily to logical tasks. But if I'm learning a complex physical task I'll begin in the consideration mode, and I won't do it very well.

In interactive exhibits, we need to consider that experience and consideration relate to both the subject and method of interaction. Some subjects — like writing and coordinate systems — relate closely to consideration. Other subjects — planetary motion, for example — might best be explained experientially.

Motivation

In "What makes things fun to learn," Thomas Malone discusses two basic ways of motivating children to use educational, computer games. "A distinction is made between extrinsic fantasies that depend only weakly on the skill used in a game and intrinsic fantasies that are intimately related to the use of skill" (Malone, 1980, 10).

According to this view, the type of motivation is based on the relationship between task and reward. If there is a direct, cause and effect relation between task and reward, we can say the motivation is intrinsic. For example, if the reward for learning to drive is going places, then the motivation is intrinsic; there is a concrete relation between driving and going places. If the relationship between task and motivation is arbitrary, then motivation is extrinsic. Getting paid for learning to drive is an entirely extrinsic form of motivation. (Getting paid is extrinsic motivation to do anything. The paycheck as an abstract medium of reward is a recent, cultural development.)

Further examples of extrinsic and intrinsic motivation can be found in two popular educational games. In Trivial Pursuit, children learn facts about the world by moving around on a game board and answering questions about history, geography, literature and so forth. The first player who answers one question from each category correctly wins the game. Motivation in Trivial Pursuit is clearly extrinsic. Rolling dice and moving around on a game board has nothing to do with history, geography or literature.

In Monopoly, children learn about business practices by buying, selling and managing risk. The motivation behind Monopoly is clearly intrinsic, as there is a concrete relation between business practice and game tasks. (Even so, the game's goal of bankrupting the competition is a questionable business practice, even if it is highly motivating.)

Mihaly Csikszentmihalyi describes two similar concepts — "autotelic" and "exotelic" experience: "...when the experience is autotelic, the person is paying attention to the activity for its own sake; when it is not, the attention is focused on its consequences" (Csikszentmihalyi, 1980, 67). He gives the example of teaching children in order to make them good citizens (exotelic experience) and teaching children because one enjoys interacting with children (autotelic experience.) In a later article, he labels these concepts intrinsic and extrinsic motivation (Csikszentmihalyi and Hermanson, 1995).

The major difference between Csikszentmihalyi's autotelic and Malone's intrinsically motivating experiences is that in autotelic experience, the activity is its own, immediate reward; while with intrinsic motivation, the reward could come later as a direct, concrete consequence of the activity. To Malone, going places would be an intrinsic reward for learning to drive. To Csikszentmihalyi, the only truly intrinsic reward for learning to drive would be the joy of driving.

Interactive museum exhibits obviously need to provide autotelic experiences, whether or not motivation is intrinsic. Children view museums as "infotainment." A more difficult question is whether designers should base interactive exhibits on Malone's concept of intrinsic or extrinsic motivation. If a topic, molecular motion for example, lends itself to an intriguing demonstration, intrinsic motivation is a natural choice. Intrinsic motivation is also preferable for subjects in which the audience is highly interested.

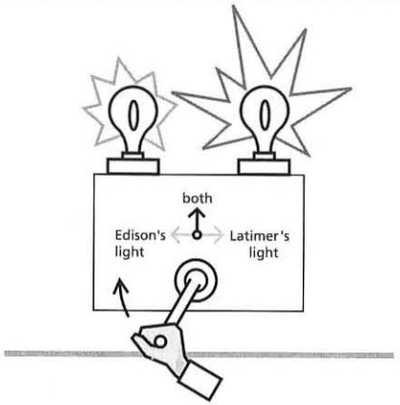
But where neither of these two cases apply, we feel extrinsic motivation becomes a viable alternative. A few years ago, one of us worked on an exhibit development team for Chicago's Museum of Science and Industry's "Star Walk" exhibition. The subject of the exhibition was children's mental health, and exhibits dealt with topics like appropriate goal setting, recognizing emotions and self-esteem (Whitney, 1988). Given these abstract and rather mundane topics, our exhibit prototypes made extensive use of extrinsic motivation. Doug

Cooper, teacher education manager of the Pacific Science Center, reports a similar experience: "We had an exhibit this year about problem-solving, and we know that if we advertised it as a problem-solving exhibit, it would not attract visitors" (Shields, 1992, 10). In the following section, we give a few illustrations of interactive exhibits that occupy different positions in our model.

Case studies: an illustration of the model

In order to show how task, cognitive mode and motivation apply to interactive museum exhibits, we've created concept sketches which illustrate some of the possibilities.

Figure 2

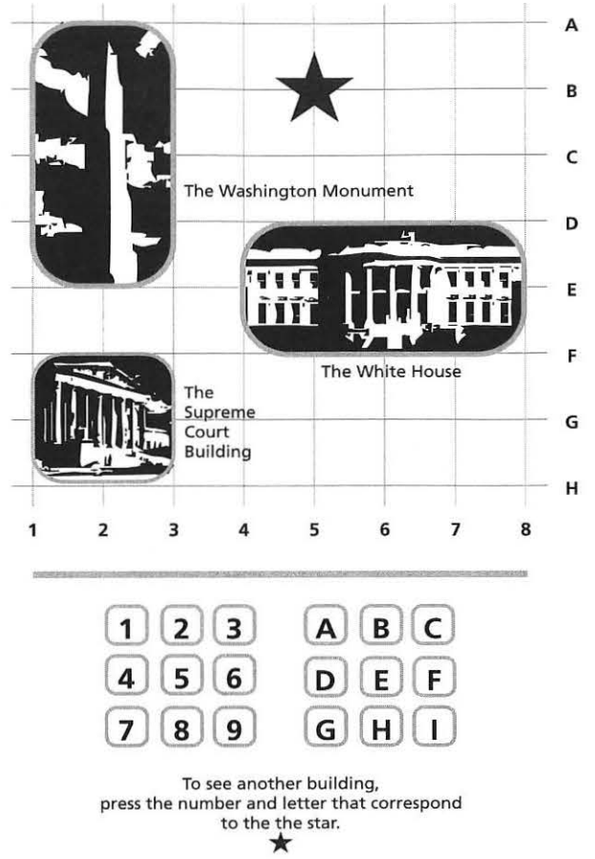


Louis Latimer's electric light

This concept sketch is intended as part of an exhibit about Louis Latimer, an African American electrical engineer and inventor who developed a vastly improved filament for the electric light. The sketch provides users with a hand dynamo and two light bulbs, one of which is perceptibly brighter than the other. A switch can direct electricity to either bulb or to both simultaneously.

One objective of this concept sketch is for children to notice which bulb is brighter. This is an experiential task which is extrinsic to electrical engineering, still, this kind of quiz can provoke curiosity and wonderment in children.

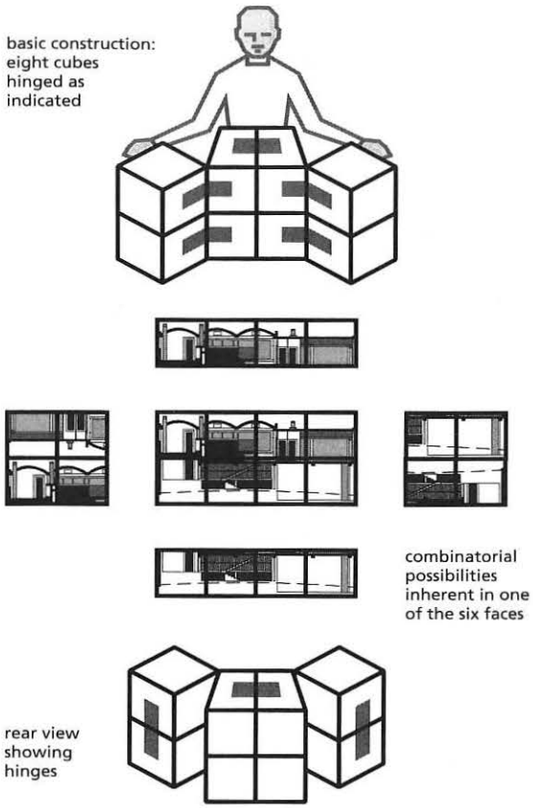
Figure 3



Famous buildings in Washington

This concept sketch is part of an exhibit describing the contributions of Benjamin Banneker, an African-American city planner, surveyor and author who was, among other things, responsible for the layout of Washington, D.C. One objective of this concept sketch is to teach children the basic concept of a coordinate system. As the exhibit allows only a single goal, it is clearly a quiz type activity-children make buildings appear by selecting their coordinates. Correlating coordinates with a two-dimensional plane is intrinsic to surveying, and the activity clearly involves conscious consideration.

Figure 4

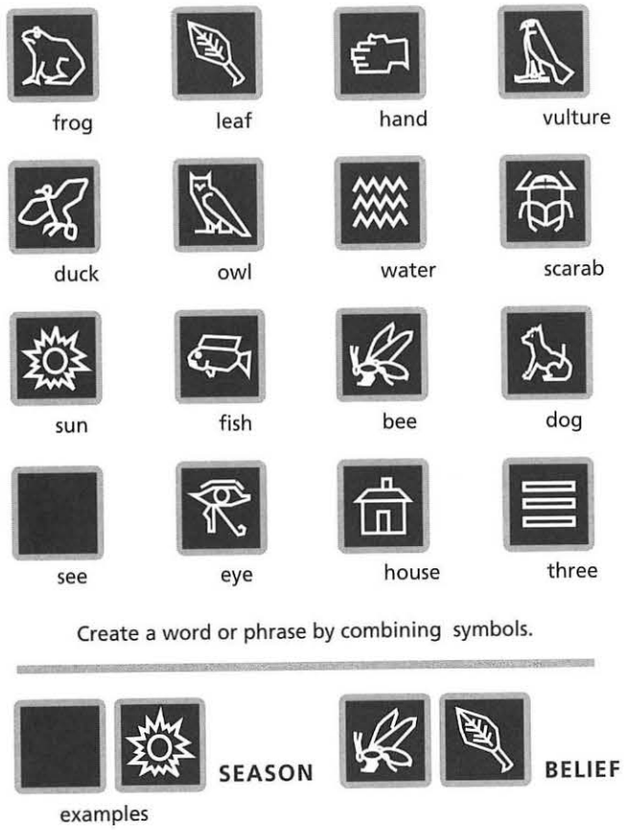


African-American Architects

In this concept sketch, children manipulate a three dimensional puzzle, where blocks are interconnected in a way reminiscent of Rubrik's Cube. The puzzle has four faces, each of which displays the work of an African-American architect. The puzzle allows children to rearrange the architect's work in a wide variety of combinations, demonstrating modular construction, mathematical patterns and constraints — all of which are intrinsic to architectural practice.

This concept sketch invites a child to become his own architect: there is no single, correct solution, but in manipulating the blocks a child experiences some forms as more pleasing than others. In this way, the puzzle provides an intrinsic, experiential activity.

Figure 5

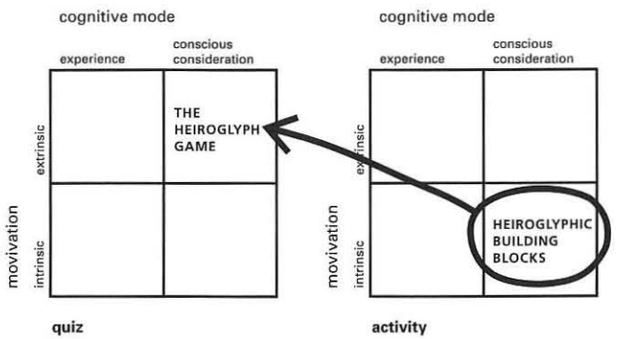


Hieroglyphic building blocks

This concept sketch involves a set of hieroglyphic building blocks, loosely adapted from ancient Egyptian hieroglyphics. One objective is to teach children the concept behind syllabic writing. Children can combine these symbols into strings representing words or phrases. In this activity, children can express a multiplicity of meanings, requiring conscious consideration. Combining symbols is intrinsic to written language.

Figure 6

Transposing a concept to another place in the model can suggest design possibilities.

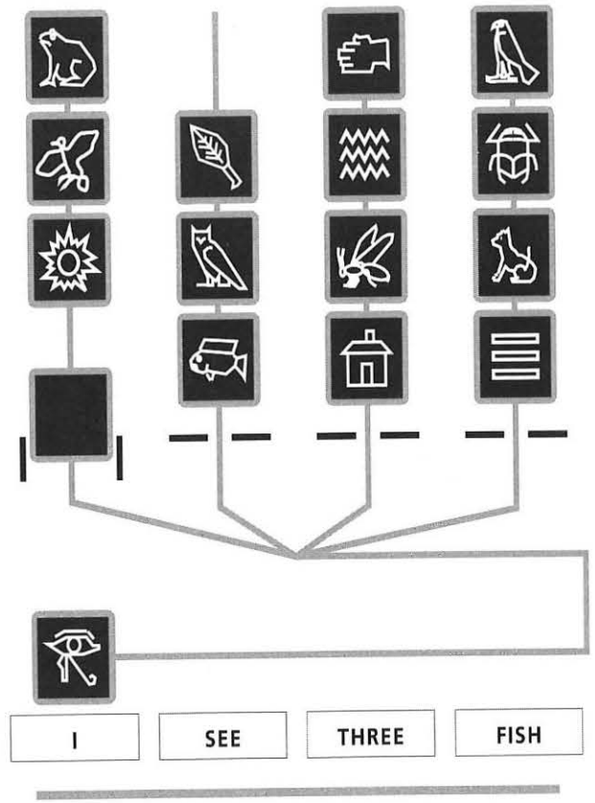


The model as a generative tool

Our model of interactive exhibits provides designers with a way of rethinking basically sound concepts that don't quite work. Our model allows designers to pose questions like: What if my concept were an activity instead of a quiz? Or: what if it involved experience instead of conscious consideration?

In order to show how this process might work, we have created a variant of the "Hieroglyphic building blocks" exhibit, which presents a different approach to the same concept. "The hieroglyph game" is a pinball-like game, where hieroglyphics pass through gates and slide down a path. Pinball is extrinsic to written language, and this task is a quiz because the children try to match a given phrase. While there may be ways to make the exhibit experiential, we kept to conscious consideration as that mode fits naturally with language.

Figure 7



Create a phrase
by choosing the symbol that matches each word.

The Hieroglyph Game

Will "Hieroglyph building blocks" or "The hieroglyph game" work better as an exhibit? We won't know without evaluative testing. Our model is generative, not predictive, and we recommend a development process like the ones used by Jarret (1986) or Diamond (1992). But if a visitor finds himself at loose ends with an activity, try a game or quiz.

Exhibit design and affordances

Our conceptual model for interactive exhibit design defies common wisdom in that it treats each component of our key considerations — quiz/activity, experience/conscious

consideration, intrinsic/extrinsic motivation — as equally viable alternatives. Exhibits in the Exploratorium are primarily intrinsically motivated, experiential activities. In his "Exploratorium exhibit conception and design," Frank Oppenheimer (1980) reports that Exploratorium exhibit designers routinely ignore "who your audience will be," and that many single activity exhibitions (or quizzes, in our terminology) have proved "extremely disappointing."

We argue that Exploratorium exhibits are unique in that they demonstrate physical phenomena — an area that allows designers to incorporate "perceptual affordances" into their exhibits. Perceptual affordance is a term first used by the psychologist James J. Gibson (1982). He believed that experience — not memory — lay at the root of much of perception and viewed perception as the ability to operate in an environment. The "total experience" he wrote about is entirely consistent with Exploratorium exhibits — requiring movement through an environment, touch, sound and balance as well as sight, and the opportunity to experiment.

Gibson believed that light enters the eye in an inherently meaningful code, reflecting categories which naturally exist in the environment. Perceptual affordances are one such category: objects that invite interactivity. According to Gibson, stairs afford climbing, a chair affords sitting, a level surface, such as a table top, affords laying an object on top of it. Rather than relying on memory, our perceptual system tunes in to affordances just as a television tunes into a channel.

Affordances explain why Exploratorium designers don't have to worry about their audience — their exhibits take advantage of low level perceptual processes common to all people. And because the interaction is experiential, museum visitors can consciously consider goal setting. (This may explain why quiz exhibits seem disappointing in comparison.) One limitation is that affordances can only demonstrate concepts that are tangible — and may fit science exhibits better than exhibits on language, history or social relations.

But even in exhibits which use extrinsic motivation and require conscious consideration. The concept of affordances should play an important role — museum visitors should not have to consciously consider how to operate an exhibit. We've observed a number of exhibits that visitors cannot figure out how to operate. They try several things which fail to work and leave frustrated. Sometimes they tell others that the exhibit is broken. The usual museum response is to attach a label containing printed directions. Later visitors commonly ignore these and experience the same frustration.

Poorly designed interactive exhibits are like digital watches. There seems to be no easy, natural way to set a digital timepiece. The difficulty is certainly operational, not conceptual, we know what time is. Instructions may help, but they are a poor solution. If we look at an old-fashioned analog watch, we have no such problems. The stem affords turning, and it's simple logic that the hands turn in harmony.

A decade after Gibson's death, his theories remain controversial. But designers feel they are a useful way of looking at people's interactions with objects (Smets, 1989; Gaver, 1991). While user interface is not a central part of our work, we advocate taking advantage of affordances wherever possible and basing exhibits on structures which afford manipulation — cranks which afford turning, buttons which afford pushing, levers that affording pulling, etc.

Should designers be biased toward intrinsic motivation?

Thomas Malone strongly favors intrinsic over extrinsic motivation. "If students are intrinsically motivated to learn something, they are likely to spend more time and effort learning, feel better about what they learn and be more likely to use it in the future" (Malone 1980, 10).

In this study, we take a different position. As previously mentioned, attraction is a critical factor in exhibits — and visitors may not find all subjects intrinsically motivating. Also, numerous varieties of both forms of motivation can be found in the real world — not only in things like popular games, but in real world practices, like jobs, which have developed through centuries of cultural practice. We view intrinsic and extrinsic motivation as elements that exhibit designers should apply consciously to best advantage.

We would, however, add a cautionary note for designers who choose extrinsic motivation. Screvin (1986, 114) states that some efforts to motivate viewers prove counterproductive, noting that three-dimensionality, novelty, gadgetry and manipulatory aspects can distract visitors from the main ideas, distinctions or story line of an exhibit. Extrinsically motivating activities need to be used in an applied way that promotes visitor attention to the subject matter.

Our approach to African-American children

African-American children should not just learn about their history and cultural practices — they need to gain an affinity for these things. They should gain a sense that careers which have historically been closed to them are within their abilities and reach.

In illustrating our model of interactivity, we've kept things straightforward and have chosen subjects which involve logic, science, linguistics and architecture, using African-American pioneers in these areas as points of departure for basic principles in their subject area. One reason we took this approach is that the contributions of African-Americans have generally been ignored by the museum community (Corrin, 1992). While we believe that social issues can be subjects for interactive exhibits, we have left this as a topic for further research.

Conclusion: the model as a design tool

An essential part of the exhibit design process is visualizing different forms that a basic concept might take. The model for interactive exhibits described in this paper might help with this process. Our model does not work like a recipe book, it's more like a map when you're out for a Sunday drive, it tells you where you can go, but leaves it for you to decide when you've found a neat place.

The model allows you to ask questions such as: What form could my concept take if the motivation were intrinsic? Could I add extrinsic rewards as well? Would the challenge in my concept be more appropriate as a quiz or activity? Is the subject and activity behind my concept expressed best through an experiencial mode or by conscious consideration?

Obviously, the world of interactives is not as simple as three sets of polar opposites. There are grey areas between all three dimensions of the model. At the same time, the components of the model are invariably combined within real exhibits. Good exhibits do not happen by accident. We advocate a simple, memorable model as a way of recognizing the design possibilities inherent in interactive exhibits. We present concept sketches as examples because we believe our model of interactive exhibits may be most useful in the early stages of exhibit development. We realize our sketches must undergo many refinements involving design for interaction, learning and fabrication before they will function in a museum environment.

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Leif Allmendinger is an associate professor of visual communications at Northern Illinois University. His areas of research include visual human-computer interface, interactive exhibits, interactive diagrams, educational software and software documentation. He is a board member of the Graphic Design Education Association.

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inclusive

Abstract This article presents **issues raised in designing an interactive multimedia software interface as a teaching aid for an inclusive preschool user group.** Issues such as: message variance caused by the disappearance of information when media access varies by user; finding commonalities across a broad user base out of which to build viable interface metaphors; among others, are presented within the description of the project team's approach to human computer interaction design. The software project is a cooperative project between East Carolina University School of Art's Environmental Design Program and School of Education's Remedial Education Activity Program, an inclusion preschool open to children with all levels of motor, sensory and cognitive ability, including typical children.

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Visible Language 32:1
Twarog, 200-213

Inclusive Interaction: Ability Enhancing Multimedia Design

This article presents a multimedia software interface currently in development between East Carolina University (ECU) School of Art's Environmental Design Program and the School of Education's Remedial Education Activity Program (REAP), an inclusion preschool open to children with all levels of motor, sensory and cognitive ability, including typical children. The interface project is presented as one example of designing interactive multimedia (IMM) software for children with special and typical needs, which raises issues such as: message variance caused by the disappearance of information when media access varies by user; finding commonalities across a broad user base out of which to build viable interface metaphors; and others presented in this article.

Kim Braddy, REAP Lead Teacher, articulated a need for software with which non-reading children could begin to learn the associations of words with actions. Vocabulary building interfaces existed to teach nouns and objects, and many more have been produced with young readers as the intended user group, but in her opinion there remained a gap regarding a clear and successful digital presentation of action-word concepts. Upon further investigation we both agreed that among action-word concept teaching software, a much larger void remained (in part due to issues explored later in this article), for digital interactive multimedia products whose intended user group was preschoolers including chil-

1 A survey of multimedia software products in this or any domain could never be thorough given that new multimedia products are constantly being created whose scale of geographic distribution and availability vary greatly. For the injustice done to artists, designers, developers and thinkers working in this area, of whose work I was unaware, I respectfully apologize.

dren with special needs.[1]

We defined the generation of such an IMM teaching aid as our project goal adapting the abilities and needs of current and future REAP students and instructors as representative of our user group. Our project team would include: Kim to inform issues regarding teaching action-word concepts to preschoolers in this inclusive user group; REAP Director Dr. James Taylor for Special Education expertise, product review, enthusiasm and encouragement; interested ECU Environmental Design students as multimedia artists and interaction designers; myself as interaction designer.

Our user group would not include all preschool age children. Digital multimedia software interfaces have certain prerequisite skills for navigation, even if motor skills capable of manipulating input devices could be assumed, which in our case they would not, there are other sensory and cognitive skills which could not be assumed representative of all chil-

education

dren, specifically among children with profound or perceptual disabilities. **We identified our user group as children with cognitive development levels representative of typical children from about two to four years old. Some characteristics of the early part of this stage include: a rapidly increasing receptive vocabulary, an understanding of two-word semantic relations and an understanding of action-word concepts.** Toward the latter part of this stage students exhibit skills such as: the basics of sentence grammar, syntax and moving from a semantic base to sentence grammar (Prizant and Bailey, 1992).

Children just entering this stage of development would not be expected to possess all of these skills and may be continuing to hone skills from what Piaget referred to as the sensorimotor stage of intellectual development. He defined the sensorimotor stage as progression through six successive stages of intelligence concepts pertaining to object permanence, means-end relationships, causality and spatial concepts. The tasks being attempted by children in their growth during this stage are (Robinson and Robinson, 1978):

1 visual fixation
2 visual tracking
3 sound localization
4 object grasp maintenance
5 visually directed reach and grasp
6 prerequisite object permanence skills
7 simple object permanence problems
8 complex object permanence problems
9 systematic repetition
10 development of attached tool use
11 use of separated object as a tool
12 development of operational causality
13 localization of objects in space
14 examining and relating to objects
15 container play

A user of instructive software interface products must possess several of these skills in order to provide for a rich, or even a functional, learning experience. Handling simple input devices such as: mouse, keyboard style devices and touch pads, require somewhat developed motor skills while manipulation of a device in order to direct predetermined input requires comprehension and competence with many of these tasks. Students not having attained skills in all of these areas could be assisted in navigation of the interface while it aids in their development of some of these sensorimotor skills.

Utilizing language building software to develop sensorimotor skills would not be supported by some researchers or theorists. One objection to utilizing our software in this manner might be found in Bricker and Dennison (1978): "... the development of a symbolic system, in general, and the comprehension and production of a formal language system, specifically, are predicated on the acquisition of an entire array of prerequisite behaviors which develop during the sensorimotor period." Given the reliability of this statement we would expect that children or instructors employing our software as a sensorimotor skills development tool would find success possibly with some delay. Instructors employing the software for exercises with children not possessing accomplishments in all tasks associated with the sensorimotor stage may achieve results only with difficulty. According to this theory the interface would be expected to be most effective when employed in the teaching of action-word concepts to children with developed sensorimotor skills.

Charles Brainerd (1978), however, objects strongly to the notion of structured stages as whole entities or what I

might call quantum stages. In Brainerd's view the notion that a child must complete all skills in one stage prior to advancement to the next stage is faulty. He believes that a child at any given instant exhibits behavior characteristics which represent combinations of Piaget's stages. Feldman states that empirical

interface

evidence found in their tests in map-drawing problems supports this theory. For example, when given an exercise in drawing a map representative of a model landscape, children frequently exhibited skills from multiple stages.

Corresponding to the display of skills from several stages, the presence of novel skills and reversion was noted. A *novelty* refers to a leap ahead or demonstration of an advanced skill not typically associated with the stage at which a person is otherwise performing. A *reversion* refers to backward movement between the stages. Feldman (1994) explains: "Suppose, for example, that our novel element is *perspective of buildings.* What happens to the other elements that deal with say, perspective of trees, or of roads? What seems to occur is that the novelty has a strong pulling effect on other elements dealing with the same map-drawing problem or feature (in this case the feature cluster of *buildings*)."

Feldman's idea of gradual transition of forward moving developmental organization versus quantum advancement through complete stages seems to support a larger user group for a teaching aid including one that is IMM software based. Students at individualized skill levels of several stages have the potential for benefit from the teaching device, exhibiting greater ease with familiar learned concepts and being challenged by new concepts. The individualized nature of the student's skill levels could provide further benefit through interaction of paired students representing different skill levels.

"Positive planning also includes pairing children whose dissimilar needs might serve as motivation or reinforcement for the others in the group. If, for instance, one child has a physical limitation and cannot hold or manipulate curriculum materials, a child who has those skills should be considered for inclusion in the group. **This pairing is likely to build constructive interpersonal relations, establishing empathy in the physically capable child, while helping the child with the limitations to accept help when it is needed.** Conversely, the child receiving help must have an opportunity to give help in other contexts." (McKnight-Taylor, 1989)

An IMM software based teaching aid offers a unique opportunity for shared learning benefit through pairing. Students could take turns navigating or assisting each other with navigation and problem solving, providing an opportunity for the development of sharing skills. Navigation and task presentation could also be instructor prompted for the benefit of small groups if the monitor hardware, designed scale of graphics and the clarity and intensity of audio could support greater (than single-user to monitor) viewing distances.

As degrees of objectives attainment in teaching are often measured through testing and observation, the success of the design of any teaching aid must be similarly established. The teaching software, by definition, must be complete prior to use by any student, and as such cannot be informed by this testing. However, desired objectives must be set to aid in the generation of a coherent teaching tool and to aid instructors in the evaluation of its appropriateness in any student's instructional development plan. A unique feature of IMM teaching tools is the ease and speed with which they can be updated and revised following testing. It is imperative that multimedia designers allot time and resources to act on collected testing results by altering, improving and updating software as a final development stage. Only careful planning can make the testing and the software, worthwhile and effective.

The objectives of our IMM action-word concept teaching software are modeled after the four major objectives of a language training program developed by Bricker and Dennison:

1 On-task behavior
2 Imitation
3 Discriminative use of objects
4 Word recognition

A software environment provides an opportunity to control some environmental teaching conditions and consistency in repetitive tasks. On task behavior refers to a person's ability to develop focused attention relative to selected tasks. As the amount of time needed to accomplish a task is highly individual and expected to change with each student, we deter-

mined that task **specific time allotments would not be employed in the interface. In this way a child could utilize the time necessary for them to resolve the task.** It would be left to an attending instructor to observe excesses of time in task solving and administer further explanation as needed. Our interface would, however, employ a maximum timeout after which further digital prompting and explanation would be provided. During the delivery of this additional information, the task presented would be sustained in as original a manner as possible — the helping message would be an addition to, and not a replacement for, the assigned task.

Imitation refers to the child's ability to receive and reproduce the vocalizations and gestures of a model. A digital model offers the benefit of presenting a given example identically, each time it is summoned, or to offer the vocalizations and gestures in a variety of contexts for the purpose of building generalization skills. Digital models must be built sensitively to minimize the already present abstraction of anthropomorphizing screen images and computerized speech or object usage.

IMM software designers employ, among other techniques, two-dimensional images of objects as metaphors in task construction and presentation. This often requires the users of their products to utilize these metaphoric representations in a theatrically similar manner to utilizing the real objects. The profound exception is that the user may be employing comparatively different motor skills to manipulate an onscreen digital representation of an object as would be needed to manipulate the actual object. In such exercises the user must reference recollected experiences with real objects in order to make the onscreen representations meaningful. The discriminative use of objects objective, which is defined by: the child's ability to carry out specific activities with objects generally associated with the characteristics of the object (e.g., sitting on a chair), carries the most severe risk of confusion of all four objectives, due to possessing the greatest degree of abstraction.

Word recognition is defined by Bricker and Dennison (1978) as: an ability to associate meaningful auditory signals with appropriate events. While word recognition is the final objective, in the case of our IMM software, the associations of successful users need not be exclusively auditory and in the cases of some of our users, may alternately be sign-based signals. Our user group includes children who represent a

multimedia

variety of levels of speech production capability and communication modalities from verbal word generation to graphic symbol selection or identification.

We include a fifth objective as articulated by the REAP instructors motivated by observations in the classroom — the children could benefit from greater skill development in the area of choice-making. Further discussion however, created concern that while a multimedia interface could certainly be designed to build choice-making skills, this facet of the interface should be transparent to a child with developed abilities in this area. We decided that choice-making skill development be included in the software but be designed in such a way as to vary by user.

These general objectives needed to be presented in a manner which would engage and challenge the users without overwhelming them. Haskell and Barrett offer some general guidelines for teaching children with learning difficulties adapted from a combination of Piaget's developmental stages theory and Skinner's learning theory which has been tested with typical children. Only those directly applicable to IMM design for inclusive preschool groups are presented here, which include: assessment; employment of incremental steps in task building; beginning with lower level skill tasks to ensure success; providing positive reinforcement; overlapping various sensory modalities in task presentation.[2] The employment of any instructional aid in the education of any individual student, must always and only be ascertained through careful and thorough assessment and program planning, on the student's behalf, by a careful and trained instructor. The assessment of each student's cognitive, physical, emotional and perhaps social strengths and weaknesses is essential to the development of a programmatic instruction plan upon which the decision to

2 The remaining guidelines more specifically inform techniques not achievable at this time by a software interface such as student performance observation, preliminary explanation to alleviate expected difficulties a specific student may encounter with a learning technique as supported by the observation of unsuccessful results using similar techniques, etc. Readers interested in these issues are referred to the original text from Haskell and Barrett, **The Education of Children with Physical and Neurological Disabilities**, 70. See also Hermelin and O'Connor, 1970.

employ a specific instructional aid should be based.

Providing encouragement and proper pacing through the interface should be careful considerations in the design of instructional software. Beginning with simpler tasks, with which members of the intended user group should be able to achieve success, can provide an encouraging springboard into more challenging task assignments. From these introductory tasks, intended to review and reinforce achievement more than teach new skills, the problems and tasks presented should advance incrementally in difficulty and complexity. The occasional inclusion of an earlier accomplished task concept presented in a new context, can be valuable to build generalization skills. Dunst discusses the benefit of presenting skills in a structured manner that is both horizontal and vertical, building generalization capacity and depth. Presenting skills horizontally refers to teaching a given behavior in a variety of situations, vertical refers to presenting a series of incrementally advancing skills (Dunst and Bartholomew, 1990).

In addition to presenting a task in a variety of contexts, tasks or modeled examples may be presented using a variety of overlapping sensory modalities. An expanded opportunity for clarity exists in the teaching of a new concept with IMM when the modeling of each concept stimulates multiple sensory modes: audio, static graphic illustrations or photographs, with diagrammatic or illustrative animation and captured video. While seemingly fundamental there are different consequences to presenting messages in multiple, overlapping, simultaneous media versus presenting messages, via distinct and exclusive media, simultaneously.

The question concerns which collection of events are occurring at a specific time, multiple messages each in an individual media or an individual message in many media. The latter method provides more opportunities for the user to both receive and understand the message, but with the risk of boring a user who comprehended the message at the outset. The former method provides a viewer, user or preferably interactor, an experience which builds in depth and complexity in what can be a symphonic manner. This is, however, provided that the interactor has sensory abilities with all of the media which are being employed by the IMM author. If not, then messages pass unreceived and the user is left either to guess at the gaps or confused. In this case, a sensory challenged user

becomes disabled because their access to the information is reduced or eliminated. As Mitchell (1977) explains: **"Handicap is the unsuccessful interaction between users and their environments."**

Clearly the designers' goals for their product, in either case, do not include boring or disabling users, but these can be the consequences of early design decisions. A third solution is to design using the latter method but with transparency, that is allowing the user to disengage modalities which they find unnecessary. For example, an interface which communicates the same information via graphics, text and audio, presents the interface as an audio interface to users with low vision. Sighted users could be given the option of disengaging text or audio which they may utilize depending upon the difficulty of the material.

For our action-word teaching IMM interface, we choose a combination of the second and third methods — presenting each individual message in many media and occasionally employing disengagement options when appropriate

metaphoric

for a given task. The team felt that while full disengagement options were appropriate for older children and adults, given our age group, repetition would be useful and, if designed in an engaging and fun manner, the risks of boredom could be reduced.

"When we address the needs of preschool children, the use of chronological-age appropriate materials and of activities that do not infantalize or stigmatize the individual is not as critical an issue as it is when we address older individuals with severe disabilities." (Bailey and Wolery, 1992)

Bailey and Wolery identify that interventions should be designed to build upon childrens' current interests and activities. For this reason we choose to design around a first batch of action-word concepts in order to aid in the design of an interface metaphor appropriate for our user group. Later we could expand the metaphor to include other action-word concepts. The first batch would be *running, swinging, jumping, throwing, sitting, eating, drinking.* As we began to sketch we decided that they could be appropriately presented in a consistent manner within a digital playground environment. This

graphic and audio digital playground would include spaces for each activity with children already engaged in an action in each space. In this manner, the activity or the action would be an icon for itself as opposed to an abstracted generalized icon, for example shoes to represent running. In our interface running children would represent running both audibly and graphically.

Decidedly the greatest abstraction with which our users must grapple is that our playground is being represented on a computer, utilizing graphics and sound for presentation and navigation. For this reason we feel that the software should contribute to a learning plan designed to teach action-word concepts and not be employed as an exclusive measure in this area. The addition of metaphoric icons for this age level would add another level of abstraction. Designing the graphic and audio representations of activities to be representations for themselves removes this extra layer, leaving the skill of translating the action or activity into a word as the only other abstraction with which the user must grapple.

The digital playground offers familiar terrain for a preschool user group. A child enters a real playground and sees activities occurring there. Surveying available options, a decision is made and the child proceeds to engage in, or join in the case of an already occurring group activity, the activity. Upon approaching the chosen activity, it becomes for them a point of focus. All other activities are less apparent.

Our digital playground, would be designed to function in much the same manner. In our mockup the child would survey the available activities which would be presented visibly and audibly. They would hear and see all of the activities taking place on the screen. Clicking on an activity area with a mouse or other input device would engage this activity and access tasks associated with vocalizing the word, making finger signs and engaging audio and video of other living creatures engaging in the activity. A user with low or no vision would hear the activities taking place as a sort of collection of ambient sounds and could survey each of the activities in a linear fashion with the numeric keypad or the arrow keys, engaging the chosen activity by pressing the spacebar.

If a long delay occurred because a child was unclear on what sort of next step they may have available to them or they became distracted, then a digital playground friend would appear to advance toward them and with: actions, directional gestures focusing on various activities and audio, invite them to investigate one of the available activities. The playground friend would also provide interface navigation-aiding prompts if there was no response.

Utilizing these techniques we hope to create an interface which utilizes the extended sensory environment of multimedia to offer the user overlapping, simultaneous, multisensory messages to aid in the teaching of action-word concepts and present them with the tone, action, voice and prompting, fun environment of a playground. At this time our IMM software yet remains far from complete but as it progresses we depend upon previous, current and future testing to influence its design in hope of generating a competent product to assist instructors of preschool children in the teaching of word associations. As we proceed in this direction we are reminded of the gravity of our real challenge: The learning of action-word concepts by the students.

symphonic

"...we cannot say that they have learned it until they demonstrate that they can quickly try another viable solution (fluency), or until they continue to do it after we have stopped teaching it (maintenance), or until they have demonstrated the ability to discard unsuccessful solutions and select alternatives for many different types of problems and in different contexts (generalization)." (Bailey and Wolery, 525)

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inclusive education interface multimedia metaphoric symphonic **playground**

Abstract

From the computer-mediated realms of on-line "chats" to immersive virtual reality (VR), the experiential aspects of cyberspace generally, and VR in particular, seems to confound description and provoke discourses revolving around issues of identity, human agency and the body. These experiences both reify and disrupt boundaries between the "real" and "virtual" worlds. Screen-based multimedia often assumes the user is in a fixed position, capable of interaction on a limited basis. Thus, there is little or no need to represent the user - he or she is simply a point-of-view, able to interact through a simple representation of a mouse or multi-participant cursor. In computer-mediated worlds, which range from text-based MOOs and graphical chats to three-dimensional and immersive VR, the user must choose an avatar to define and distinguish herself as a discrete entity. Thus, avatars are the very site where a user brings, modifies, problematizes and constructs a sense of self as distinct from others. Yet, the avatar is a representation, a simultaneous "I" and "not I." Avatars, broadly defined, may range from textual representations to graphic, or much less often, aural representations. This paper examines notions of subjectivity as they relate to users' experience, particularly through their representations, or "avatars," as a technological intervention in subjectivity.

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Virtual Avatars: Subjectivity in Virtual Environments

Diana J. Gromala

Introduction

Students in an English class spent untold hours in a fictive, on-line world they created, inspired by the writings of William S. Burroughs. They continue to create and participate in this world, long after the class ended, creating a community which includes the instructor as only one of many participants.[1] The case of the "Rape in Cyberspace"[2] generated hotly contested debate in academic discourse, engaging a community of scholars from computer science to the humanities, and inspiring articles in the popular press, to the degree that it has assumed the stature of cultural myth. The incident occurred in an on-line virtual community, with the victims and perpetrator(s) acting through their textual representations. Thousands regularly queue up in long lines in order to experience mere minutes of immersive virtual reality (VR). Unable to immediately deliver upon promises alluded to by extensive media coverage, VR seems to have been a passing fad; yet the entertainment industry, among others, continues to heavily invest in this area. New simulations are developed, affecting some users so profoundly, it is said, that they weep.[3] The popularity of non-immersive virtual worlds, such as on-line social "chats" continue to surprise industry analysts, who banked on home shopping applications, rather than social spaces, to drive the growth of online use.

From the computer-mediated realms of online "chats" to immersive VR, the experiential aspects of cyberspace generally, and VR in particular, seems to confound description and to provoke discourse revolving around issues of subjectivity, human agency and the body. These experiences, it is argued, both reify and disrupt boundaries between the "real" and "virtual" worlds, allow users to engage multiple and unexplored aspects of the self, and create a profound shift in the way we understand and experience self, body and technology. How do the sustained experiences of computer-mediated communication in general, and the specific use of "avatars"

1 Dalgren, the text-based multi-user domain, object-oriented (MOO), is "an electronic community devoted to the exploration and criticism of virtual reality and postmodern science fiction." It was initiated and is maintained by students of Professor Steve Shaviro's class at the University of Washington. telnet://dahlgren.washington.edu:7777/

2 The incident occurred in one of the oldest, heavily populated, text-based virtual environments, LambdaMOO. telnet://lambda.xerox.com:8888/
Refer to Julian Dibbell, "A Rape in Cyberspace or How an Evil Clown, A Haitian Trickster Spirit, Two Wizards and a Cast of Dozens turned a Database into a Society." Mark Dery. editor. 1994 **Flamewars: The Discourse of Cyberculture**. Durham: Duke University Press, 237-261.

3 Reported by the creators of the immersive virtual environment, Osmose: ". . .the after-effect of immersion in Osmose can be quite profound. Many individuals feel as if they have rediscovered an aspect of themselves, of being alive in the world, which they had forgotten. http://207.68.137.9:80/softimage/frameless/News/Events/Osmose/osfront.htm

— virtual representations of a user — function in regard to subjectivity? What are the limits of these new opportunities for technologically-mediated experience, how do they affect users' perceptions, and what do they suggest about users' subjectivities? This paper examines the use of avatars as a situated discourse, a specific site of technological intervention in subjectivity, in the realms of text-based virtual communities, two- and three-dimensional chats and immersive virtual reality.

Screen-based multimedia often assumes the user is in a fixed position, capable of interaction on a limited basis. Thus, there is little or no need to represent the user — he or she is simply a point-of-view, able to interact through a simple representation of a mouse or cursor. In computer-mediated multi-participant worlds, which range from text-based MOOs,[4] graphical and three-dimensional chats to immersive VR, the user must generally choose an avatar to define and distinguish herself as a discreet entity. Thus, avatars are the very site where a user brings, modifies, problematizes and constructs a sense of self as distinct from others. Yet, the avatar is a representation, a simultaneous "I" and "not I," through which human agency is projected and reflected back to influence the user's subjectivity. Avatars, broadly defined, range from textual representations to graphic, or less often, audio representations.

The role of the avatar in these computer-mediated realms is constructed and defined by the participant, but also by the nature of the virtual community and its participants, and by constraints imposed by the specific technological medium. Avatars in MUDs, for example, function differently from avatars in immersive VR. Further, avatars contribute to or impede a sense of immersion and degree of participation within the virtual world, a sense of bodily connection and a sense of self.

Finally, any discussion of subjectivity in relation to technology must take into account the larger cultural milieu within which it resides and operates. This ranges from the ways in which avatars function and are understood as particular instantiations of technological intervention in subjectivity, to the culturally constructed presuppositions and perceptions of the participant. The act of viewing and participating in virtual domains, as well as the articulation of that experience, raises questions about the nature of culturally conditioned perception and conceptualizations of technology as it relates to the body and to the self.

4 MOOs, MUSHes, MUSEs and MUCKs, among others, are variants of MUDs (Multi-User Domains). These text-based, on-line virtual environments allow participants to interact in "real-time," or synchronously, as they type. The environment itself is described, responding to the participant, as he or she travels through it. Thus, if the participant types "enter elevator, go to ninth floor," the participant will then see text appear which describes the elevator ride and the appearance of the ninth floor. Likewise, "objects" may also respond to the user.

The following examination of subjectivity in relation to avatars will account for three types of virtual environments: widely accessible text-based MUDs, emerging two- and three-dimensional chats and the celebrated but relatively inaccessible immersive VR.

Text-based virtual communities

In text-based MUDs, participants may communicate with others by typing responses in "real-time," much like a textual version of a telephone conference call *(figure 1)*. Others may look up attributes of that character in a different part of the screen, even as they interact. Those who log on to the MUD but who do not directly participate are referred to as lurkers. During their voyeuristic time, lurkers do not define themselves as a particular character or role, but may often appear in a sub-screen, whose presence is thus knowable by all users. Although it is generally assumed that each avatar corresponds to an individual, several avatars operated by a single user may be simultaneously participating. Further, agents or BOTs — programmed units which function independent of a user, and which may be preliminarily indistinguishable from avatars connected to "real" participants — may be present and active. While seemingly a fanciful enterprise to non-users, thousands participate in these realms — for purposes social, entertaining, professional and educational — to a degree that merits consideration as a social and cultural phenomenon. In this textual symbolic realm, the avatar allows a participant to enter into and co-create the participatory virtual world, often exploring subjectivity in ways not possible in other realms. In *Life on the Screen: Identity in the Age of the Internet,* Sherry Turkle examines the effects on identity of participation in MUDs. Here, according to Turkle, participants project, express and explore multiple and parallel aspects of

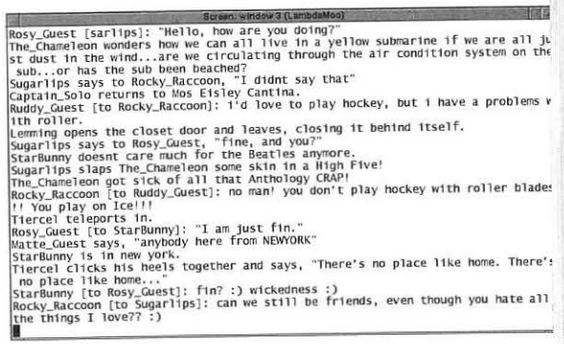


Figure 1. LambdaMOO is among the oldest and most populated text-based virtual communities. Thousands of participants regularly log in, choose avatars, and communicate through text. Words appear in "real-time," or nearly simultaneously, as participants type.

themselves. Because there is an on-going permeability between virtual and real worlds, and because the self is constituted through interaction with and through machines, Turkle argues that MUDs are unlike the theater, where one steps into and out of a role.[5] This allows us to conceive of the self as fluid, multiple and distributed, and represents a fundamental shift in the way we experience human identity. This in turn affects our ideas of mind, body, self and machines. Boundaries between real and virtual worlds are eroded, along with boundaries between animate and inanimate, human and machine, mind and body.

The boundaries between mind and body are among the most widely discussed. Discourses surrounding text-based virtual communities such as MUDs reveal the problematic conceptualizations of the body and its relations to technology and subjectivity. In the context of an avatar in a MUD, either the body itself is understood to not be present, though clearly (unless the avatar is a BOT), a body is operating the keyboard or the computer is viewed as a prosthesis, a technological extension of the mind and body whose boundaries are increasingly indistinct. The tendency to think of the mind and body as separate are further problematized by the widespread use of the term "disembodiment," used in VR to describe transcendent sensations and experiences, and by science fiction, which popularizes liberatory dreams of "downloading pure consciousness," leaving the problematic and expendable "meat" behind. Foregrounding these conceptions is the assumption that technology and subjectivity are distinct, which forecloses the consideration of technology and subjectivity as mutually constitutive, each intervening in the creation of the other. Two instances will serve this point further: the use of emoticons and the case of the Rape in Cyberspace.

Participants' avatars in MUDs may bear extensive textual descriptions, but the medium does not allow for certain aspects of an unmediated presence of the participant. Thus gestures, facial expressions, vocal intonations and other indications which serve to clarify and condition communication are represented, in MUDs, as text: emoticons[6] express emotion and gesture, the use of capital letters indicates yelling or screaming and numerous acronyms define specific conditions. This type of inscription, read by other participants, and in an interaction unmediated by technology, may provoke or produce bodily responses. This is most evident in "virtual sex," where the connections among the participants' body, mind, avatar and textual

5 The assumption underlying Turkle's argument relies in a certain conceptualization of the theater as a particular, situated cultural form, rather than broader notions of performance and performativity in the sense employed by Herbert Marcuse, Jean Francois Lyotard or other cultural theorists. For discussions of the wider conceptualization of performativity and technology, see Jon McKenzie, 1994. "Virtual Reality: Performance, Immersion, and the Thaw." *The Drama Review* 38:4, 83-106. See also Brenda Laurel, 1991. **Computers as Theatre**. Reading, Massachusetts: Addison Wesley.

communication become seamless. Likewise, an effective flame — an aggressive and unsolicited action — will produce a response affecting the mind, the emotions, the heart-rate and the blood pressure of the recipient.

The case of the Rape in Cyberspace often serves to illustrate the permeability of virtual and "real life" (RL), and to elucidate the limits of thinking in terms of mind/body and biological/symbolic dualisms. In LambdaMOO, the malicious Mr. Bungle used a voodoo doll to gain control of two participants' avatars and brutally forced them to perform sexual acts on him. When ejected from the room, Mr. Bungle continued his sexual assaults on others until he was finally "toaded" or ejected from the system and denied re-entry privileges (or what amounts to a virtual death of an avatar). One of the victims called for both "civility" and for Mr. Bungle's "virtual castration," a curious amalgam of "murderous rage and eyeball-rolling annoyance"[7] that indicates the complicated nature of the victim's simultaneous virtual and real life experience. Journalist Julian Dibbell recounts:

Where virtual reality and its conventions would have us believe that legba and Starsinger were brutally raped in their own living room, here was the victim legba scolding Mr. Bungle for a breach of 'civility.' Where real life, on the other hand, insists the incident was only . . . confined to the realm of the symbolic and at no point threatening any players' life, limb, or material well-being, here now was the player legba issuing aggrieved and heartfelt calls for Mr. Bungle's dismemberment. Ludicrously excessive by RL's lights, woefully understated by VR's, the tone of legba's response made sense only in the buzzing, dissonant gap between them.[8]

While those unfamiliar with MUDs might easily dismiss this incident, and the sometimes profound degree to which participants experience a sense of self through their avatars in the symbolic realm of MUDs, it is useful to consider other aspects of life which illuminate the transcursion between the "real" and the symbolic. The forging of a signature, for instance, or defamation of character which may occur in the media, also affect the social, political and economic reality of the victim. Or, in another example, a patient signed over all rights to the diseased tissue of a segment of his pancreas. This tissue was removed by doctors, who subsequently developed a patent and profited from his genetic material.

Mary Douglas, an anthropologist, examined the relationship of the biological and symbolic realms in order to understand the way bodies are culturally constructed, regulated

6 Emoticons are textual shorthand for emotions and gestures. Read sideways, the punctuation becomes pictorial. :) expresses happiness or a smile, :(expresses sadness, ;) represents a wink, and >:P depicts a tongue stuck out in anger.

7 Dibbell, Julian. 1993. "A Rape in Cyberspace or How an Evil Clown, A Haitian Trickster Spirit, Two Wizards, and a Cast of Dozens turned a Database Into a Society." **The Village Voice**, 21 December, 38.

8 Dibbel, "A Rape in Cyberspace..."

and understood. She argues that how a body acquires meaning and is able to signify involves a process of symbolic construction and change. "The social body constrains the way the physical body is perceived. The physical experience of the body, always modified by the social categories through which it is known, sustains a particular view of society. There is a continual exchange of meanings between the two kinds of bodily experience so that each reinforces the categories of the other."[9] Technology is necessarily implicated in the inextricability of the ways in which the social subject and physical body co-constitute each other, as illustrated in the examples just discussed.

While Turkle discusses how boundaries such as these are eroded through computer-mediated communications, she stops short of also describing how the very erosion of boundaries may also serve to concretize, maintain and reify those very boundaries, even as they fall. To define falling boundaries, post-structuralist thinking suggests, is also to continually keep them erect. The figure of the cyborg defined by Donna Haraway offers a potentially liberatory way out of this feedback loop. Haraway's cyborg is both a matter of fiction and a matter of lived, embodied material experience; a site for continually reorganizing boundaries; a figure that disrupts ideological constructions that are still regarded as incontestably natural. The subjectivity enjoyed by this cyborg is already always partial and contingent; it both finds pleasure in boundary confusion, but also takes responsibility for their re/de/construction.[10] Thus, the cyborg is understood as a perpetually emitting collection of material-semiotic vectors, simultaneously biological and symbolic, always residing within specific regimes of power and knowledge which embody and normalize social subjects, but always also capable of disturbing and contributing to their continual reinscription.

9 Douglas, Mary. 1982. **Natural Symbols: Explorations in Cosmology**. New York: Pantheon Books,

10 Haraway, Donna J. 1991. **Simians, Cyborgs, and Women: The Reinvention of Nature.** London:

Immersive virtual reality

Graphical, two-dimensional chats allow users to choose or create avatars with particular attributes in visual form. Most often these are human depictions, but because the environment can be fictive, avatars may range from animals and god-like figures to anthropomorphized inanimate objects, or elements like wind. Participants communicate through their avatars by moving them within the graphic environment with the mouse, by choosing the avatars' gestures and through inscribing conversational text which appears in a subscreen or in a cartoon-like balloon. Some three-dimensional chats, like V-

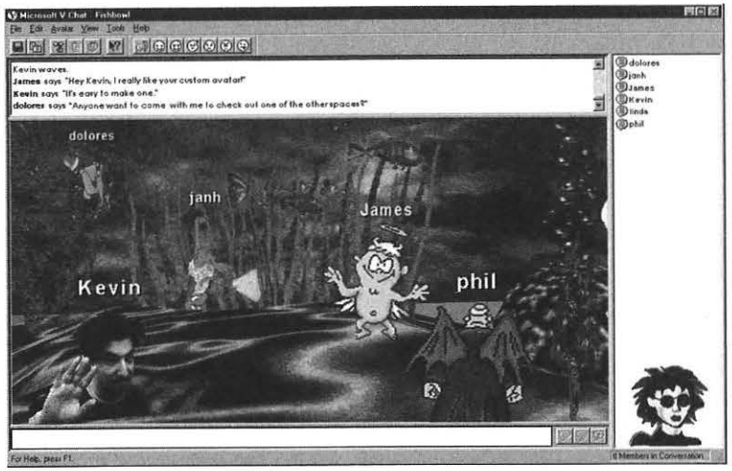


Figure 2. V-Chat is one of several emerging three-dimensional, online virtual worlds. Participants choose or create their avatars, which have several variants available through the gesture toolbar. These gestures are termed wave, smile, shrug, flirt and silly, along with be sad and get angry. Typed, real-time dialogue appears above the scene, augmented by "think, say, emote" indications. All participants are listed in the vertical window; they individually navigate their avatars through the three-dimensional space via mouse movements.

Chat (*figure 2*), allow users to construct their own avatars, mapped with a limited library of pictorial or photographic facial expressions and bodily gestures. Users' views of themselves as avatars becomes complex. More than one window is provided to show the avatar from a first-person point-of-view; another window allows the participant to zoom out as a camera might, showing the avatar from an angle behind and above, from the approximated perspective of others or from a more synoptic bird's-eye-view. Thus, the user is able to both see himself as if he were embodied in the avatar, and by "stepping out" of that avatar's form, may simultaneously view his avatar as other participants do.

Although participants in these virtual communities may choose or create, define and name their graphical avatars, the specificity of a more visually descriptive environment functions to both limit and possibly enhance the participants' sense of relation to their avatar. In a low-bandwidth medium like text-based MUDs, it is argued, much of the experience necessarily occurs within the participant's imagination and may thus more readily provide the participant with a sense of immersion.[11] As one student who participates in both textual and graphic environments put it, "it is like the difference between reading a novel and seeing the film adaptation." The sense of immersion within these fictive realms depends on the creator's abilities, but also upon the specificities of the medium, which in

11 Allucquere Rosanne Stone. 1992. "Virtual Systems." *Zone*, 615. Stone specifically refers to the low-bandwidth medium of phone sex in this publication, but relates it to text-based media in others. See 1995. **The War of Desire and Technology, at the Close of the Mechanical Age**, Cambridge, Massachusetts: MIT Press.

part influence how the reader or viewer understands and relates to it. In addition, the relative verbal, visual, and spatial skills or proclivities of the participant is a contributing factor in the construction, experience of and sense of relation to the avatar and to the environment. Participants who create photographic avatars of themselves often report an odd sensation of looking at themselves "in the mirror."[12] This phenomenon, along with the multiple points of view offered by some three-dimensional chats, seem to lead participants to experience their avatars as puppets at a remove, rather than as bodily extensions of themselves. However, habituation to these strategies of interaction and medium specificities often serve to reduce the sense of distance users report in relation to their sense of selves as avatars.

If our subjectivity is constituted by and through language, we must also account for both the textual and visual aspects of that language, particularly in graphical and three-dimensional chats. This necessarily assumes the socially constructed nature of perception,[13] which influences how the participant comes to knowledge and a sense of self through relating their avatars in specific ways. It also necessarily extends to other participants and how their communications are created and structured, as well as to the designers of these two- and three-dimensional chats.

Many of these designers are computer scientists, who create the virtual environments, including the systems that operate them, structure the methods of and possibilities for interaction and direct the artists employed to render their visual aspects. These computer scientists bring the particular biases of their discipline, which include aspects of the social sciences, but which are dominated by the assumptions inherent in scientific positivism. This can be most easily seen in their literature related to virtual chats, which belie a reliance upon existing, specifically western stereotypes, objective and measurable outcomes and standardizations of avatars. The literature rarely, if ever, takes into account the language, age, gender, ethnicity, sexual preference or class of participants, and does not acknowledge the ways in which the technology may profoundly affect the nature of this specific type of social discourse. The literature is prescriptive, rearticulating conservative, masculine myths and biases, particularly with relation to gender.

12 N. Katherine Hayles, describes a second mirror stage, the Mirror of the Cyborg, which accounts for a subjectivity not reliant upon physical boundaries. See N. Katherine Hayles, 1993. "The Seductions of Cyberspace," in **Rethinking Technologies**, Conley, Verena Andermatt, editor. Minneapolis: University of Minnesota Press, 186-188.

13 Burnett, Ron. 1995. **Cultures of Vision: Images, Media, and the Imaginary**. Bloomington, Indianapolis: Indiana University Press. Crary, Jonathan. 1992. **Techniques of the Observer: On Vision and Modernity in the Nineteenth Century**. Cambridge, Massachusetts: MITPress. Jay, Martin. 1994. **Downcast Eyes: The Denigration of Vision in Twentieth-century French Thought.**. Berkeley, California: University of California Press. Levin, David Michael, editor. 1993. **Modernity and the Hegemony of Vision**. Berkeley, California: University of California Press. Mitchell, W.T.J. 1994. **Picture Theory: Essays on Verbal and Visual Representation.** Chicago, Illinois: The University of Chicago Press.

The first instantiations of two- and three-dimensional chats[14] in particular reinscribes gender stereotypes, both in their form and effect. Although genderswapping is popular and celebrated as liberatory, for example, it relies upon avatars stereotypically gendered male or female. Participants describe the liberatory aspects of gender as more akin to changing clothes, without recognizing the way in which gender deeply structures the use of language, behavior and subjectivity. It is commonly understood that if the participant desires attention, he or she should assume a female avatar, whether because of or in spite of their smaller numbers on-line. To be taken seriously, however, the choice of a male avatar is necessary. While such gender-swapping may indeed offer opportunities for social and self-exploration, feminists point out that it is limited: a man using a female avatar can, at any time, simply log off. While the experience may be permeable from the virtual to the real world, and while he may enjoy the pleasurable aspects of being gendered female, it elides the experience of the more oppressive and disempowering aspects that are also part of this gender construction.[15]

In contrast to text-based and two- and three-dimensional virtual communities, the users' bodies are more directly implicated in immersive VR, and are capable of more types and ranges of interaction, extending to those not ordinarily possible in the physical realm, like "flying." The user's body is generally attached to a computer by trackers, which enables the virtual environments to respond to the user's ever changing position in the simulation, real-time movement and methods of interaction. In addition, the user's interaction within the simulation extends from simple navigation through it, such as walking through Virtual Venice, to complex interactions with responsive objects or characters. Further, because the possible interactions of users is complex, extending from the visual and auditory to the kinesthetic and haptic, their representation becomes a crucial aspect in their perception of cause-and-effect — how they apprehend the language of interaction strategies, particularly through their bodies — as well as navigational abilities, cognitive approaches and a sense of self.

14 Particularly the two-dimensional Habitat, and the three-dimensional AlphaWorld.

15 Allucquere Rosanne Stone. "Sex and death among the disembodied: VR, cyberspace, and the nature of academic discourse." In **The Cultures of Computing**. 1995. Susan Leigh Star, editor. Oxford: Blackwell Publishers, 254.

Two- and three-dimensional virtual communities

Immersive virtual environments currently require expensive computing equipment, and therefore are not widely available. A few of these environments are accessible as entertainment: "rides" allow groups to simultaneously experience and influence the simulation, but not as individual users. Most environments are limited to one or two participants, who spend no more than fifteen minutes in the simulation. Because each user in the simulation requires significant computation, multi-user environments are only now emerging. In early immersive virtual environments, the singular immersant did not choose an avatar, but experienced the simulation from a first-person point-of-view *(figure 3)*. Many of the early and familiar virtual environments of this type depended on navigational strategies through a head-mounted display (HMD) and a dataglove. Trackers attached to the HMD account for where the immersant looks and thus what she sees in the simulation. The dataglove, attached to the immersant's hand, appears as a graphic, disembodied hand in the simulation. The immersant is able to move forward by pointing an extended hand, stop by making a fist, and turn by pointing in the desired direction.[16]

Just as in text-based and two- and three-dimensional chats, it is necessary in emerging multi-participant VR for immersants to choose an avatar to define themselves as distinct from others. However, the nature of this medium offers opportunities to affect the immersants perceptions of themselves and of the simulation. In GreenSpace,[17] two immersants in Seattle met, within the simulation, with two immersants in Tokyo. Each was defined by an avatar comprised of a series of head-and-shoulder videograbs and a ping-pong like paddle, operated by a simplified dataglove. Each could speak with their voices spatially localized near his or her avatar. Unlike a three-dimensional chat, the simulation appeared differently to immersants in Seattle and Tokyo. All immersants viewed the same table, paddles and videograbs; however, the immersants in Seattle viewed these as situated within a traditional Japanese house with Mt. Fuji in view, while the immersants in Tokyo saw the surroundings as a log cabin with Mt. Rainier in view. Thus, some elements appeared common, while other elements of the simulation were unique.

In Brenda Laurel and Rachel Strickland's PlaceHolder, the very point-of-view of each immersant may function differently, altered according to the character chosen.

16 Other types of related environments which do not depend on attaching sensors to the user's body include "augmented reality" and "artificial reality." Here the user is inserted in the simulation through video compositing. Refer to Patti Maes, Artificial Life Interactive Video Environments, http://casr.www.media.mit.edu/groups/casr/maes.html; and Myron Krueger, 1991. **Artificial Reality II**, Reading, Massachusetts: Addison-Wesley.

17 GreenSpace was developed at the Human Inter Interface Technology Lab.

Figure 3. Osmose is an immersive virtual environment created by a team led by Char Davies. In this VR, a singular user is not represented in the simulation, but experiences it from a first-person point-of-view. The unique interface depends on the breath and balance of the immersant, a method derived from the scuba diving practice of buoyancy control. According to Davies, this allows the user to explore the self's subjective experience of "being-in-the-world," as embodied consciousness in an enveloping space where boundaries between inner/outer, and mind/body dissolve.
(1995 © Char Davies, Soft Image.)

If one chooses the snake, for example, that immersant's vision is changed to an anthropomorphized, "as-if infrared," physical actions are limited to ground movement, and voice synthesized. Likewise, if the Crow is selected, the user is able to "fly," and experience the concomitant vision and movement of a bird, with a different quality of synthesized voice. In both GreenSpace and PlaceHolder, the immersants' experience both vary and are shared within the shared and multi-participant simulation, affecting immersants' subjectivities, as experienced through their avatars.

Immersive VR in particular problematizes boundaries between mind and body, and between the biological and the symbolic. The common articulation of the transcendent state of sensation experienced in VR as "disembodiment" belies its most outstanding characteristic: the profound experiential dimension that seems to resist description and conceptualization, and which confound binary oppositions of mind/body and self/other. This is because more of the immersants'

bodily senses are very directly involved in the simulation, providing a multiplicity of sensorial feedback and cause-and-effect. This is particularly true of the proprioceptive sense of "being in the body." Because the immersant is simultaneously experiencing dissonant sensations from the simulation (flying) and from RL (gravity), users often describe what has been termed sim-sickness (or simulation sickness). Lag times in how the simulation appears to respond to the immersant add to a dissonance of experience. Sim-sickness reveals a simultaneity of experience, involving the difficulty of adapting to the conjoined experiences, resulting initially in dizziness and nausea. However, the immersant most often habituates or adapts to these dissonant inputs after a few minutes. The experience is multiple and simultaneous, only partially shared, not reducible to the VR world or the "real" world, yet necessarily implicated in both. Just where is the self and the body in relation to this disconcerting and simultaneous experience of being in and not in the virtual world, and how do they constitute each other?

The experiential dimensions of VR further provoke confusion in the relationship between bodily experience and subjectivity in the symbolic realm.[18] A fluid subjectivity can seem in some way to bodily inhabit or occupy the symbolic realm of VR. Because the technologically enhanced body or human sensorium is "joined in a sensory feedback loop with the simulacrum that lives in RAM, it is impossible to locate an originary source for experience and sensation."[19] Thus, the body, experienced as more viscerally "present" than it is in other fictive realms, is therefore seen to somehow circumvent our subjective relation to the symbolic. According to Jaron Lanier, for example, VR abrogates the process of entry into the symbolic realm, what he terms "postsymbolic communication."[20] Such resulting attempts to conceptualize experience in VR and to describe this VR experience as "disembodiment," however, only serve to reify the Cartesian mind/body split — a simultaneity of experience is denied — adaptation to simultaneous experiences of subjectivity in relation to the body and virtual and unmediated realities is disavowed.

Subjectivity then, mediated, constituted and reconfigured through experience in immersive VR and the larger cultural domain within which it resides and operates, is problematized: the experience is irreducible to subject/object, inside/outside, mind/body and VR/"real" world oppositions.

18 Gromala, Diane. 1996. "Pain and Subjectivity in VR." **Clicking In: Hot Links to a Digital Culture**. Seattle, Washington: Bay Press.

19 Hayles, N. Katherine. 1993. "The Seductions of Cyberspace." **Rethinking Technologies**. Conley, Verena Andermatt, editor. Minneapolis: University of Minnesota Press, 174.

20 As Katherine Hayles reminds us, Jaron Lanier's view that VR will supplant language denies the underlying assembly language of VR computation, as well as the formation of our sensibilities through language. Because our sensibilities are formed through language, Hayles continues, language pervades even nonlinguistic domains.

21 The French term "jouissance" may be translated as "extreme pleasure" and generally is connected to the pre-linguistic infant (that is, before it differentiates itself from others and the world). Also considered an experience which defies representation, sometimes associated with sexual pleasure, it is found in psychoanalytical discourses of D.W. Winnicott, Jacques Lacan, Julia Kristeva and Luce Irigaray.

22 Ronell, Avital. 1993. "Our Narcotic Modernity." **Rethinking Technologies**, Conley, Verena Andermatt, editor. Minneapolis: University of Minnesota Press, 59-73.

23 Deleuze, Gilles and Felix Guatarri. 1987. **A Thousand Plateaus.** Brian Massumi, translator. Minneapolis: University of Minnesota Press.

24 Merleau-Ponty,Maurice. 1995. **Phenomenology of Perception.** Colin Smith, translator. London: Routledge. First published in Great Britian by Routledge & Kegan Paul, 1962.

However, strategies for thinking within the contingent interstices between binary oppositions, and which serve to disturb them, reside in examinations of the conditions of jouissance,[21] Avital Ronell's notion of drugs,[22] and Julia Kristeva's exploration of the abject (I/not I). In addition, a schizophrenic subjectivity as described by Gilles Delueze and Felix Guattari[23] might rather provide an alternative to these dualisms by its nomadic embrace of shifting and contingent experiences. Finally, the phenomenology of Maurice Merleau-Ponty,[24] with its focus on the radical semiosis of the polymorphous lived-body, points toward alternative ways to conceive of subjectivity and the simultaneity of experience which take into account the material and symbolic, both existential acts and perceptions, and especially, prereflective experience. Merleau-Ponty's work in particular allows for a rigorous method to examine the sometimes phatic apects of immersive VR.

Cultural domains

The sharable and otherworldly places of multi-participant virtual realms are sites where humans extend and project their agency — the ability to act upon, within and through the world — through their avatars, and in turn, are sites where subjectivity is problematized. At the same time, this subjectivity functions within the larger cultural domains within which the subject constructs a sense of self and sociability, and understands and relates to technology. Although it is impossible to specifically define users in this cultural milieu, the majority of them and the technologies themselves are dominantly western, and particularly, it may be argued, American and postmodern. The hyper-real and postmodern context as described by Baudrillard, Deleuze and Guattari, Jameson, Lyotard and Virilio, among others, is profoundly influenced by technology. The hyper-real, postmodern context is typified by a fluid and indeterminant subjectivity, disconcerting shifts in the time/space continuum, contentious and shifting power relations and free-floating signifiers — symbols which no longer maintain a referent, or are preferred over the thing they originally represented — on the level of the everyday. Technology is seen as a specific instance of power/knowledge which embodies and normalizes social subjects, yet it is not to be regarded as distinctly separate from or quite fully part of the human subject. Technology, power and subjectivity are understood to be dialogically and mutually consitutive.

While technology is understood to be powerful, defining instances of instrumental forces of domination, those very structures may be simultaneously disrupted through emerging contingent and hybrid subjectivities, such as those precipitated in virtual communities. Likewise, an unquestioning acceptance of the common rhetoric which demonizes technology — renders it in utopian terms — which reifies mind/body or biologocial/symbolic dualisms — works at the level of ideology and allows hegemonic forces of domination to work, influencing subjectivity at the level of "common sense." Rather than adhering to a demonization of technology or reacting to it by developing another, oppositional and totalizing theory, theorists like Haraway enjoin us to consider and embrace "the skillful task of reconstructing the boundaries of daily life, in partial connection to others, in communication with all of our parts."[25]

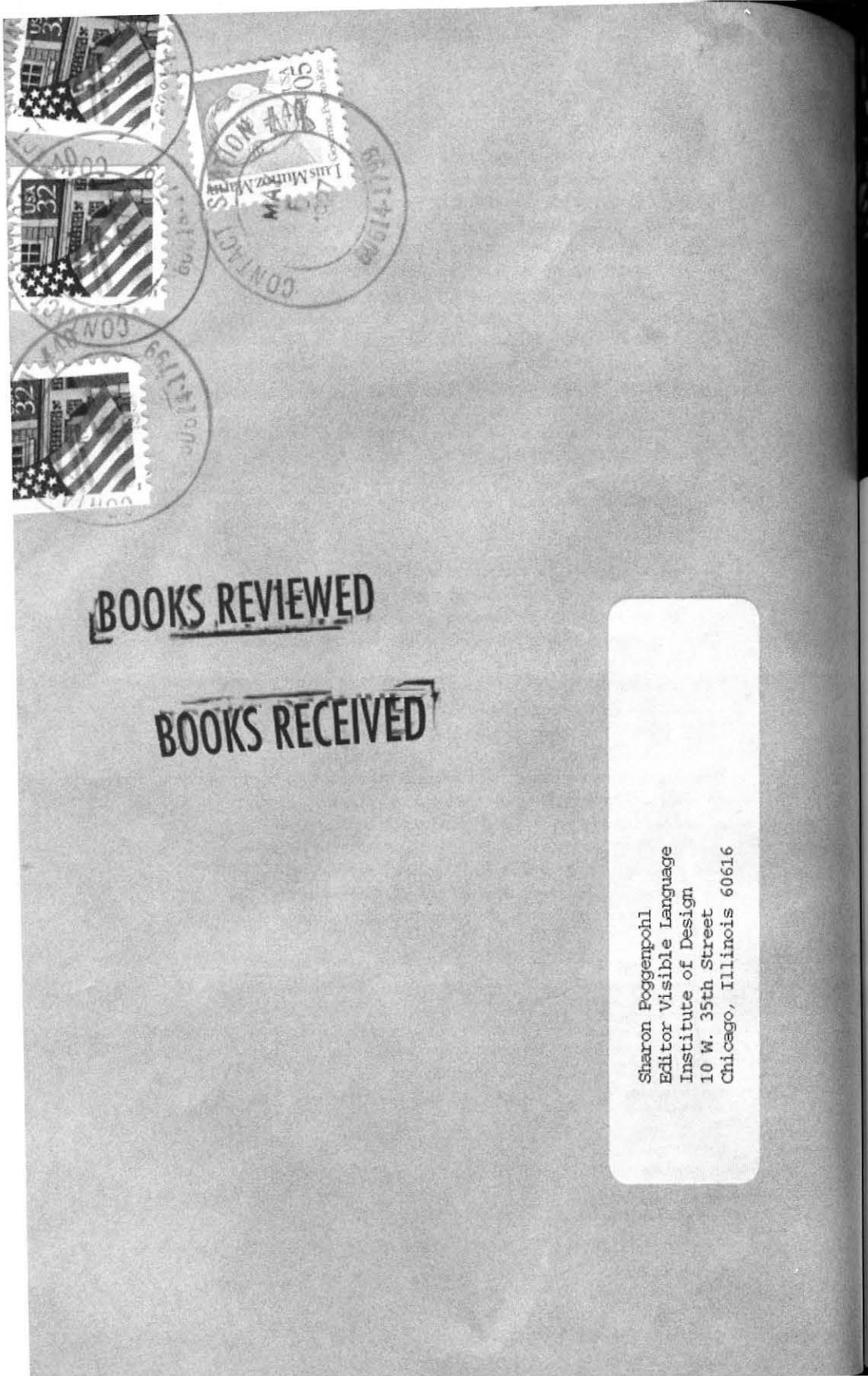
25 Haraway, Donna J. 1991. **Simians, Cyborgs, and Women: The Reinvention of Nature**. London: Routledge, 181.

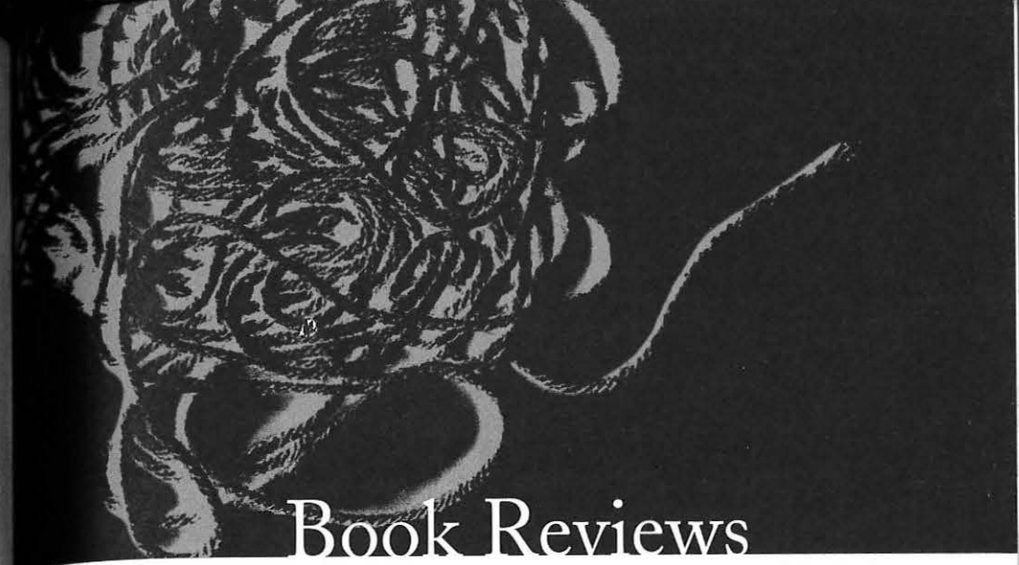
Conclusion

In the virtual realms of multi-participant MUDs, two- and three-dimensional chats and immersive virtual reality, an avatar functions as the site through which human agency is projected and reflected back to the user, influencing that user's sense of self. Through avatars, users experience both the reification and disruption of boundaries between the "real" and "virtual" worlds, between the mind and body and between the biological and symbolic. Understood as a particular instantiation of technological intervention in subjectivity, the ways in which an avatar functions necessarily include the culturally constructed presuppositions and perceptions that participants bring to bear in virtual domains. These operate both on the level of individual experience, and the level of the cultural domain within which it resides and operates, thereby creating a profound shift in the way we understand and perceive the complex interrelations among the self, body and technology.

Diana J. Gromala directs the New Media Research Lab at the University of Washington in Seattle, where she teaches courses in new media and virtual environments. Her work, at the intersections of virtual systems, culture and technology has been exhibited and performed internationally and is currently conducted at the Human Interface Technology Lab.

Acknowledgement
The author wishes to thank Toni Emerson, Director of Information Services at the Human Interface Technology Lab, for her extensive research contributions.





Book Reviews

Cybercities, Visual Perception in the Age of Electronic Communication.

M. Christine Boyer. 1996.
Cybercities, Visual Perception in the Age of Electronic Communication.
New York: Princeton Architectural
Press, 1996
245 pages, cloth, $19.95
ISBN I-56898-048-5

Cybercities is a collection of scholarly essays that explore the relationship between the space and expectations of a city user and the space and expectations of users of computer-mediated information. The author, an urban historian at Princeton University, refers to her essays as disjunctive assemblages of information that examine analogies, metaphorical associations and juxtaposition rather than essays based on rational argumentation. Throughout the collection the balance shifts from that of favoring an analysis of the effects of electronic media to focusing on city structure and its representation and the effect of all these on contemporary life.

The essays are cultural criticism. Each is fully referenced, exposing the source for the ideas juxtaposed or expanded upon within the discourse. Boyer draws on diverse authors — philosophers, film theorists, literary critics, art historians, computer analysts and futurists among others — weaving

the conceptual work of Gilles Deleuze, Jean-François Lyotard, Michel Foucault, Guy Debord, Sergei Eisenstein, Walter Benjamin, Marjorie Perloff, Barbara Stafford, Manuel Castells, George Landow, Nicholas Negroponte and William Gibson into her discussion. The discourse relies on the layering of sources and the shifts in perspective they encourage. Selection of telling examples for historical contrast, such as Fritz Lang's Metropolis (1927) and Ridley Scott's Blade Runner (1982), anchor the representation of cities and their abstraction in modernist and postmodernist modes, respectively.

This is a meditation on modernism and postmodernism based on the assumption "...that the machine is to modernism what the computer is to postmodernism." Among the questions asked within this text is one that deserves particular attention — how do technological devices alter our perception and direct our thinking? Early in the book the author sets the stage for this. "[There is]...the issue of willful agency — the matter of choice and control — over the construction and content of electronic communications. It recognizes the need to develop new modes of perception with which to receive, absorb, criticize, and produce new combinations of information. It examines the implications that the disappearance of reality as a referent and that the rise of the virtual entail."

If we accept that the foundation for modernism was set in eighteenth-century Enlightenment, then three centuries of scientific and technological discovery, many of which extend the function of the human body whether with energy or force, or by extending our senses, brings us to this particular moment. If we look at communication inventions alone we find that from 1816 with the invention of photography to now, we have dramatically increased our ability to collapse space and capture time. This alone is a fascinating story. Boyer dispatches these preparatory events quickly in order to better investigate our current situation.

The continuity of experience was broken, as time and space could be effortlessly sampled (at least from a consumer point of view), relationships that had been once stable were broken, and indeterminacy set in. It is analogous to the tightly argued and lengthily sustained political discourse of the nineteenth century (see Neil Postman's, *Amusing Ourselves to Death*), yielding to the abbreviated and highly mediated "sound bite" of today's so-called political discourse. It could be argued that the form of information is increasingly a product of technological media (as Marshall McLuhan did in *Understanding Media*). Curiously, McLuhan and his prescient ideas are nowhere referenced in these articles; yet media investigation and

technological criticism underpin much of what is presented here.

All the themes presented within the book bring the reader to ponder how one "knows" what one presumes to know — because the knowledge is second-hand, processed and mediated by someone else (for what purpose? with what intention?). The politics of repression are touched upon briefly when Guy Debord and his theory of the spectacle is discussed in the essay titled "Disenchantment of the City: An Improbable Dialogue between Bodies, Machines, and Urban Form." Debord presents a warning that things which were lived, i.e., previously experienced directly, are now representations that are not merely a collection of images but a presentation of social relationship among people mediated by images. Earlier Walter Benjamin understood that the spectator lost critical distance at any political spectacle (historically these were Nazi and Fascist extravaganzas) — the very process that integrated the viewer into the event legitimated the event and silenced dissent.

Images cannot escape a rhetorical bias. Selection, framing, size, contrast, value or color balance all direct the viewer to pay attention to something, implying that other acts, objects or events are less important, unimportant or even nonexistent. Technology is not neutral. Manipulation of images and media exposure and saturation are two obvious technological artifacts that alter our perception of reality. Image and technology in combination is potent, deserving serious scrutiny. This combination continues the process of expanding human sensory capacity which curiously both reveals phenomena, fascinating the viewer with both its pyrotechnics, and newly revealed information, while it simultaneously reduces human experience to something less than real.

The analogy between computer and city is one of organized space. What potentially connects the two are acts of wayfinding and identification along with the mental model we schematically build in our mind. What separates the two are the fact that one (the city) is experienced primarily in real life, but is layered with other media representations; the other (the computer) is experienced primarily as virtual, but with occasional real life touchstones. The author encourages us to think about both epistemological and practical issues residing between these two entities and our experience of them — for this reason the book is important.

Reviewed by Sharon Helmer Poggenpohl, a professor at the Institute of Design, Illinois Institute of Technology in Chicago, who is actively considering how new media alter our communication life.

A History of Reading

Alberto Manguel
A History of Reading
New York: Viking, 1996
372 pages, cloth, illustrated, $26.95
ISBN 0-670-84302-4

At a time when millenial fever has overtaken us with the publication of such books as Neil Postman's *The End of Education* (1995) and John Horgan's *The End of Science* (1996), it is a pleasure to read *A History of Reading* with its frankly celebratory tone. This is not to diminish either Postman or Horgan, who have written thoughtful books, reflections on our current situation and the future of learning and science. But as contemporary commentators, their tone is critical and sometimes dire. Yes, we are worried about the future of reading, not perhaps for the middle-aged or older generations, but for the young and the just learning, who may not be progressing sufficiently or are distracted by other more glitzy media before they truly encounter the pleasures of reading.

A History of Reading is a rather eclectic, even idiosyncratic history of a most liberating act. The book is a series of digressions that does not follow a chronology, rather it develops its ideas in historical context and through careful detail. It reminds us that reading is magical — that it has changed over time from a kinesthetic, rhythmic act involving the whole body along with the speaking of words to a meditative posture completed by a silent reading. Nevertheless many of us still enjoy being read to and reading to others, in this way we multiply our engagement with the text. In the section titled Being Read To, the Cuban cigar industry becomes a surprising example. It was mid-nineteenth century. Labor conditions were abysmal. Cigar making was a boring and repetitive job that engaged the hands but not the minds of the workers. Saturnini Martínez, cigar-maker and poet, decided to publish a newspaper for these workers, La Aurora. However, the low literacy rate among the workers made the publication inaccessible. Martínez approached the owner of the El Figaro factory with a proposition — let workers hear literature read to them as they worked. The owner agreed and the workers collectively paid for the reader. Other factories soon followed suit, but in a short time the Governor of Cuba realized that these readings were potentially subversive and forbade the practice. Nevertheless clandestine readings took place for a time.

The El Figaro readings demonstrate the author's eye for telling detail and his ability to put a human condition

into context — politically, socially, culturally — the better to make memorable and clear a reading event. The book is full of such telling illustrations.

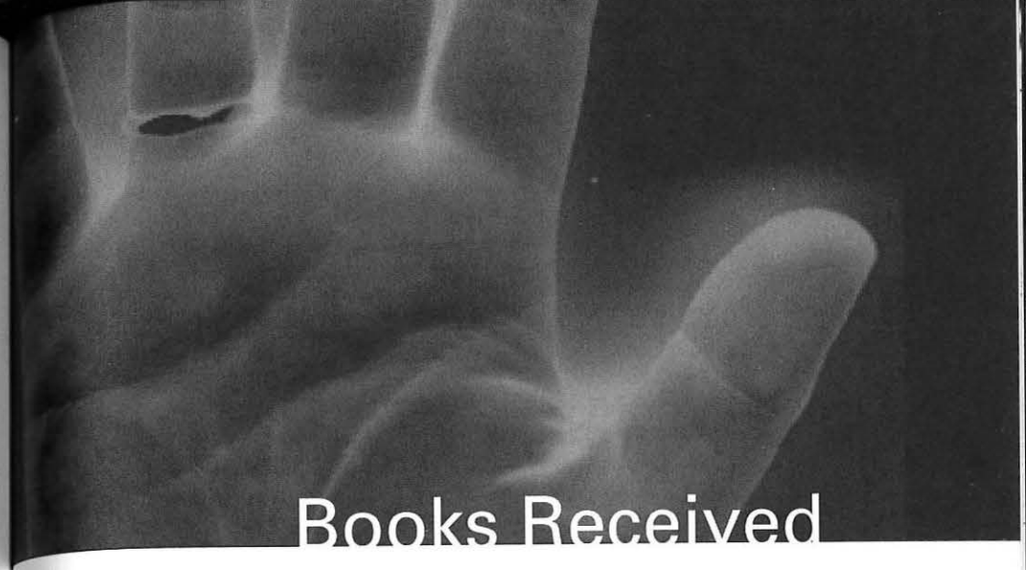
Reading is about access to information. In the section on Forbidden Reading, the author explores the attraction of forbidden reading and the secrecy involved in obtaining the skill and practicing the art. He reminds us that slaves in colonial America were consciously and forcefully forbidden to read. But some learned and passed the skill along to others. In this same section, he discusses the phenomena of forbidden books that were outlawed and often committed to the fire. The desire to control information and people's thinking is a demonstration of the power of books and the ability to read. One can't help but recall the Ray Bradbury story/movie *Farenheit 451*, in which books were banned resulting in individuals committing to memory complete books. The anti-heroine was drug-addicted and obsessed with interactive television. The dystopian message of this film underscores the power of books and literacy as it comments on the trivial nature of much broadcast media.

Alberto Manguel is at his best when he is speaking/writing from the heart. In the following example, he reminds us of the many ways in which we read. "We know that we are reading even while suspending disbelief; we know that we are reading even when we don't know how, holding in our mind at the same time, as it were, the illusionary text and the act of reading. We read to find the end, for the story's sake. We read not to reach it, for the sake of the reading itself. We read searchingly, like trackers, oblivious of our surroundings. We read distractedly, skipping pages. We read contemptuously, admiringly, negligently, angrily, passionately, enviously, longingly. We read in gusts of sudden pleasure, without knowing what brought the pleasure along...We read in slow, long motions, as if drifting in space, weightless. We read full of prejudice, malignantly. We read generously, making excuses for the text, filling gaps, mending faults. And sometimes, when the stars are kind, we read with an intake of breath, with a shudder, as if someone or something had 'walked over our grave', as if a memory had suddenly been rescued from a place deep within us — the recognition of something we never knew was there, or of something we vaguely felt as a flicker or a shadow, whose ghostly form rises and passes back into us before we can see what it is, leaving us older and wiser."

We don't yet know what form reading in the future will take — how this might expand our already extensive repertory of methods and reasons for the act. While some

might take the radical position that reading will become obsolete, supplanted by speech recognition of text and other media, this seems a doubtful position. Listening to an oral presentation in real time is far too inefficient when compared with the reader's control of time, interest and content through selective reading and skimming. What is certain is that we will read on screen an increasing amount of material. As more excellent information becomes available on the Web — see for example the Library of Congress site (www.loc.gov) with its reported 300,00 primary source documents — screen-based examination of text and imagery will only expand. However a book titled "The End of the Book" is not eminent, as Manguel points out in the section on The Shape of the Book. The variety of book sizes to accomodate personal reading and public display are impressive; they combine the tactility of a real object under one's physical control, while the weight loosely signifies a time commitment. The presence of an index suggests we can surgically enter the text based on our own interests. The human factors relating to typography on paper are historically well resolved. Its durability and portability are impressive. At a time when ever more digital information is rendered obsolete or "lost" due to changing operating systems and the relentless search for ever faster and more sophisticated processing — books deliver a comfortable and reassuring archival sense of permanence. After all, we have examples that have endured a millenium or more.

Reviewed by Sharon Helmer Poggenpohl, a professor at the Institute of Design, Illinois Institute of Technology in Chicago, who is actively considering how new media alter our communication life.



Books Received

Prints and Printmaking, An Introduction to the History and Techniques

Antony Griffiths
Prints and Printmaking, An Introduction to the History and Techniques
Berkeley: University of California Press, 1996
160 pages, paper, illustrated, some in full color,
$22.00
ISBN 0-520-20714-9

The reproduction of images has had a profound effect on visual culture, but often even those who are literate in art historical terms lack an adequate understanding of technique. Antony Griffiths, Keeper of the Department of Prints and Drawings at the British Museum, serves to redress this weakness. Clear technical explanations are complemented by visual examples shown as totalities and with telling details enlarged to show both the overall visual effect and the method. Printmaking techniques are put into historical context, through discussion and selection of various artists' works. A useful glossary and a commentary of reference sources for bibliographies of print and books about printmaking and the history of prints round out the book.

An Embarrassment of Misprints.

Max Hall
An Embarrassment of Misprints.
Boulder, Colorado: Fulcrum Publishing, 1995.
80 pages, paper, $9.95
ISBN 1-55591-202-8

The author, a former editor at Harvard University Press, is a confessed "type" watcher. While many typographical errors are merely annoying or messy, some alter or even negate the author's intended message resulting in confusion, humor or false statement. Using the following definition of misprint — "an alteration during the process of getting something into print that makes it different from what it was supposed to say," the author organizes a typology of misprints. Eight groups result including omission, malicious perpetration, insertion, vulnerable (easily mis-written) words, unreadable handwriting and the Devil among others. These groups are then illustrated with famous historical and contemporary examples, many of which are humorous. All who are engaged with language through reading, writing, editing or typographically preparing text for public dissemination will both cringe and laugh at the examples.

Six Essays on Design and New Media

Jessica Helfand
Six Essays on Design and New Media
New York: William Drenttel, 1995.
64 pages, paper, $12.00
ISBN 1-884381-09-X

Directed to graphic design practitioners and educators, these essays speak plainly about the challenges of new media. The third entry, The Pleasure of the Text(ure), is particularly thoughtful in its critical exploration of what multimedia conceptually promises and its as yet unrealized presentation. The author states one significant problem succinctly: "Experiential or informational? Multimedia . . . often aspires to be both, and the disparity between the inside (experiential) and the outside (informational) reflects an identity crisis that characterizes much of this industry." Media, sensory experience and interaction form the structure on which these essays rest. The author does not hesitate to exercise her critical perogative.

The Idea of Design, A Design Issues Reader

Victor Margolin and Richard Buchanan, editors
The Idea of Design, A Design Issues Reader
Cambridge: MIT Press, 1995
285 pages, paper, illustrated, $19.00
ISBN 0-262-63166-0

Twenty-three articles previously published in the scholarly journal Design Issues are represented here, organized into three sections: Reflecting on Design, The Meaning of Products and Design and Culture. Because there are so few venues for serious scholarship in design, this is an important book. The authors are interdisciplinary including designers, psychologists, sociologists and historians; they are international representing Japan, Germany, Canada, France, Italy, Hong Kong, India, Australia, Great Britain and the United States. The articles are thoughtful and sometimes provocative as the authors examine what lies beneath the skin of design.

Signs of the Times

Klaus F. Schmudt
Signs of the Times
New York: Graphis, 1996
160 pages, paper, full color
ISBN 1-888000-11-9

This is a beautifully produced book, designed to be looked at. The author has over decades of world travel documented the signs that identify, warn and direct us in our reading of the environment. The typographic variations come across exuberantly. But whether formal or informal, old or new, polished or with patina, the signs seem selected from up-town locations or nostalgic recreations of the past. The sun is nearly always shining and the weather is benign — these are vacation images. The result seems a bit superficial. Why no graffiti or night signs? Why no close ups of beautiful details? Why no long shots of distant jumbled signs? The book is beautifully produced, but curiously lacking in visual variety and control beyond what is given by the sign itself and the author's formalist vision.

Grow Your Vocabulary

Robert Schleifer
Grow Your Vocabulary
New York: Random House, 1995
230 pages, paper, $13.00
ISBN 0-679-74450-9

This is no vocabulary drill. Instead it is a systematic and analytical approach to understanding words through deconstructing and reconstructing English words based on their roots, which in combination with prefixes and suffixes account for much of the richness found in the language. The author points out that this is particularly true for learned and technical terms. It is easy to tailor the use of the text to focus on vocabulary development, understanding the fundamentals of English etymology or gaining knowledge concerning the classical Greek and Latin components of English words. The book is organized like a workbook with examples and exercises. It is visually organized for quick reference. The author's sense of humor is most apparent in a section on outlandish terms: pornocracy, bibliophagist, googolplex, etcetera. (I think if I ever need to invent a term, I will consult this book.)

Handwriting in America

Tamara Plakins Thornton
Handwriting in America
New Haven: Yale University Press, 1996
248 pages, cloth, illustrated, $30.00
ISBN 0-300-06477-2

In contrast to books and articles preoccupied with style, aesthetics and pedagogy in handwriting, *Handwriting in America* is a cultural history. Shifting meanings of letter form, learning discipline, social status and business utility emerge from a careful reading. But beneath it all run two themes: handcraft replacement with technological tool and the struggle between social conformity and individual expression.

Beginning with colonial handwriting, the author brings us to our present situation of deteriorating (some would say obsolete) handwriting skill and its replacement with keyboarding skills necessary at ever earlier ages to accomodate computer use. Along the way history is traced via handwriting touching on graphology, the conflicting status of form and content and the resurrection of various writing techniques.

Literacy and Script Reform in Occupation Japan

J. Marshall Unger
Literacy and Script Reform in Occupation Japan
New York: Oxford University Press, 1996
176 pages, cloth, $39.95
ISBN 0-19-510166-9

This book explores a little known experiment in the romanization of the Japanese language undertaken collaboratively by Japanese and American officials following World War II. The author provides historical information indicating that script reform in Japan was entertained as early as 1873 — the idea was not an American mandate. Statistical results of the Romaji Education Experiment (1948-1951) are reported as are teacher, student and parent assessment of the value of and interest in romanization of Japanese. The historical and political context in which the experiment was conducted is carefullly developed as well as the suppression of results. Language reform and typographic development of character systems have long been instruments of cultural and political domination — Unger's recovery of this experiment can be viewed through such a filter.

Design Innovation for Global Competition

The **Institute of Design** at the **Illinois Institute of Technology** is a world famous school engaged in preparing design planners and human-centered communication and product designers for the world economy of the twenty-first century. Based on lectures first delivered at the National Cheng Kung University in Taiwan in 1994, **Design Innovation for Global Competition**, is a fully bilingual book containing four articles which address key design issues in a global context:

Design and Global Competition by Patrick Whitney
The decline of national markets and the rise of global markets presents new opportunities for designers. Because of increased competition from companies which have different labor costs, access to resources, skills, technology and political contexts, it is much more difficult to plan. Design of new products that can help companies to be more competitive are presented in terms of: 1) rapid prototyping, 2) human-centered design, 3) design planning.

Cultural Human Factors by John Heskett
Cultural human factors, recognition of a society's learned behavior regarding social organization, patterns of object use and values in relation to design and global business, are this paper's focus. Problem areas regarding respect for cultural difference or the imposition of cultural change are explored with diverse specific examples from Euro Disney to British Telecom.

The Dilemma of Communicating — Globally by Sharon Poggenpohl
The problem and scope of global communication is explored with a focus on language use. The author argues that language needs to be understood as an enabling technology subject to both rational and evolutionary change. Attempts to create an international language are reviewed, including artificially created language hybrids like Esperanto and pictographic languages like the Olympic sign systems.

Design Innovation: Reforming the Development Process by Charles Owen
The changing business environment from WWII to the present is the context against which the changing roles of design and planning are cast. An integrated view of product integrity is presented, characterized by the need for a more dynamic and earlier entry of design planning into the overall business strategy, including: fast prototyping, human-centered design and systemic

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