It was both generous and courageous of White to make his corpus available, even under the constraints of privacy enforced by the Murray Center Archive. White said (in personal conversation) that he never expected his interpretations and corpora to have a future; he felt they would be forgotten and ignored, and he was content with that. In his view, his psychological interpretations were literary constructs and did not embody any attempt to be scientific in a narrow sense. Other such acts of generosity can be the foundation for a more open and credible case study method in the future. The case analyst will henceforth be put under cross-examination and held accountable for whatever interpretations may be advanced. We should expect no less, but no one should imagine the experience will be pleasant for either the analyst or the subject of the study.

My hope is that we will move into a period where more analysts join the effort to make this would-be science into a more credible field of study. The gains possible if this approach can be made effective include:

- A change of stance: Case studies of individuals will come to be viewed less as magna opera than as nonrepeatable studies open to later examination and investigation.
- Theory development: Secondary analysis could lead to alternative interpretations of richly detailed case corpora.
- Improved data collection: Attempts at secondary analysis should lead to a better appreciation of how to make future studies more broadly useful.

Case studies will be then a field where major works are open to criticism; thus the general quality of work will be open to improvement, even if we conclude that such studies comprise a field of science with a time constant longer than the life of the individual researcher.

SUMMARY OF EFFORTS AND LESSONS LEARNED

These four projects represent a progressive series of attempts to realize and embody the vision of a case analysis support system represented in Figure 2.3. Because the problems proved more difficult than first imagined and for accidental reasons, various detours have been undertaken, but each has concluded with specific accomplishments and lessons learned for use in subsequent design efforts.

The HALE Datacase

In this project, the intention was to develop a facility that would support the textual comparisons essential for capturing insights and making sense of information available in remotely connected stores of data. Two novelties were intro-

duced and remain significant contributions from that effort. The first was introduced with the Hale datacase prototype: the cyclic structure of file relations now the basis of the RING file assemblies. Second was the introduction of knowledge links and their implementation.

The Hypercard *Society of Mind*

The Society of Mind Hypercard stack solved several problems and defined some others. The implementation made it clear that the comparison and contrast of different segments of chunks of text from the work were essential to have available for an analyst in order that he be able to make sense of the interconnectedness of the whole (as in the Hale datacase). The second need defined by the inadequacy of the *Society of Mind* datacase implementation was the essential need to make room for the analyst's creativity in exploring the material. The indexing facility developed in the *Society of Mind* datacase was extended and perfected in the Hale datacase prototype. The problems solved by the Hypercard *Society of Mind* were the methods usable to construct indices and to integrate figures and indices into a card record structure of multiple planes.

The Psychology of the Particular

The Psychology of the Particular datacase implemented the first three-level integrated datacase structure. Here were developed the importing programs and the coding schemes needed to map the logical structure of the data into the graphically organized fields of Hypercard stacks. The code scheme employed was arbitrary. This discomfort-causing fact will no longer be relevant when the early arbitrary coding schemes are replaced by more nearly standard schemes such as the HTML (Hypertext Markup Language) proposed by the World Wide Web project[36] Two major limitations of that datacase—the structure of the included text itself and the difficulty of making interconnection to the functionality of other programming languages—affected the decision to undertake the *Society of Mind* datacase and to move slowly on the modeling front.

CASE

In the initial attempt to implement a Case Analysis Support Environment as represented by the vision of Figure 2.3, I tried to use Notecard's typed links to begin organizing a mass of material from an infant study. The effort did not work well for two main reasons:

[36] See "World Wide Web: The Information Universe" (Berners-Lee et al., 1992) for an introduction to the W3 project.

- The typed links of Notecards were not especially fit for representing the analysts state of knowledge about the data in a useful way.
- The basic insight of that project is that at the time of data selection the analyst will most likely not know how to classify what he recognizes as interesting and of possible value. The analyst's reaction is not "Aha! Here's another example of X!" The reaction might be better characterized as "Hmm. Here's something I'd better think about and remember. This is interesting because it relates to. . . "

The primary lesson is that the process of data selection and theory formation are interactive more than they are purely driven by one extreme or the other. The following projects including those now underway are efforts to deal with this situation and still enhance the analyst's capability to mark, relate, annotate, and integrate information in disparate and extensive files. The CASE effort made it clear that having an established body of work as an example for analysis around which the system itself could be constructed would be invaluable.

Making a static or single-state example of the kind of entity that would undergo revision and development in the CASE cycle of theory development was a necessary place to begin for progress toward creating the CASE facilities needed to support the interpretations of the infant study. This drove the decision to work with the materials of The Intimate Study, its interpretations and models, comprising the Psychology of the Particular. The materials, interpretations, and models of The Intimate Study are represented by Figure 2.5. To what extent does the datacase model of the Psychology of the Particular map onto the CASE vision of Figure 2.3? Has anything been gained or lost in the conversion?

First note that the fit is not perfect. The datacase structure of POP is the more traditional, implying that one examines data and writes a book including some samples of the data and an interpretation of their relationships and significance. Afterwards, one may then proceed to construct computer-based models of the notions advanced in the interpretation. The CASE vision is more radical, specifically in the suggestion that one may proceed from observations of portions of the material, via samples taken as examples, and directly to computational models of ascribeable cognitive structures and their changes—all without writing a book first. One can even imagine constructing multiple models in different paradigms of representation for the same limited collection of material—all without committing to a single, specific scheme of representation and theory. This is surely possible, even though it may not fit the current practice of academic research and publication. It may be a better way to do real science. The structure of RING file assemblies, described later, permit either form or approach to the challenge of interpretation, as the individual analyst may prefer.

There is second major difference. In Figure 2.3, there is a one item that is not marked separately in Figure 2.5. This is "books"—but such is a huge prob-

lem, for "books" includes all the literature there ever was. This omission was not dealt with in any of the datacases discussed this far. Now is the time.

The Problem of References to Literature

Analytical works with a strong empirical foundation tend to be so absorbed in their own detail that they reach out less to the works of other scholars. George Goethals, Robert White's successor to the chair of Life Span Psychology at Harvard, produced with Dennis Klos, a volume of autobiographies, *Experiencing Youth* (Goethals & Klas, 1986). His focus in the interpretive section of that book is making sense of the case material (though limited to autobiographical studies) through the interpretive stances of three primary theorists in psychiatry. On reading *Experiencing Youth*, I was able to analyze the references in Goethals' interpretations for their relative centrality to his interpretations of the meaning of the individual cases. Figure 2.12 is a graphical summary of the relative centrality of references to the five theorists in *Experiencing Youth*.[37] It also includes suggestions for what materials should be made available online for a datacase that might be built around the collection of stories in *Experiencing Youth*.

If one has selected materials available online as references, would one want them to be included in the RING file assembly? That would lead to direct modification of those files, something not especially appropriate for shared resources. And yet, any analyst might find some elements of text in related literature certainly worthwhile keeping available, perhaps of directly copying into his own journal file. Journal links, to be described in more detail later along with the other features of the RING file assembly, provide this functionality and others. The analyst should be the person who decides where to draw the line between what is included in his journal and what remains less central for his own sense-making efforts.

This section has summarized the lessons learned from several attempts to construct datacases. We turn now to a description of my best current design ideas for such a facility, based on the experiences of the past projects.

A FILE ASSEMBLY FACILITY

File assemblies are sets of machine-readable files related primarily by the analyst's purpose in making sense of how elements of each file relate to elements in the others. A central structure of RING is the journal, typically another file, in which the analyst records his understanding about relationships between elements of the files. The centrality of the journal is represented in Figure 2.13, where the journal is shown as connected to other files by different kinds of links.

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[37] The more complete analysis of these references is in Appendix D. In a personal discussion with Goethals, he essentially agreed to the connectness of this analysis.

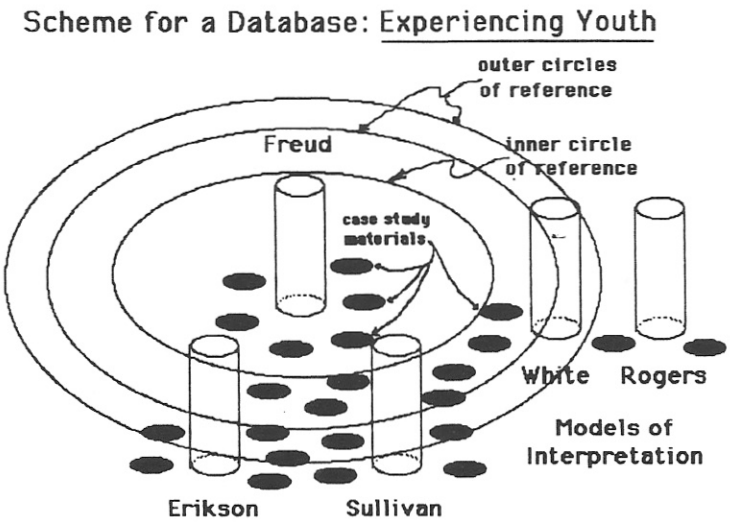

Figure 2.12. Datacase scheme for *Experiencing Youth.*

RING (ijk)

RING is a database shell designed for applications whose essence is the comparison and relating of information.[38] RING is designed to function in an environment of file assemblies. The RING shell[39] contains sets of utilities to load and save machine readable files; ~~it includes utilities to merge graphics files into existing files where appropriate~~. RING also contains a coherent set of programs *

[38] The current prototype runs under Apple Macintosh Hypercard. The RING facilities are programmed primarily in hypertalk. The design and implementation of RING are an evolutionary development of the preceding case analysis support environments.

[39] The collection of programs embodied in the RING Hypercard stack is a shell in the sense that every file in an assembly will be an instance of the stack; they will be different one from another because different ASCII files will have been loaded into those instances.

* it includes methods and facilities to manage picture files of different sizes.