ADDING VALUE—THE HYPERCARD SOCIETY OF MIND

In the commercial world, labors of love are a rarity; you do not invest money or time in a project unless what you can do makes it more valuable to someone. My disappointment with the outcome of my Psychology of the Particular datacase, coupled with the conviction that a well-designed hypertext facility would be essential for good progress in my further case study analyses, urged me to create another datacase where this structure would be an enhancement of the material. I had the material and the ideas needed at hand to create a digital biography, which I consider an extension of the notion of a datacase (see Cameo 4).

CAMEO 4. DIGITAL BIOGRAPHIES

Digital is the medium that encompasses and subsumes all others—but what is it for?

What uses or applications of digital media can we create that will fully exploit its potential in service of the deepest of human desires?

> Sin of self-love possesseth all mine eye
> And all my soul and all my every part . . . (Shakespeare)
>
> Each mortal thing does one thing and the same—
> Selves—goes itself; *myself* it speaks and spells,
> Crying *what* I *do* is me: for *that* I came . . . (G. M. Hopkins)

And each has a story to tell, the story of the life it has made.

Digital Biography

In *The City and the Stars*, Arthur Clarke described a world where people live, die, are reborn, and continue in this cycle through billions of years. In that world, the memories of an individual's past lives are restored to the reborn person after the 20th year. When, tired of living, one returns to the hall of creation to end the current life, the person reviews the memories of past lives, including the latest one lived, and chooses what will be saved for recall in the next reincarnation.

What Clarke imagined as a necessary part of that cycle of birth and death, we can undertake today—in the sense of editing this life's memories to reveal and illuminate what has been most important to each of us as an individual. Multimedia control, nonsequential text, simulation, animation, extensive memory, and quality video now permit individuals to begin to use the digital

medium in a nontrivial, essentially artistic, and deeply personal task—recreating one's own vision and experience of life.

Who would want to do so and why? Many people and for various reasons.

Who would pay?

- The *wealthy* first, for themselves.
- Then *organizations*, subcultures, even nations, wishing to honor their most distinguished members.
- Then *the technically adept* with access to limited resources.
- Eventually and more generally, *those able to use tools* that will be created as the activity becomes popular.

Typically biographers make books, but they rarely do justice to people of genius. For example, in a recent book *A Mind of Her Own*, a biography of the theorist of psychotherapy, Karen Horney, the author wrote a most engaging story, but as a study her story was severely limited. She told her audience about Karen, the person, but she left out Horney, the theorist.

Digital biographies, flexible enough to permit a reader to find the preferred depth, with components capable of function as well as presentation, can better do justice to the most remarkable among us.

What should be done? Where? Some digital biographies should be produced. It should be done in a place where the technical resources, local expertise, even closeness of subjects should minimize the external difficulties of such projects. The work should be undertaken by a person with the imagination to be excited by it, with the skills needed to begin, with experience in the study of lives, and with the tenacity that the very long time scale of such studies demands. Here follows an example of such an effort, centered on the MIT community, an effort that could be appropriately housed in the Media Laboratory.

A "family history" of the heirs of Wiener and McCulloch. In *Makers of the Modern Mind*, a popular biographical anthology ranging from Leonardo in the Renaissance to the giants of this century (such as Freud, Wittgenstein, Keynes), Toulmin (1972) wrote of Wiener and McCulloch in the final article that "we can still hear their footsteps echoing in the halls of MIT" (p. 483). They began one of the great intellectual traditions of the postwar era. Much can be recovered. Many of their students are alive and accessible; some would be delighted to offer an appreciation of others in the family. Their original texts can be made machine readable (especially those under copyright by MIT), and minimal simulations of their best ideas can be constructed by colleagues and students, who would profit as well as contribute by such participation.

What would be done with such digital biographies? For the individual as participating subject, digital biography would be an expressive act, an opportunity to render a vision of life and a sense of experience. For a biographer, it would be an effort of intellectual and social history. For society, one could think of

such as archives for today and resources for tomorrow. Understanding individuals as creators of ideas can help in understanding the ideas themselves and their subsequent modifications. To the extent that such resources can permit better access for students to the original work of important thinkers and agents—even with later added annotations for clarification and guidance—their availability may improve students' appreciation of the application as well as of the structure of ideas in a community as it grows through time.

What would be problems in publishing digital biographies? Publication separates into two issues: distribution and annotation. At any time, the limits on distribution would be technical (what hardware is accessible through which general access could be had), economic (who profits), and ethical (how does one deal with errors, misrepresentations, and distasteful truths?). The technical issues need not be confronted immediately—except that one would want to define specifications for or design a language for describing the relationships among the elements of the media in such a way that it would be only marginally dependent (if at all) on specific media or systems in which the biography would be instantiated. Economic questions would require negotiation as always.

The ethical questions would probably have to be dealt with on a case-by-case basis at first until satisfactory norms evolve. This is because the willingness of some people to share their views will depend on keeping secrets until their interests are invulnerable. On the other hand, if it is known that the truth will come out in the end, misrepresentations of various sorts would likely be minimized except by the chronically deceitful. This is where annotation comes to the fore, because it will permit a kind of secondary public dialogue where the annotator will not have to invest years producing "a work" to criticize mistaken points and argue against mistaken impressions.

What would be required to begin?

- The decision that such an effort is worthwhile.
- The agreement from possible participants that they would be willing to become involved in such an effort.
- The Media Lab would be the right place for it to be done.
- I could help start such an effort in a future visit to the Media Lab.

(June, 1990)

Motivation—The Scholar's Corpus as a Datacase

Marvin Minsky's (1986) book *The Society of Mind* was intended to be accessible to an audience of people interested in the nature of mind but not having any extensive technical training. In structure, the book is a collection of some 300

single-page essays, interrelated in a variety of ways.[20] My students usually had trouble understanding the relationships between the parts.[21]

In a discussion with Oliver Selfridge about ways to make ideas of *The Society of Mind* more comprehensible for my students, I suggested building a datacase on a collection of Minsky's more traditional academic papers as a foundation layer,[22] with the essays of *The Society of Mind* as the analytical layer integrating the ideas in those various papers, and with a modeling layer of the computational ideas represented by specific essays.

Selfridge pointed out that the proposal did not address the problem represented by my student's difficulty in appreciating the relationships between the essays. He noted he had found the best way to read the text was to consider it a semantic web and read the essays by starting with the index and taking series of "tours" through the web, following whichever sequence of index entries were most interesting.

What Was Done—Beginning the Minsky Datacase

Minsky made available to me a machine-readable version of his text with the index entries he had created embedded therein. With this and my file stack creation programs from the Psychology of the Particular, I had the beginning needed to make the 1990 Hypercard version of *The Society of Mind.*

The software environment for the datacase. Earlier work had been done by others to make hypertext versions of *The Society of Mind*, but the best of these required use of computers and software more sophisticated than those in the personal computer market. The audience Minsky had in mind for this embodi-

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[20] Minsky has mentioned in conversation that it was Stewart Brand who suggested he write up the text as a series of short essays. In 1980, I prepared a similar collection of single page essays titled "Some Powerful Ideas," (Lawler, 1982) as an attempt to popularize some of the educational and computing ideas that were extant in the MIT Logo Project. (These essays were serialized a little later in *Creative Computing.*) Having labored to produce my own 16 little essays, I could appreciate better than most the tour de force represented by Minsky's *Society of Mind.*

[21] It is possible to be critical of the *Society of Mind* for failing in its goal of persuading a popular audience of the value of artificial intelligence. A different perspective is worthwhile considering however. It could be the case that the audience for this sort of work does not yet exist—in the sense that there are very few people who are comfortable with reading where the structure of the text is more suited for a new medium than for a familiar one. As McLuhan (1962) argued in *The Gutenberg Galaxy*, a new literature is created in a new medium before that literature can attract an audience whose members eventually learn to understand it. I think that the *Society of Mind* is a work that will help create that audience by asking people to interact with texts differently.

[22] This collection of tradition articles would surely include a selection of Minsky's seminal papers. Done properly, the collection would include all of Minsky's AI papers. (See Cameo 4, for my view of what should be done to provide a foundation for such a work.) A smaller collection would presumably begin with "Form and Content in Computer Science" and "A Framework for Representing Knowledge" as points of departure and then include the papers on K-lines, on C-lines, and the unpublished long paper "Learning Meaning."

ment of his work was that cadre of young enthusiasts, collegiate and high school hackers, some of whom might get attracted to the work in machine-readable form and then begin to take the ideas seriously. Hypercard was proposed as the software environment because it was widely available for free.

The contents of the datacase. The essential content of the Hypercard *Society of Mind* is the text and index of Minsky's book, recreated in a different medium from the machine-readable files he supplied to his book publisher.

Indices in the Hypercard Society of Mind. The index was advanced as a navigation tool for reading the Hypercard *Society of Mind*. This is the method: Index entries were extracted from the text of Minsky's files and associated on a card record level with the text. The index entries were loaded with their text onto each card record, but into a separate field. The index entries were compiled by collecting them from each card, sorting them, and fusing identical terms into single index line items. The glossary originally appearing at the end of the printed text was relocated to the beginning of the Hypercard *Society of Mind* so that its entries appeared first in the index entries for any term so glossed.

One novelty introduced with this index was its distribution throughout the database. The value of having a distributed copy of the index was its providing the opportunity to follow every term indexed on a specific card record from any location in the database. This is what made it possible to use the index flexibly as a facility for following different threads of connection through the database.

Given the constraints of available display space, which required that text and graphics be alternately displayed on separate "display planes" on each card record, a third display plane was added for the indices of each card (see Figure 2.8).

The method of file construction. Because of the extensive collection of graphics supporting the text (supplied as copies of Minsky's original MacDraw files), a technique for merging separately edited files of text and graphics was required (see Figure 2.9).[23]

Project limitations and problems encountered. Using the Hypercard *Society of Mind* with my students made it clear they did not get much value out of the online version that could not have been found in the print version. One possible reason is that the interface was certainly not optimal; the index entries were presented in text strings followed by lists of numbers.[24] Minsky suggested introducing in some later version a graphical representation of the local index neighborhood; labeling the links in such a local semantic network (with text titles of the target card record) would be a further improvement. However, I think the problem was more profound than being simply an interface issue.

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[23] This was suggested to me by Mike Travers, a member of the MIT Media Laboratory at that time. His was the best of the earlier attempts to produce a hypertext *Society of Mind*.

[24] Thus the card record with the identification "SOM08.08" might appear in an index entry thus: K-lines: 08.01, 08.02, . . . , 08.08, 08.10.

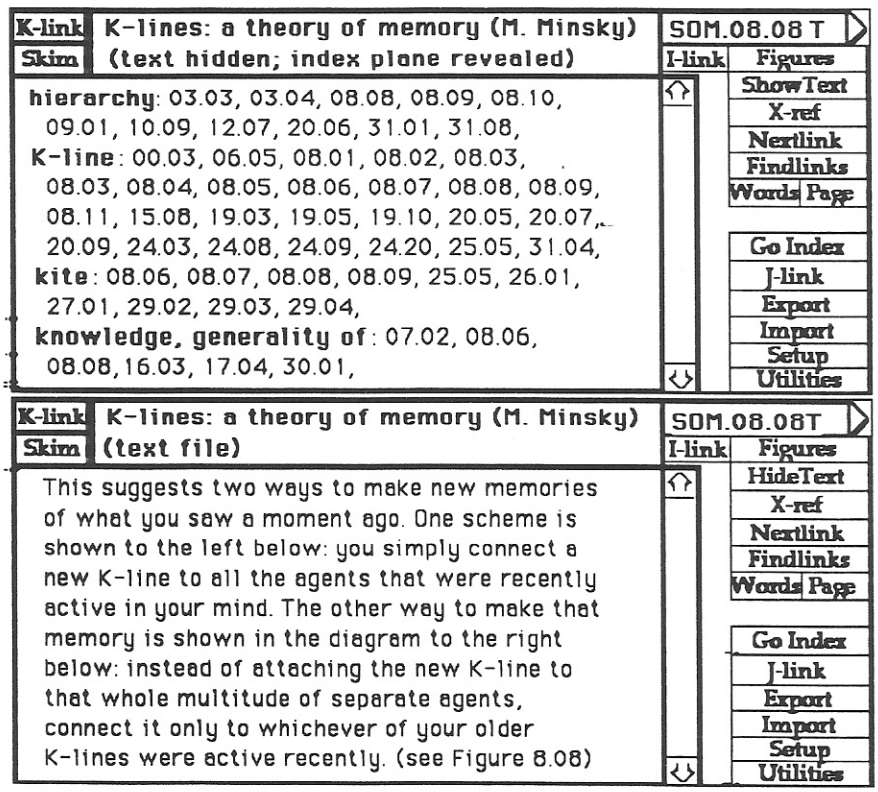

Figure 2.8. An index plane in *The Society of Mind*. The indices of the stack were extracted from Minsky's machine-readable text files. The specific entries were associated with the page of text in which they appeared and were compiled into a general index, which is stored on the initial card of the hypercard stack. For each card in the stack, its associated entries were then distributed throughout the database to provide local indices on each card for the terms there indexed.

What Was Learned

My students persisted in reading the Hypercard *Society of Mind* serially one page after another from front to back. In retrospect, what would have been useful for them was a facility in which they could construct their own indices, as they tried to make sense of Minsky's work; user constructability was an essential missing ingredient. In attempting to understand complex relationships, often it is less valuable to follow another's network than to create your own. But the specific implementation did not offer tools permitting that.

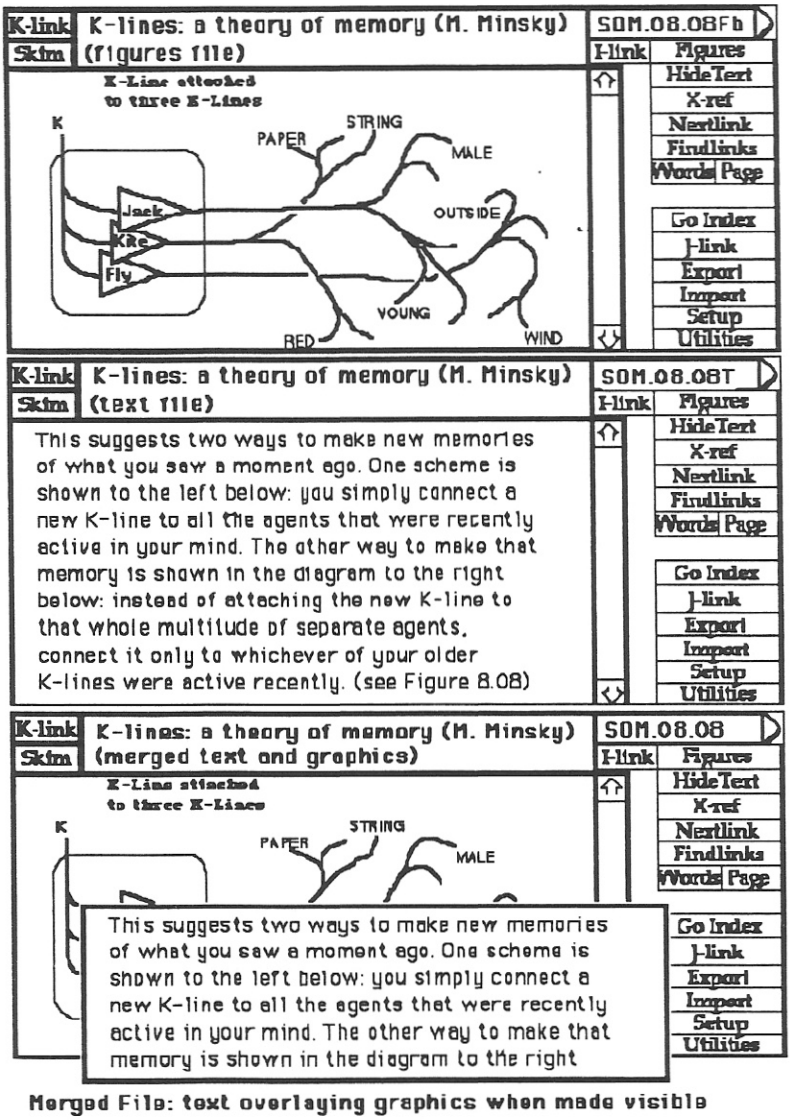

Figure 2.9. Graphics merge in *The Society of Mind.*

The central limitation of the *Society of Mind* Hypercard stack was similar but more profound. What is essential for making sense through appreciating relationships is being able to compare and contrast things, to put them in juxtaposition, and to mark those relationships. Not the things themselves, but their relationships and the transitions between them are essential in making sense;

that is why the *Society of Mind* (either in print or online) is hard for most people: Because there are so many relationships, and so many different places to go, readers do not know where to go next or what to make of the relationships.

Here was the problem through which I saw that Minsky's work itself might contain an answer to the problem his work embodied. One needed a new kind of hypertext link, one that would pull together into a unified whole different bits and pieces of information from various places, as the "learning structure" of his *Society of Mind* integrated partial states of mind into a new compound entity. The structure is called by Minsky the *Knowledge-line* or the *K-line*. I could see then that an analogous structure on a larger scale could be a useful tool for making sense of relationships of information in disparate computer-based files. I could see this structure as the solution to the problem presented by my vision of a Case Analysis Support Environment—that is, how precisely can one integrate information in a coherent and highly flexible fashion. Those applications that would have the greatest added value from use of such structures would be precisely those that require such activity as part of their essential challenge. The detailed analysis of case study material is for me the obvious choice for such work.

If I expect others to conduct later analysis of material I assemble, it seems only fair that I should look at the work of earlier analysts. Doing so is also one way to appreciate better the situation of a datacase user; I saw such a project as another step to creating a useful Case Analysis Support Environment for embodying and analyzing my own studies.

SECONDARY ANALYSIS—THE HARTLEY HALE DATACASE

One of my favorite personality psychology books, Robert W. White's (1975) *Lives in Progress*, is a thoroughgoing interpretation of case study materials. By good fortune, the corpora of those cases were accessible for my use.[25] They contain information about a subject known as Hartley Hale and an analysis of his long term development.

Motivation—Using Another Scholar's Corpus

The challenge of secondary analysis—the use of data by someone other than the collector—reaches its most acute form in the reinterpretation of individual-

[25] When he became emeritus at Harvard, White donated his corpora to the Henry Murray Research Center of Radcliffe College. I was admitted to the research center as a visiting scholar for several months during 1991. I remain grateful to the staff and scholars of that center for their hospitality and their helpfulness. I believe the Murray Center for the Study of Human Lives is a valuable resource for all those of us who are interested in the study of life outside the laboratory. In 1991, I also discussed with senior scholars of the Piagetian community (Inhelder, Sinclair, Voneche, Gruber, Cellerier, Papert) the possibility of similar work with Piaget's materials, but the responses were mixed.