AN EXISTING EXAMPLE—THE PSYCHOLOGY OF THE PARTICULAR

I already had available an alternative corpus with which to work, my first case study. Working with it had important advantages:

- I owned the corpus material.
- I had completed an extended interpretation of the information; that interpretation recently had been published in two books, *Cognition and Computers* and *Computer Experience and Cognitive Development*
- I had constructed some elementary models in Lisp of the ideas in the interpretations; such could be the beginning of a modeling layer.

Motivation—An Example to Work With

Because I had available for the earlier study at least parts of all the components needed to build a CASE, I made the strategic decision to build the facility using that example. The goal was to have the CASE environment available later to help with the interpretation of the infant study. The first part of that effort took longer than I expected.

In addition to the scientific impetus, I had a reason whose goad others might recognize. Academic authors are often frustrated in their relations with publishers; the two have different objectives in publication. Academics will probably never break free of bondage self-imposed by the values of their peculiar culture ("publish or perish, even if it costs years of your life and others profit from your labor"). There are some constraints from which scholars can break free, however. For example, because of production costs and constraints based on page counts, I had to delete an already-written, favorite chapter from *Computer Experience and Cognitive Development*. I did so to make room for long citations of the works of other scholars whose opinions and ideas underlay my work. We no longer need to make such decisions. The digital medium provides much greater capacity than print, if we can but figure out how to use it effectively.

As I looked at the publication in two separate books (Lawler 1985, Lawler et al. 1986) of related but distinguishable aspects of the same study, I decided it would be worth my time to try to make a single thing of the study that was really one long and unified intellectual effort. Thus was born my effort to create a datacase I call "The Psychology of the Particular." The effort was not one from which I expected to make any profit—except that of crafting a work that would respect the unity of ideas and effort that was the core of a decade of my research. That is profit enough for an academic.

What Was Done—Constructing a Three Layer-Datacase

Implementation efforts. After acquiring a Macintosh II computer in 1988,[15] I tried to develop a computer-based fusion of my materials in the two books. My ambitions ran ahead of Hypercard's hypertext capabilities at that time. It was clearly possible to develop Hypercard databases with sequential chaining from one card to another. To the extent that one invested time and effort in link label definition, and so on, one could mimic the typed links of Notecards. It was also very clear that Hypercard would undergo significant change. Therefore, a premature commitment to a given version of the system would lead to later compatibility problems. The obvious solution was to develop a system for textual materials based on a file load and save cycle , which I proceeded to do in Version 1 of Hypercard. The lower part of Figure 2.5 shows the three layers of a datacase as represented in exploded form by the materials of The Psychology of the Particular. My further hope, temporarily deferred, was to use this facility for exploration in modeling of these existing materials. I have some ideas on how to proceed with modeling of the more complicated parts represented by my developmental corpus (see Appendix C).

The contents of the psychology of the particular. The materials collected and embodied in The Psychology of the Particular (POP) is a corpus I call "The Intimate Study." This includes observations on my two oldest children over a period of 5 years. The materials of that corpus were interpreted over a period of years, leading to a number of intermediate papers and two books. The books *Cognition and Computers*[16] and *Computer Experience and Cognitive Development* are the backbone of the interpretative layer of this datacase.[17] There are two subjects, my son Robby and my daughter Miriam. Between the two books, there are four chapters focused on the boy and four chapters focused on the girl. The studies of the girl are much more detailed. There is also a long and detailed appendix containing additional test and school-related information about the girl subject.

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[15] Essential equipment to support this work was provided under the aegis of Barbara Bowen, then director of Apple's External Research Office.

[16] This book contains four chapters of my own with other work by DuBoulay and by Hughes and MacLeod. With respect to the books produced, they were significantly shaped by production constraints. The organization of books is determined in part by issues such as anticipated marketability and limits of the paper-binding process. Similarly, a few years ago digital books would have been limited by the medium capacity as well—imagine putting an encyclopedia on 440k diskettes. But today, encyclopedias fit easily on a CD-ROM with their graphics, indices, and plenty of room to spare. The capacity of the digital medium for large-scale hypertexts is a reality to be explored by those of us who have something to do that requires that very capacity and requirement for restructurability.

[17] The two books in Figure 2.5 intersect because one chapter, "The Development of Objectives," is thematically integral with both.

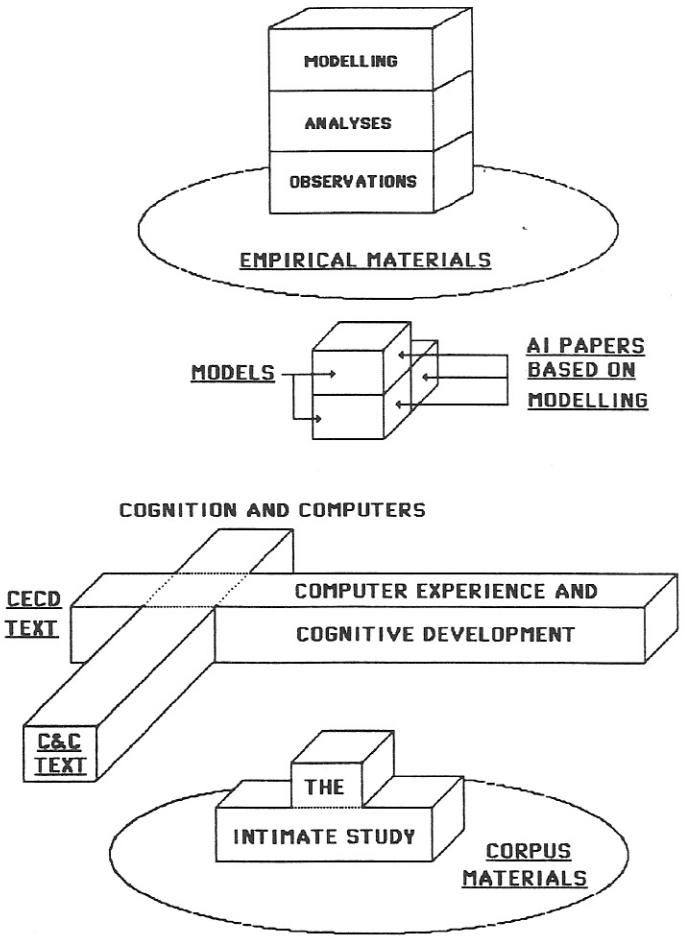

Figure 2.5. The psychology of the particular—A datacase.

The POP interpretation and cognitive modeling. A general statement of the significance of those observations and arguments is that Piagetian stages are emergents of computational processes of self-construction. The position is less a conclusion than an interpretive stance. The detailed characterization of the children, their context, and their interactions changing over time show that stance to be a ground for working problems more than a vacuous formal claim. Progressive cognitive self-construction, the integration of knowledge from different roots into new coherent wholes, and even the interplay of social roles and cognition are explored in these analyses. Beyond the interpretations presented in text, I forged for these materials of The Intimate Study a few simple learn-

ing models to explore the possibilities of modeling in a style grounded in the concrete details of observed behavior and documented within the corpus.[18] These models and the academic papers explaining the results comprise the third layer of The Psychology of the Particular. This assembly of materials then is the first embodiment of the notion of a datacase, as described in Cameo 3.

CAMEO 3. THE NOTION OF A DATACASE

Case study has long been recognized as a primary tool for exploration and theory development in the behavioral and social sciences. Given that case studies—in all their particularity and complexity—cannot be replicated, their most productive scientific use requires that case study materials be maximally available for secondary analysis. The enhancement of recording technologies during recent decades has made significant strides in permitting such secondary analysis. Comparable advances in the area of interpretation are required; such appear within our reach, if not within our immediate grasp, through the well-directed exploitation of computer technologies.

Exploiting Computing Technology for Secondary Analysis

The classic example of case studies used for the illumination of differently based interpretations is Robert White's *Lives in Progress*. White provided interpretations of three of his case studies based on the biological, psychodynamic, and social and cultural views of man. That work is a classic for psychological education, primarily because it so well illustrates the theories. White's corpora, on which *Lives in Progress* is based, exist in archives at Radcliffe's Murray Research Center. It is possible at this time, with sufficient knowledge and access, to construct a new thing, a database of cases (call it a *datacase*) organized around White's interpretations in his classic text, but more thoroughly undergirding (and perhaps in some instances contradicting, even disconfirming) the notions published in his text. The first notion of a datacase then is that it represents a textual layer, interpretive in character and theoretically rich, supported by case detail both as exemplifications of notions and as existence proofs for phenomena. White's work can be made more available for secondary analysis through its embodiment in a Datacase. His work is important and exemplary in its commitment to multiple interpretations.

An online textual layer for the White datacase could be created by scanning and restructuring the text of White's book. The construction of the supporting

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[18] During several years, I worked with Selfridge to develop simple models of interactive learning. Initially it seemed feasible to use these as part of a three-layer datacase in Hypercard, but the task proved more complex than anticipated because of language interface problems.

layer, based on more extensive case study materials, would depend on access to the archive of those cases. The best candidate software concept for organizing such ill-formed records and relations into an information processing system is hypertext. A hypertext datacase will unify the database and text processing functions of information processing systems into a medium for supporting scholarly investigation of data-rich fields, such as the behavioral and social sciences epitomize.

If datacases also include the construction of epistemological models based on behavioral observation, they will exploit more fully the interpretive potential of computing. That is, simulation of processes comprise a third layer in a datacase.[45] It is not possible to say, beforehand, that historically based studies are suitable for use as a foundation for the construction of epistemological models. White' studies were not collected with such an end in mind.

Where does the datacase go beyond commentary and extension? *Down*, to the detail of supporting materials; here is where the datacase earns its name as materials are linked into the structure of ideas to either support or disconfirm those ideas. *Up*, to simulations and alternate representations of the ideas and the evidence bearing on those ideas; models first will appear as demonstrations of notions appearing in the textual layer. Later, if the interpretations used are amenable to computational representation (such as those advanced in Minsky's *Society of Mind*), as more work is done on the themes of extending modeling to cover the notions of the interpretive layer, there could emerge a computational layer amounting to a functional redescription of the view of mind advanced in the interpretation. Ultimately, the modeling layer would become a computational epistemology, one growing out of the human experience but open to more general characterizations of what mind is and might become.

(Autumn, 1990)

Methods and files constructed. Working with multiple source files, it was natural—in terms of efficiency of program maintenance—to develop a Hypercard template (or program shell) that could, when loaded with text from the structured ASCII files, become embodiments of the various collections of text. Thus, one shell when loaded with the text of *Cognition and Computers*, became a part of the interpretation layer of stacks; when another copy was loaded with the

[45] Lawler's studies of his children's development were designed with such an intention, and their analysis has led to some modeling studies. These studies are respected in a community of scholars who take developmental case studies seriously. Sheldon White of Harvard has described Lawler's study of his daughter's cognitive development as "the finest single study of children's learning we have, in care, in detail, in breadth, and sensitivity of perspective. . . . The work of The Intimate Study stands as a model of the way a child's thinking should be examined." Barbel Inhelder of Geneva has noted that it is also "The first highly convincing synthesis of cognition science and genetic psychology. An innovative study which highlights the computational approach to new understandings of the growth of mind."

substitute "*" "†" for cameo fo

files of The Intimate Study it became a part of the foundation layer. This approach also permitted some flexibility as well because the loader programs were written to accept a range of files as input. This meant that any specific embodiment could be a single text chunk (for example a chapter) or a range of chunks that might be an entire book. The ASCII texts of the first embodiment of The Psychology of the Particular were typically grouped into files analogous to book chapters, within which individual units were defined as card-record text files.

By far, the greater part of the work was more clerical than technical in nature. One instance of the Hypercard stack template was used without loading any text files into it. This served as an overview and introduction to the assembly of stacks that comprised the datacase (see Figure 2.6). The primary difference between Figure 2.5 and the images shown in the Hypercard stack of Figure 2.6 is that the later functioned as an active index to the text files of the stack ensemble. (Clicking the Macintosh mouse on the box representing the chapter loaded that book stack and brought the initial card record of that chapter to the screen.)

Project limitations and problems encountered. One of the greatest frustrations of the original Macintosh embodiment of POP was the limited screen area available. It was too small to display a reasonable segment of text at one time. Even more frustrating was the situation where figures accompanied the text. Typically, the figures were stored on the graphics plane of the card record and were hidden by the main text field (see Figure 2.7 for an example) while the text was displayed.

What Was Learned

Making progress with this project was sufficiently difficult that I gave up before completion. The essential reasons for doing so were that the linking capability was inadequate, the inflexible and limited record display window size was frustrating, and methods to connect actions in Hypercard to execution of programs in other languages outside Hypercard were so awkward as to be an impediment to model building.[19]

I never completed a POP datacase that I could offer to colleagues with pride. I had to admit that as a consumer I would rather buy a copy of the associated books than have a free copy of the datacase. But the final problem was that the

[19] I did have some programmed models available from my own earlier work. These were originally coded in Lisp for a Symbolics 3600. At the time of this work on POP, I did not have available a copy of Lisp, but I did have available Paradigm Software's Object Logo. In order to attempt execution of these programs with input from the Hypercard front-end, I had to modify the Hypercard-Lisp interface (sent to me by Steve Hain of Paradigm Software) to work with Object Logo. By the time I got that interface working, Apple had announced the future availability of system 7 and some of its features. It was clearly a good time to wait for clarification of the system interface and the new version of Hypercard announced with it.

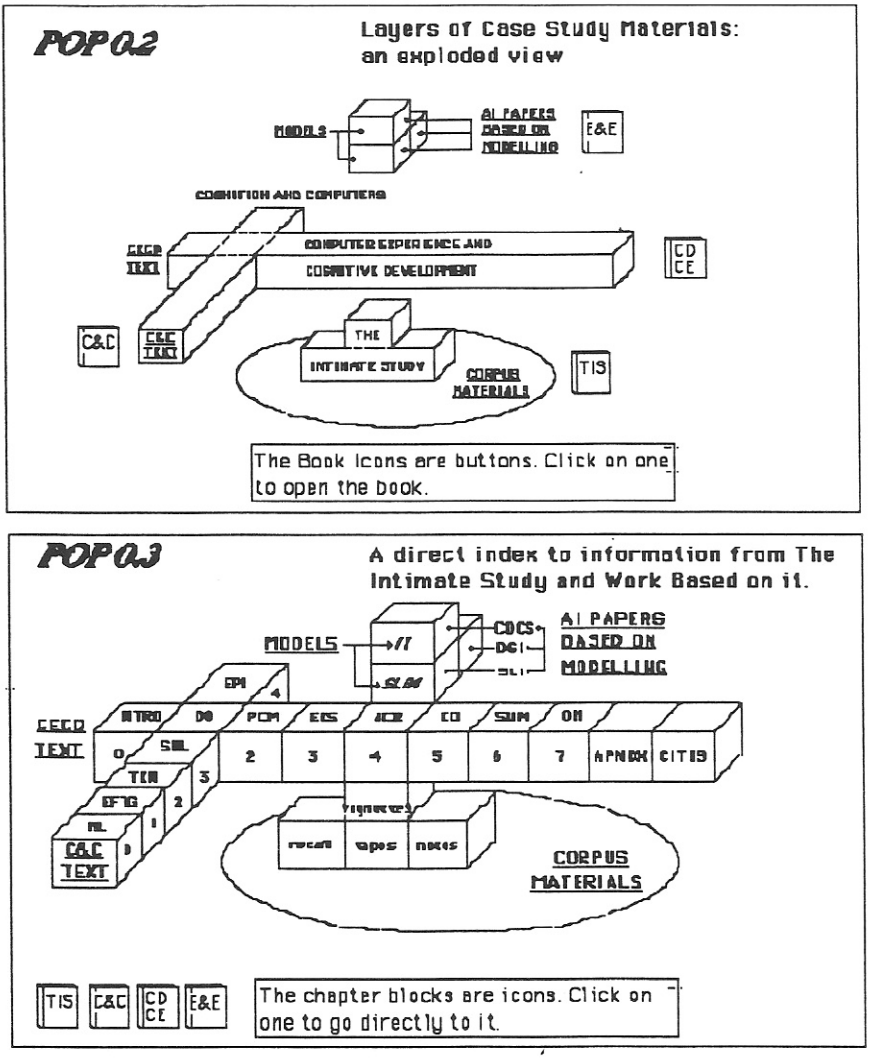

Figure 2.6. A table of contents in graphical form.

Hypercard version of POP did not offer enough added value to justify the effort required to overcome the hurdles. While waiting for control transfer and interface issues to be worked out by Apple in System 7, I decided to look for an alternative project where the machine embodiment of a text could produce a potential added value that would justify the effort of creating the datacase.

Thus far I have concentrated on my work, but it is also appropriate to reach out from my studies to that of other scholars who work in the same vineyard.

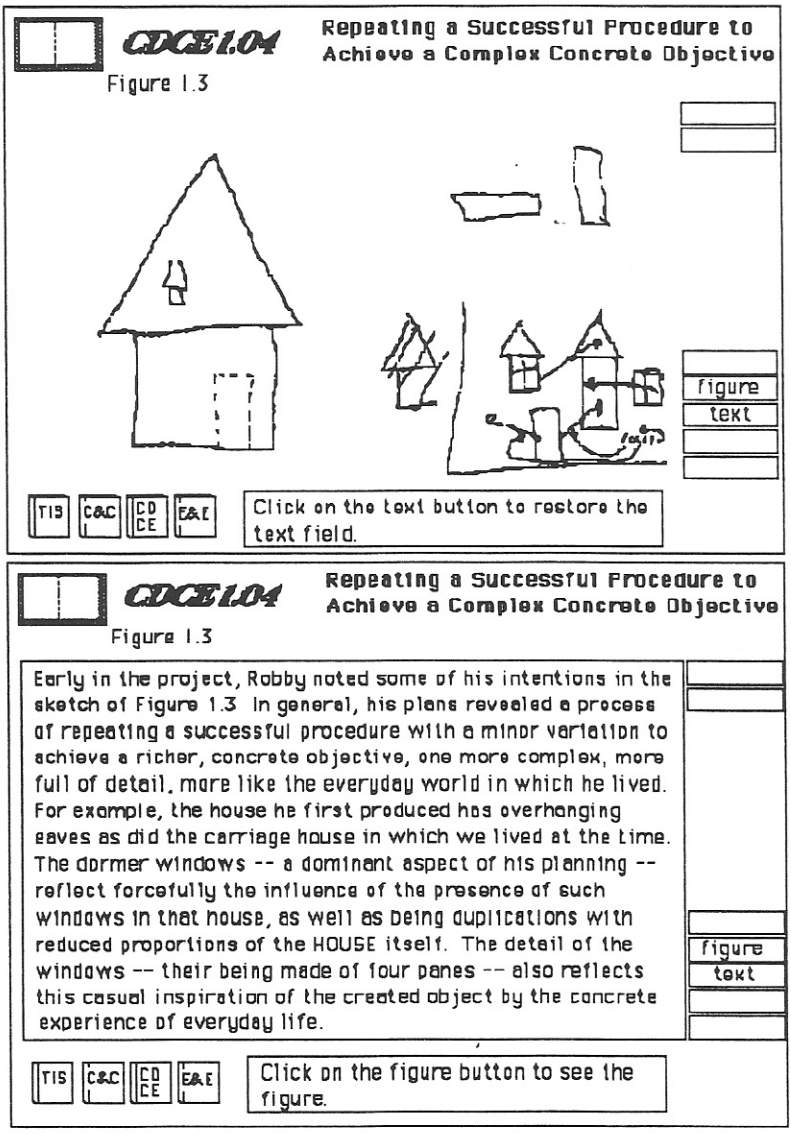

Figure 2.7. Text and graphics planes within a file.

Most important in this respect—in terms of specific influences as well as life-long inspiration—are the works of Minsky, Piaget, and White. The objectives of pursuing my CASE vision were continued with materials from Minsky's (1986) book The Society of Mind, which I used in a graduate course I teach.