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Memory, Amnesia, and the Episodic/Semantic Distinction

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1. INTRODUCTION

Imagine that our present civilization develops more or less peacefully and that the world is still intact a thousand years from now. Imagine further that you could visit the future world and bring back with you, among other things, the answer to one crucial question about human memory. What would be the question, and why?

Choosing "crucial" questions in any area of a developing science such as psychology is both easy and difficult. It is easy because crucial questions seem to abound; they are readily perceived anywhere and everywhere. Most contemporary students could rather easily make up a long list of apparently critical questions. The choice would be difficult, however, if it had to be guided by consensus. At present there is little agreement among practitioners as to what questions are important. In the discipline itself it is difficult to discern compelling, permanent developments that clearly point to a particular future. Today's crucial questions have a disconcerting habit of turning into tomorrow's historical curiosities. The time-traveler runs a real risk of disappointment at finding that his or her crucial question is meaningless to future generations.

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But science has always been a risky business; the possibility that the questions we ask are meaningless with respect to future developments should not deter us from taking a chance. The self-correcting nature of the enterprise guarantees that our mistakes of posing wrong questions will have no permanent effects. That is why we feel free to discuss one "crucial" question concerning human memory.

Our question has to do with the subdivisions of human memory. We assume, along with most other students of the subject, that memory is not a monolithic, unitary entity and that what we label memory in fact represents a number of separate but interacting systems. All these systems have a common function: They make possible the utilization of acquired and retained knowledge. It is their differences that are the subject of our crucial question: How can we characterize the various systems that comprise human memory?

The question implies, as well as leads to, others. How are the systems related to one another? How and to what extent do they interact? How are they similar to and how do they differ from the memory systems of other organisms and intelligent machines? What is the sequence of their development? To what extent do they serve strictly separate functions and to what extent can one substitute for another? All these and other related questions, too, can be regarded as critical to our understanding of memory. But they could not be raised unless we raise the first one concerning the nature of the systems; hence our present choice.

In this chapter we shall discuss the current status of one distinction between different memory systems—namely, the distinction between episodic and semantic memory. Our discussion will draw on observations of dissociations in memory function in individuals rendered amnesic through brain damage, hypnosis, or other, as yet little understood, psychological factors. The dissociations take the form of particular patterns of impaired and preserved abilities and skills of acquiring and subsequently utilizing new information or knowledge. We shall focus on data gathered in studies of pathological, rather than normal, populations because these data rather clearly—and sometimes dramatically—suggest the need for extending and revising the constructs of episodic and semantic memory.

2. EPISODIC AND SEMANTIC MEMORY

In speculations about the varieties of knowledge handled by human memory, the dichotomy between knowledge of personally experienced events and knowledge of the world at large has a long history. William James (1890), in presenting the distilled wisdom of a long series of keen

observers of human nature, distinguishes between associations among ideas and memories of a person's own past as separate psychological phenomena. Henri Bergson (1911) also argues for the distinction between personal recollections of specific events and automatic or habitual memories that are built up through repetition. Reiff and Scheerer (1959) discuss in some detail the difference between *remembrances* and *memoria*. Remembrances are contextually specific memories for personally experienced events, and according to Reiff and Scheerer "are always accompanied by the experience of personal continuity through time . . . what is remembered is always experienced as 'being in my past'" (p. 25). Memoria, which include general knowledge of the world as well as habits and skills, lack this quality of self-reference. Schachtel (1947) argues for a separation of autobiographical and practical memory; Nielsen (1958) distinguishes between temporal and categorical memory; and Piaget and Inhelder (1973) contend that "memory in the strict sense" (autobiographical memory) should be demarcated from "memory in the wider sense" (general knowledge and skills).

The distinction between personal memories and general knowledge was brought into the focus of the experimental psychology of memory by the creation of a new field of study concerned with *semantic* memory (Quillian, 1968). The contrast between semantic memory and the kind that had been studied by psychologists since the time of Ebbinghaus (1885/1964) was in many ways similar to the earlier philosophical and psychiatric distinctions between personal and general memories. The two kinds of memory are discussed by Tulving (1972), who adopted the term "semantic" memory from Quillian and the term "episodic" memory from Munsat (1966).

According to Tulving's (1972) initial formulation, episodic memory is concerned with knowledge about a person's own past experiences, whereas semantic memory handles knowledge of language and what it represents, as well as knowledge of facts, concepts, and rules of various kinds. Episodic memories are unique to the individual; semantic memories may be shared by many. Episodic memories are "located" in particular places and "dated" at particular times: A person remembers doing something, there and then. Semantic memories are timeless and spaceless: If a person knows that Caesar crossed the Rubicon in 49 B.C., his or her *knowledge* (memory of the fact learned on an earlier occasion) does not have any temporal and spatial referents, although the statement itself refers to a particular dated event. Episodic memories are always embedded in a more or less rich, concrete context of other remembrances; semantic memories are related to other semantic memories but their truth value does not depend on any particular context. Finally, episodic memories are autobiographical, that is, they refer to a

person's own past; an organism could not have any episodic memories if it was not aware of its personal identity and its continuity through space and time. Semantic memories, on the other hand, are generic; there is no necessary connection between a bit of semantic memory and the awareness of its relation to self. (By this criterion, computers could have semantic memories but not episodic ones.)

Despite the somewhat awkward terms and the somewhat uncertain status of the concepts, the distinction between episodic and semantic memory has become very popular. The strong philosophical flavor of the characterization of the two systems has not discouraged many people, not only in psychology but also in other fields, from adopting the distinction, at least for heuristic purposes (e.g., Berch, 1979; Eysenck, 1975; Hannigan, Shelton, Franks, & Bransford, 1980; Johnson, Klinger, & Williams, 1977; Kihlstrom, 1980; Kinsbourne & Wood, 1975; Nelson & Brown, 1978; Petrey, 1977; P. N. Russell & Beekhuis, 1976). A number of investigators have gone beyond this use of the distinction and have sought to establish the separate existence of the two memory systems in an empirically bound, functional sense (Herrmann & Harwood, 1980; Herrmann & McLaughlin, 1973; Moeser, 1976; Shoben, Wescourt, & Smith, 1978; Wood, Taylor, Penny, & Stump, 1980). And there have been critics who have argued against any need for a distinction between episodic and semantic memory, preferring what they regard as a more parsimonious view of unitary memory (e.g., Anderson & Ross, 1980; McKoon & Ratcliff, 1979; Muter, 1978).

Along with many other students of memory, we believe that the episodic/semantic distinction is a useful one. However, we also regard the initial formulation of the distinction (Tulving, 1972) as a beginning, and incomplete attempt to construct a taxonomy of memory systems. Accordingly, our major purpose in this chapter is to delineate and discuss some phenomena that are not easily accommodated by the distinction in its current form, with the hope that such discussion will help point the way to a more satisfactory taxonomy of memory systems.

Our discussion will be divided into three major sections, each concerned with observations of dissociations in memory function in one of three types of amnesia. First, we shall consider studies of amnesic syndromes that are due to various kinds of organic brain damage. Second, we shall discuss experiments in which amnesia is induced by hypnosis. Third, we shall consider observations made in cases of *functional* amnesia, in which memory disturbances appear after psychological trauma. We shall attempt to show how the patterns of impaired and preserved memory function observed in each type of amnesia suggest the need for revisions of the episodic/semantic distinction. Furthermore, we shall argue that the dissociations observed in the three kinds of amnesia are, in several respects, similar to one another.

3. ORGANIC AMNESIA

Both clinical and experimental studies of the organic amnesic syndrome have yielded data that bear on the episodic/semantic distinction. The amnesic syndrome can arise consequent to a variety of neurological malfunctions, including Korsakoff's syndrome, encephalitis, gas poisoning, closed-head injury, lesions of the medial temporal lobes, and Huntington's disease. The major clinical features of the amnesic syndrome, which have been thoroughly described in the literature (e.g., Grünthal, 1923; Korsakoff, 1889; Störring, 1931; Zangwill, 1946), are consistently observed from patient to patient. Amnesics' verbal skills are preserved, there is little impairment of general intelligence, they can adequately answer questions that tap their knowledge of the world, and their perceptual abilities and immediate memory are relatively unimpaired. However, these same patients demonstrate a striking inability to remember their recent personal experiences. Amnesics may not recall having met someone only minutes after seeing them, frequently fail to recognize physicians who have been treating them for months, and are often disoriented as to time and place.

It is possible to describe this general pattern of deficit as a selective impairment of episodic memory: In the amnesic syndrome, episodic memory is more severely affected than semantic memory. Some early clinical students of amnesia noted precisely this feature of the syndrome (Claparède, 1911/1951; Korsakoff, 1889), and more recent theorists, based on experimental as well as clinical observations, have argued that the amnesic syndrome represents a selective impairment of episodic memory (Kinsbourne, 1982; Kinsbourne & Wood, 1975; Rozin, 1976; Schacter & Tulving, 1982; Wood & Ebert, 1982). We shall now consider in some detail the pertinent evidence. We shall begin by discussing studies that have demonstrated retention of certain kinds of recently acquired information by amnesic patients, and then consider experiments that have provided evidence that amnesics can acquire a variety of skills much in the manner of normals. We shall then discuss some implications for the episodic/semantic distinction.

3.1. Retention of Recently Acquired Information

Let us first consider some clinical observations reported by the Swiss psychiatrist Claparède (1911/1951). Claparède's patient was a 47-year-old woman suffering from Korsakoff's syndrome. This patient presented a clinical picture entirely consistent with the conceptualization of amnesia as a selective impairment of episodic memory. She did not recognize the doctors who daily treated her, and forgot "from one minute to the next what she had been told" (p. 68); yet she could readily

retrieve well-learned facts and adequately perform mental calculations. Claparède, however, was able to show that this patient could acquire and retain some information from a learning episode, even though she had no memory for the episode itself.

> When one told her a little story, read to her various items from a newspaper, three minutes later she remembered nothing, not even the fact that someone had read to her; but with certain questions one could elicit in a reflex fashion some of the details of those items. But when she found these details in her consciousness, she did not recognize them as memories but believed them to be something "that went through her mind" by chance, an idea she had "without knowing why," a product of her imagination of the moment, or even the result of reflection. (p. 69)

Claparède observed a similar phenomenon after pricking his patient with a pin hidden in his hand. When he again motioned toward her, the patient reflexively withdrew her hand. Claparède asked her why she did so, and she conjectured, "Is there perhaps a pin hidden in your hand?" (p. 69). When Claparède asked her why she thought he might have a pin hidden in his hand, she claimed that it was "an idea that went through my mind" (p. 70), and further suggested that "sometimes pins are hidden in people's hands" (p. 70). Although this patient retained some information about Claparède's behavior, she did not remember the episode in which she acquired it.

Observations reported by MacCurdy (1929) resemble those of Claparède. MacCurdy taught Korsakoff patients his full name and address; the patients failed to recall this information just minutes later. He then presented them with a series of 10 first names, 10 surnames, 10 street numbers, and 10 street names, and asked patients to "guess" which ones were his:

> To my surprise, the guesses were nearly as accurate as would be the conscious memory for such data of normal subjects. But the response remained to the subject a sheer guess, it was associated with no feeling of me-ness; on no occasion did the patient think that he had the slightest reason for picking one name rather than another from the list. (p. 121)

Weiskrantz and Warrington (1979) recently observed similar phenomena. These investigators studied the development of a classically conditioned response in amnesic subjects, using a compound auditory and visual signal as a conditioned stimulus and an air puff as the unconditioned stimulus. They assessed conditioning by measuring subjects' eyeblink latency at both 10-minute and 24-hour retention intervals. Weiskrantz and Warrington found that two severely amnesic patients showed evidence of conditioning at both retention intervals. However, when questioned during the delayed-retention sessions, these subjects expressed no memory for the events of the first conditioning sessions, although these events clearly affected their subsequent behavior;

Weiskrantz and Warrington observed that the amnesics did not even recognize the conditioning apparatus. Indeed, the sole reference to the air puff was made by a patient who claimed that he "had a weak right eye because someone had once blown some air into it" (p. 192).

Another example of amnesics' ability to retain information imparted to them during a learning episode, without conscious memory of the episode, is found in a case study of *source amnesia* that we recently completed (Schacter, Tulving, & Wang, 1981). Source amnesia occurs when subjects can retain an acquired fact without memory of how or when they learned it (e.g., Evans & Thorn, 1966). We developed two tasks for the investigation of source amnesia, and employed them in the study of a 34-year-old man (E. R.) who had developed amnesic symptoms after closed-head injury.

One of our tasks tapped the ability to retain newly acquired facts. The patient was asked a series of difficult questions about little-known facts and instructed to select an answer from five alternatives. For instance, the patient was asked, "Who holds the world's record for shaking hands?" and subsequently presented with the correct answer (Theodore Roosevelt) interspersed with four distractor items (Richard Nixon, Jimmy Carter, Woodrow Wilson, and Abraham Lincoln). When the patient selected the correct answer to a question, the item was eliminated from further consideration and a new question was substituted for it in the text. When an incorrect answer was selected, the experimenter informed the patient of the correct choice. Following a 20-minute interval, the patient was again asked all the questions that he answered incorrectly on the first pass, and was instructed to choose among the same five alternative responses. In addition, he was asked an equal number of new questions. After the patient chose an answer, the experimenter inquired about the source of the information by asking, "How do you know that?"

E. R. responded correctly to many of the questions that he had been asked, but had answered incorrectly, during acquisition. In contrast, the patient's performance on items that were presented for the first time during the test phase was at the chance level. These data suggest that E. R. was capable of acquiring, retaining, and utilizing some of the information imparted to him by the experimenter. However, E. R. was consistently unable to state accurately where or how he had acquired the new facts. He typically insisted that he knew a fact because he "read about it somewhere," "heard some people talking about it just recently," or because "my sister once told me about it." A 21-year-old hospitalized control subject with minor closed-head injury, matched for IQ and educational background, was able to retain the experimentally acquired facts and also to state accurately where he acquired them.

A second experimental task yielded a similar pattern of data. The

patient viewed and described a series of photographs. After presentation of each photograph the experimenter related a bizarre story about it that would not be inferred from uninstructed viewing. Following a 20-minute delay, the patient was shown all of the previously presented photographs intermixed with an equal number of new ones. The patient's task was to select an appropriate title for each photograph from three alternatives. Two of these alternatives reflected the obvious physical characteristics of the picture; one of them reflected the theme of the unusual story associated with it. After the patient selected a title, he was asked why he chose it.

E. R. demonstrated a marked bias for choosing unusual titles when shown a photograph about which he had earlier been told the story, selecting the unusual title for a majority of the previously presented items. He demonstrated no such bias when selecting titles for new photographs; in fact, E. R. chose only one bizarre title for the 18 new pictures. However, the patient was frequently unable to report why he selected the unusual title, and typically insisted that "it just seemed right." For instance, when shown a picture of a man standing on a farm in front of his home and told that the man was a fugitive criminal, the patient later selected the title "Hiding from the Law" in preference to "Harvest Time on the Farm" or "A Man and His Home." Asked to state why, the patient could only suggest that "it looks like he's doing that [hiding from justice]." The control subject also selected many of the unusual titles, but in each case was able to state accurately why he did so.

Amnesics have shown an ability to retain experimenter-provided information, with impaired memory for when and where they acquired it, in other experimental situations. Experiment 2 of a study by Huppert and Piercy (1976) provides relevant data. Huppert and Piercy examined Korsakoff patients' recognition of familiar and unfamiliar pictures. Familiarity was manipulated by exposing subjects to a series of pictures in a training session. The following day the subjects studied a second set of pictures; half had been shown to them the previous day (familiar), and half had not (unfamiliar). Subjects' recognition memory was tested on the second day by asking them to indicate which picture they had seen during the *experimental* (vs. the training) session. An equal number of targets and lures were tested; half the lures were entirely new pictures, and half had been shown during the training session.

Huppert and Piercy found that Korsakoff patients, in comparison with alcoholic controls, displayed a greater tendency to say yes to familiar pictures than to unfamiliar pictures. That is, there was a significant interaction between patient groups and familiarity of material. Thus Korsakoff patients said yes to familiar lures (pictures they had seen during the training session but not during the experimental session)

almost as often as they said yes to unfamiliar targets (pictures they had been exposed to only during the experimental session). Control subjects, in contrast, rarely said yes to familiar lures. These data suggest that Korsakoff patients' retention of information about the pictures' occurrence in *either* of the two sessions was relatively unimpaired, but their retention of information about the temporal context in which pictures occurred was severely impaired.

Owen and Williams (1980) report similar data using a somewhat different paradigm. They presented amnesic and control subjects with pictures of common and rare objects. Subjects were tested with sentence-frame cues that elicited the name of a target object, or an object that had not been experimentally presented, with a normative frequency of 90%. Subjects were asked to indicate, for each item generated, whether they remembered seeing a picture of the item on the experimental list. Owen and Williams found that amnesic patients experienced significantly greater difficulty distinguishing between new and old *common* objects than between new and old *rare* objects: The amnesics stated that pictures of almost all of the common objects had earlier been shown to them. Control subjects performed equally well in both cases. Thus amnesics' performance was controlled by preexperimental familiarity of the objects, rather than by contextual features of the study and test situations. Although the amnesics recalled nearly as many common objects as the controls, they could not remember the context in which the objects had occurred.

A series of important experiments by Warrington and Weiskrantz (1968, 1970, 1974) also contain relevant data. Warrington and Weiskrantz presented amnesic and control subjects with lists of common words and then probed their knowledge of these words with two different tests: (1) a yes/no recognition test in which subjects indicated which of a series of test items they *remembered* from the study session; and (2) a cued-recall test in which subjects were provided initial-letter fragments of list items and asked to try to *identify* the word. Although amnesics were severely impaired on the yes/no recognition test compared to controls, they performed as well as, and in some cases better than, control subjects on the fragmented-word prediction task. Amnesics' memory for the words they had studied during the learning episode was impaired, but they were able to use information acquired during the episode to successfully complete the fragment cues.

3.2. Acquisition and Retention of Skills

Some of the earliest evidence that amnesic patients are capable of new learning was provided by studies exploring acquisition and reten-

tion of motor skills. Milner (1962/1965), for instance, reports evidence of motor skill learning by the well-known amnesic patient H. M. Milner's observations were confirmed and extended in subsequent studies of H. M. by Corkin (1965, 1968), Milner (1970), and Milner, Corkin, and Teuber (1968). These investigators report that H. M. was able to improve his performance across trials on a variety of motor tasks, including pursuit rotor, mirror drawing, and maze learning. However, they also note that on each new trial H. M. failed to remember what happened on the previous trial: He had no episodic memory for the events that affected his motor skill performance. Similar observations were made by Starr and Phillips (1970) in their study of a densely amnesic encephalitis patient. This patient was successfully taught to play a new piece of music on the piano. On the following day he was able to play the piece by heart, but he did not remember the episode in which he learned it.

More recent evidence indicates that amnesics are capable of acquiring and retaining knowledge of a somewhat different nature. We shall refer to these kinds of knowledge as "cognitive skills": organized sets of procedures and operations that are used to perceive and encode information, formulate rules, and solve problems (Kolers, 1975). Kinsbourne and Wood (1975), for instance, report that they were able to teach amnesic subjects the Fibonacci rule (a rule for generating numbers with specified properties). Their patients showed substantial savings when they relearned the rule after a retention interval, but could not remember having previously performed the task. Brooks and Baddeley (1976) found that amnesic subjects were able to reassemble a jigsaw puzzle, and to arrange words into sentences, faster on the second trial than on the first trial; their savings scores were just as large as those of control subjects.

Cohen and Squire (1980) report a particularly striking instance of cognitive skill acquisition by amnesics. They presented amnesic and control subjects with sets of word triads that were printed in inverted script and asked them to read each triad aloud; some words appeared only once and some were repeated. Earlier work by Kolers (1975, 1976) with normal subjects had shown that time to read the inverted script systematically decreases with practice. Cohen and Squire observed a similar result with amnesics: Not only did they take progressively less time to decode the inverted script over the course of three daily sessions, the slope of their learning curve was just as steep as that of control subjects. In fact, amnesics, as well as controls, demonstrated significant savings on the inverted-script task after a 3-month retention interval.

Amnesics and controls, however, differed in two aspects of their performance. First, the amnesics' speed of reading *repeated* words was facilitated much less than that of control subjects; they benefited only slightly from the repetition of specific words. Second, when their memory for the occurrence of specific words was tested by yes/no recognition, amnesics performed extremely poorly with respect to controls. Cohen and Squire (p. 209) note that

> upon being questioned, none of the amnesic patients reported that words had been repeated during the task, even though by the end of session four the set of repeated words had been presented twenty times. All of the control subjects reported spontaneously that words were frequently repeated.

On the basis of their data, Cohen and Squire argue that the acquisition and expression of *procedural* knowledge—knowing how—was intact in their amnesic subjects.

3.3. Organic Amnesia and the Episodic/Semantic Distinction

The evidence that we have so far reviewed indicates that amnesic patients are capable of (1) retaining some of the information presented to them during a learning episode, even though they have little memory for the episode itself, and (2) improving a variety of skills—both motor and cognitive—with practice. Let us now consider the implications of these data for the episodic/semantic distinction.

The fact that amnesics can retain and utilize certain aspects of recently presented information raises an apparent difficulty for attempts to conceptualize amnesia in terms of the episodic/semantic distinction. If amnesia represents a selective impairment of episodic memory, why should amnesics be able to retain information presented during a learning episode? We believe that this problem can be at least partially resolved by circumscribing the precise meaning of the term "episodic memory." This term is frequently invoked to refer to situations entailing encoding, storage, and retrieval of any information that is presented to the subject by the experimenter. Thus experiments on paired-associate learning, recognition of recently presented pictures, or recall of prose passages might all be referred to as experiments concerned with episodic memory. Accordingly, subjects' retrieval of items, at the time of test, that correspond to the experimentally defined input units is generally regarded as evidence of episodic memory.

It is when episodic memory is viewed in this sense—as retention and utilization of *any* information presented to the subject by the experimenter—that the observations of amnesics' performance become problematic for theories that portray amnesia as a selective deficit of episodic memory: Amnesic patients clearly are able to retain and utilize some of the information that they have acquired during a learning episode. However, we suggest that amnesics' retention of isolated bits and pieces

of knowledge acquired during the learning episode should not be taken as evidence of episodic memory. Recall the critical features of episodic memory as outlined by Tulving (1972). Episodic memory is characterized by retention and retrieval of spatial and temporal contextual information, as well as by autobiographical reference—integration of newly acquired information with the personal past of the rememberer. These are precisely the types of information that amnesics do *not* seem capable of retaining. Thus data concerning organic amnesics point to a sharp distinction between memory for the *factual content* of an episode and autobiographical memory for the episode itself. Memory performance of amnesic patients can be affected by the factual content of an episode, even though they may not remember when, where, or how they acquired it. Accordingly, it seems prudent to suggest that retrieval of information acquired during a unique learning episode does not constitute, by itself, evidence of episodic memory; autobiographical reference and memory for temporal and spatial context must also be present. The distinction between memory for the factual content of an episode and memory for the episode itself has not been explicitly made in previous discussion of episodic and semantic memory.

When the distinction was formulated in 1972, it seemed reasonable to assume that subjects' ability to reproduce the factual contents of an episode, such as a word on a list, would constitute direct evidence of their memory for the episode itself; if the subjects did not remember the episode, how could they recall the word? In light of the data we have discussed, this assumption no longer seems acceptable.

These data also raise an additional question concerning the episodic/semantic distinction. If amnesics' ability to retrieve information from a learning episode is not based on episodic memory, can we conclude that it is based on semantic memory? Although the data are too sparse to permit firm conclusions, there are reasons to suggest that something other than semantic memory may underlie amnesics' performance. As shown by many studies, semantic memory is a highly structured and organized system of interrelated facts and concepts (e.g., Collins & Loftus, 1975). It is not yet clear how new information becomes embedded in this complex structure, but common sense and experimental findings suggest that the acquisition of stable structures of new knowledge proceeds gradually over time (e.g., Homa, Rhoads, & Chambliss, 1979; Hull, 1920). It does not seem likely that the information retained by amnesics in the cases discussed earlier—acquired during one usually brief exposure—could have become instantaneously integrated into the existing structures of semantic memory. Indeed, one of the qualities of amnesics' memory that has been noted in the literature is that the retrieved information simply "pops into their minds." It does

not serve as a cue that brings forth related information, as frequently happens when people generate information from semantic memory in tasks such as free association, but enters consciousness as an isolated fragment.

Another way to interpret amnesics' performance in terms of semantic memory is to argue that the experimental input "primes" existing knowledge in semantic memory (e.g., Colling & Loftus, 1975; Loftus, 1973) and that amnesics utilize the temporarily activated information at the time of recall. While this is an attractive hypothesis, it does entail a number of problems that have been discussed elsewhere (Tulving, Schacter, & Stark, 1982).

It seems clear, then, that amnesics' retention of information presented during a learning episode is not easily accommodated by the episodic/semantic distinction. Amnesics access kernels of information that have become detached from their episodic contexts, but are not, or not yet, integrated into the existing structures of semantic memory. We find it convenient to label these kernels of information "free fragments." Free fragments are, in a sense, somewhere "between" episodic and semantic memory. However, the episodic/semantic distinction, as it is currently formulated, makes no provision for the concept of free fragments. Research that systematically delineates the properties of free fragments is the next logical step: The knowledge that is gathered about free fragments in such research may provide a useful guide to revising the constructs of episodic and semantic memory.

The data on skill acquisition by amnesics likewise pose interpretive difficulties for the episodic/semantic distinction. The problem here is that the 1972 article focuses on *propositional* knowledge, and ignored *procedural* knowledge. The fact that amnesics' ability to improve their execution of skills as a function of experience can be dissociated from their memory for the content of the experience highlights the possibility that modification of procedural knowledge may be governed by different rules than modification of propositional knowledge. Accordingly, procedural knowledge should be specifically accounted for in a complete taxonomy of memory systems.

Unfortunately, we can do no better at present than to pose questions for future investigations that may help clarify how the acquisition of procedural knowledge fits with the constructs of episodic and semantic memory: Can skill acquisition be dissociated from utilization of semantic memory? For instance, are there patients who can acquire new skills but cannot access their general knowledge of the world, or vice versa? What kinds of cognitive skills are used in the encoding and retrieval of both episodic and semantic memories? Under what circumstances are cognitive skills modified as a function of experience (other

than just by "practice")? How do variables that are known to affect episodic memory and semantic memory affect the modification of skills? When questions such as these are systematically addressed, and perhaps answered, we will be in a better position to revise the episodic/semantic distinction in a way that takes account of procedural knowledge.

4. HYPNOTIC AMNESIA

In the previous section we reviewed studies of organic amnesic patients with an eye toward evaluating the ability of the episodic/semantic distinction to account for the observed patterns of preserved and impaired memory function. We shall now consider relevant studies of hypnotic amnesia. To anticipate our conclusions, we shall argue that (1) patterns of data observed in hypnotized subjects are qualitatively similar to the patterns found in organic amnesics, and (2) the hypnosis data and organic amnesic data have nearly identical theoretical implications for the episodic/semantic distinction.

4.1. Source Amnesia

We earlier described a case study of a concussion amnesia patient that provided evidence of *source amnesia:* The patient could acquire and retain experimenter-provided information, but could not remember the episode in which he learned it. This study was partially motivated by prior research that demonstrated the phenomenon in hypnotized subjects. Banister and Zangwill (1941) report perhaps the earliest experimental investigation of source amnesia; they label the phenomenon "restrictive paramnesia." Banister and Zangwill exposed subjects to series of picture postcards and simply asked them to describe what they saw. Each subject viewed a total of 12 pictures: Six were seen in the waking state on Day 1 of the experiment, and six were seen during hypnosis on Day 2. After viewing the pictures under hypnosis, subjects were given a suggestion to forget the events of the session. Subjects' recognition memory was tested on Day 3 by presenting them with the 12 old pictures, intermixed with 12 new ones, and asking them to indicate whether they had ever seen each picture, as well as to report anything the picture brought to mind.

Because Banister and Zangwill employed this procedure with only five subjects, their data are of interest for the qualitative rather than quantitative information they supply. Two of their subjects failed to respond to the amnesia suggestion and recalled all the events of hypnosis; one subject recalled most of the events. Two subjects did respond to the amnesia suggestion. Both of these subjects accurately recognized all pictures from the waking session, and correctly classified each of the new items. However, when presented with the six pictures from the hypnotic session, these subjects displayed unambiguous source amnesia for all but one of them. The following are representative responses (pp. 36–42):

> *Japanese Print:* "I've seen that before. On some exotic sort of Christmas card or Japanese lantern."
>
> *Egyptian Girl:* "I think I've seen that. In the National Geographical Magazine of American or an Egyptian State Railways poster . . ."
>
> *Reynolds' "Marquess of Crewe":* "I have seen a picture like that before. Probably in the National Gallery."
>
> *Nine Flints:* "I didn't see that card on Monday [the waking session] but I have seen it somewhere."

These responses are similar to phenomena observed in organic amnesic patients: Subjects retain some information about the experimental materials but do not remember when or where they acquired it. More recent studies of source amnesia in hypnotized subjects have provided data amenable to a similar interpretation. Evans and Thorn (1966), for instance, asked hypnotized subjects three difficult questions under the pretext of administering a "general knowledge test" (e.g., "An amethyst is a blue or purple gemstone. What color does it turn when exposed to heat?"). When subjects did not correctly answer, the experimenter provided the appropriate response (e.g., yellow). After hypnosis was terminated, the experimenter again asked the same questions. Evans and Thorn found evidence of source amnesia in about 10% of their 243 subjects: The subjects supplied the correct answer to at least one of the three questions, but could not accurately state when or where they acquired the new facts. Evans and Thorn also found that none of the control subjects who were instructed to *simulate* hypnosis developed source amnesia; they overplayed their role and "forgot" all events from the experimental session.

In the Evans and Thorn study, source amnesia was not explicitly suggested. Cooper (1966) specifically compared spontaneous and suggested source amnesia and found a small difference between the two. Nine percent of Cooper's subjects showed spontaneous source amnesia for at least one of the three experimental questions, whereas 14% displayed the phenomenon when source amnesia was suggested during hypnosis.

In the foregoing studies the incidence of source amnesia is relatively modest. Cooper (1966), however, reports that source amnesia occurred only in subjects who were also highly susceptible to hypnosis, a finding that suggests that the phenomenon might be more frequently observed by studying extremely susceptible subjects. Gheorghiu (1969) provides relevant data. He studied source amnesia in a selected group of highly susceptible neurotic subjects, who viewed a series of 10 pictures while under hypnosis (Gheorghiu does not indicate whether source amnesia was specifically suggested). Memory for the pictures was later tested in the waking state in three different ways: (1) Subjects were shown the 10 target pictures, plus 30 new ones, and asked to state if and when they had seen them previously; (2) subjects who denied having seen the pictures were required to select 10 from the set of 40 and "were told that these would be handed over for copying to a schoolboy" (p. 115); and (3) subjects who did not choose the target pictures were then asked to select those pictures that seemed familiar.

Gheorghiu found that 38% of his subjects selected only the 10 target pictures on the first test. However, these subjects, like subjects in other studies, did not know why they selected the target pictures and frequently confabulated a source: "They claimed to have seen them in a dream (sometimes they also made up a story), or that they had seen them upon some other occasion" (p. 116). Twenty-nine percent of the subjects denied having seen any pictures on the first test, but showed a marked bias for selecting the experimental pictures on the second (forced-choice) test: They chose 90% of the presented pictures and only 8% of the lures. The remaining 33% of the subjects, who neither recognized nor selected target pictures on the first two tests, chose 80% of them when asked to indicate a general sense of familiarity; in contrast, they indicated that 3% of the new pictures seemed familiar. Although these data pose interpretive problems—there were no control or simulator subjects and some of the testing methods are unorthodox—they do suggest that source amnesia may be more readily observed in highly susceptible subjects.

More recently, Evans (1979) reports data that also indicate that source amnesia is frequently observed in highly susceptible subjects. Evans selected subjects from the upper 5% of the susceptibility distribution, and compared their performance to that of simulating controls. He employed a task previously used by Evans and Thorn (1966), in which subjects are provided with answers to difficult questions and later asked about them. Source amnesia was not specifically suggested. Evans found evidence of source amnesia in about 33% of the susceptible subjects, and none of the simulating controls. Evans's subjects behaved much like those in other studies. When asked how they knew one of the

experimentally acquired facts, the subjects often invented sources, suggesting that "my girlfriend must have told me" or "I guess I read it somewhere" (p. 560). As in the other studies, subjects were capable of retaining information presented during the hypnotic episode. They could not, however, remember when or where they acquired the new information.

Although not specifically directed at the problem of source amnesia, experiments by Williamsen, Johnson, and Eriksen (1965) and by Kihlstrom (1980) provide data that in many respects resemble the data in the foregoing studies.

In the Williamsen *et al.* experiment, hypnotized, simulating, and control subjects were instructed to remember a list of six common words. Their memory for these words was evaluated, in the waking state, by a series of four consecutive tests: (1) free recall, (2) identification of perceptually degraded fragments of study words, (3) free association to cues that elicited both target and nontarget words as primary associates, and (4) yes/no recognition of target and distractor items. Hypnotized subjects' free recall and recognition performance was significantly impaired with respect to controls. However, much as in the Warrington and Weiskrantz experiments with organic amnesics, the hypnotized subjects were able to identify word fragments just as accurately as were the control subjects. In addition, all subjects identified significantly more fragments of list words than of control words. The word association task yielded mixed results. Although hypnotized and control subjects did not differ on this task, list words were elicited only slightly more frequently than nonlist words. As in other experiments, the simulators overplayed their roles; they performed poorly on all memory tests.

Kihlstrom (1980) reports two experiments in which he replicated and extended some of the Williamsen *et al.* data. In his first experiment, Kihlstrom examined retention of strongly related word pairs in subject groups stratified according to level of hypnotic susceptibility (very high, high, medium, low). The word pairs were studied during hypnosis, and amnesia for the events of the hypnotic session was explicitly suggested. As in the Williamsen *et al.* experiment there were four sequential tests, all administered in the waking state: (1) free recall of word pairs, (2) free association to word stimuli, primary associates of which had appeared on the experimental list, (3) a second free recall test, and (4) after a cue reversing the posthypnotic amnesia suggestion was given, a third free recall test.

Kihlstrom found that subjects' free recall performance was graded according to their level of hypnotic susceptibility; the low susceptibles recalled the most words, the high susceptibles the fewest. However, the

four subject groups did not differ on the word association task: All groups showed a relatively small but significant tendency to produce more list words than nonlist words. Performance on the second free recall task was nearly identical to performance on the first. Thus subjects' free recall performance did not benefit from their prior production of experimental words on the association task. After administration of the reversibility cue, however, free recall substantially improved in the high and very high susceptible subjects, though the performance did not differ among the four groups.

Kihlstrom's second experiment employed a similar sequence of experimental operations, except that only very high and low susceptible subjects were used, subjects studied lists of categorized materials, and a "category instance production" task was employed instead of a word association task: Subjects were presented with category names (half representing categories that appeared on the input list) and asked to generate instances of each category. The findings were entirely consistent with the results of Experiment 1. Very high-susceptible subjects were markedly worse than low susceptibles on the first free recall test, but they did not differ on the category instance production task; both groups retrieved more list items as category instances than would be produced in the absence of the experimental list. Neither group showed improvement in the subsequent free recall test—in spite of the fact that they produced many of those items on the category task—but the high susceptibles' free recall performance dramatically improved after the administration of the reversibility cue (low susceptibles were already at the ceiling).

The overall pattern of data in the Williamsen *et al.* and Kihlstrom experiments closely resembles data from the studies of source amnesia: Hypnotized subjects demonstrate retention of information imparted to them during the hypnotic episode when they are tested in ways that do not require them to remember contextual features of the episode itself.

4.2. The Hull Studies: Evidence for the Acquisition of Skills

The results of a series of experiments carried out in Clark Hull's Yale laboratory, which explored the extent of hypnotic amnesia, resemble in several respects data concerning preservation of skills in organic amnesics. Patten (1932), for instance, proposed to investigate the following question: "Do practice effects acquired in the hypnotic trance state carry over into the subsequent non-trance states even when the subject has a complete amnesia for the fact that practice has taken place?" (p. 196). Patten required hypnotized and control subjects to perform a continuous addition task during an experimental session for each of 18 consecutive days. For the first six sessions all subjects were in a normal state; during the second six half the subjects were hypnotized; and for the final six all the subjects were awake. Patten found that the hypnotized subjects showed about the same amount of improvement on the addition task during the hypnosis sessions as they did in the earlier and later sessions. Similarly, their practice increment while hypnotized was about as large as the control subjects' improvement during the comparable sessions. However, the hypnotized subjects reported no episodic memory for the events of the six hypnosis sessions. Using a similar experimental design, Life (cited in Hull, 1933, pp. 149–150) examined improvement in subjects' ability to learn successive lists of paired associates, a phenomenon that contemporary students of memory refer to as "learning to learn." Life found that hypnotized subjects showed as much improvement in performance across lists (learning to learn) when they were hypnotized as when they were not. The hypnotized subjects also showed as much learning to learn as control subjects.

Two other experiments from Hull's laboratory provide relevant data. Strickler (1929) taught hypnotized and control subjects paired associates consisting of line drawings and nonsense syllables. After a 15-minute retention interval, the line drawings were presented as cues for the nonsense syllables; all subjects were tested in the waking state. Hypnotized subjects were almost entirely amnesic for the experimental material: they recalled only 3% of the nonsense syllables compared to 84% for the controls. (It is interesting to note that Hull, commenting on Strickler's data, observed that when subjects did recall appropriate syllables, "they stated that the names seemed to come to mind from 'nowhere' and were not accompanied by any recollection that the character or symbol had ever been encountered before" [1933, p. 134].) Strickler's subjects then relearned the experimental list (in the waking state). Under this testing condition, the hypnosis group demonstrated large amounts of *savings:* They relearned the list in half the number of trials that were initially required. Although control subjects showed even more savings on the relearning trials, Strickler's data clearly indicate that exposure to the experimental list improved hypnotized subjects' ability to subsequently remaster the list, in spite of their dense amnesia for its contents. Coors (cited in Hull, pp. 141–145) used the savings method to evaluate the extent of maze learning in hypnotized and control subjects. Like Strickler, he found that the hypnosis group demonstrated significant savings upon relearning, although these savings were not as large as those of the control subjects.

In all of these studies from Hull's laboratory, subjects could not recall the events of the hypnotic episode. However, they were able to acquire some *procedural* knowledge during the hypnotic session that

they later expressed when tested in the waking state: Subjects were faster to add numbers after hypnosis than before it, their processing of paired-associate lists improved during and after hypnosis, and they were able to relearn material presented during hypnosis more efficiently than when they initially acquired it. Although these tasks may not be directly comparable to those used in studies of organic amnesics, and the data require corroboration by future research, the dissociations between episodic memory and acquisiton of skills observed in studies of both hypnotic and organic amnesia are strikingly similar.

4.3. Hypnotic Amnesia and the Episodic/Semantic Distinction

Overall, the patterns of preserved and impaired memory reported in the foregoing studies of hypnotic amnesia closely resemble the patterns observed in organic amnesia. Hypnotized subjects who have no memory for the learning episode as such can retain decontextualized fragments of experimental input, and are able to improve their performance on tasks that require utilization of cognitive skills. It is not surprising, then, that the implications of these studies for the episodic/ semantic distinction are similar to those of the organic amnesia studies.

First, the studies of source amnesia in hypnosis reinforce the need to distinguish clearly between memory for the factual content of an episode and autobiographical memory for the episode itself. That hypnotized subjects, like organic amnesics, can sometimes retain the factual content of an episode does not imply the involvement of episodic memory: The factual content is not remembered as part of the personal past of the subject.

Second, attempts to account for hypnotized subjects' retention of free fragments in terms of utilization of the structured knowledge of semantic memory encounter some of the same problems enumerated with respect to organic amnesics. It is unlikely that the information imparted to hypnotized subjects during a single experimental session is immediately integrated with existing semantic structures, and the possibility that priming of existing knowledge structures accounts for retention of free fragments is limited because of the brief temporal intervals over which priming effects persist. The hypnosis data emphasize the need for elaboration of the episodic/semantic distinction in a way that satisfactorily addresses the free fragment phenomenon.

Third, the data on cognitive skill improvement in subjects undergoing hypnotic amnesia emphasize the need to clarify the place of procedural knowledge in the episodic/semantic distinction. Modifications of procedural knowledge can be dissociated from modifications of episodic memory: Hypnotized subjects improve their ability to utilize various

skills, but express little episodic memory for the learning process. We do not yet know how such modifications of procedural knowledge can be accommodated by the episodic/semantic distinction. One purpose of this chapter is to call attention to the need for research on this problem.

5. FUNCTIONAL RETROGRADE AMNESIA

The bulk of contemporary research on amnesia is concerned with the analysis of organic amnesic syndromes and experimentally induced hypnotic amnesia. Relatively little attention has been paid to the category of pathological forgetting that we shall refer to as *functional retrograde amnesia*. This kind of amnesia typically occurs as a consequence of severe emotional trauma. The genesis of the amnesia is fairly consistent from case to case: Patients suddenly become aware that they cannot remember their name, where they live, and many other kinds of personal information. A fugue period often precedes awareness of the amnesia, during which the patient wanders about, unaware of his or her memory loss. After the fugue passes, the affected patient experiences little difficulty storing and retrieving information about ongoing events, but entire sections of his or her personal past remain inaccessible. The amnesia usually clears within a few days or a week, often in response to a cue that is associated with the precipitating emotional trauma.

Functional retrograde amnesia elicited considerable theoretical enthusiasm from late nineteenth- and early twentieth-century students of memory pathology. Azam (1876), who published perhaps the first case study of functional retrograde amnesia, boldly introduces his topic: "I am going to relate the history of a young woman whose existence is tormented by an impairment of memory, which is without a parallel in science" (p. 584). Coriat (1907) explicitly argues that students of memory pathology would do well to pay close attention to functional amnesias: "It is not the organic, but rather the functional amnesias, that display the most interesting and valuable phenomena" (p. 108). However, most subsequent research on functional retrograde amnesia was not concerned with its implications for theoretical analyses of memory or memory pathology. Instead these investigations pursued psychiatric issues, and attempted to distinguish between the various onset conditions of the amnesia (Abeles & Schilder, 1935; Kanzer, 1939; Kennedy & Neville, 1957; Sargant & Slater, 1941; Thom & Fenton, 1920), to relate it to different forms of psychopathology (Berrington, Liddell, & Foulds, 1956; Leavitt, 1935; Stengel, 1941; Wilson, Rupp, & Wilson 1950), to specify criteria for differentiating genuine amnesics from malingerers (Adatto, 1949; Hopwood & Snell, 1933; Lennox, 1943; Price & Terhune, 1919;

Siegal, 1951), to estimate the contribution of organic factors (Kennedy & Neville, 1957), to describe the duration of amnesia and the different forms of recovery (Abeles & Schilder, 1935; Kanzer, 1939; Wilson *et al.*, 1950), to suggest treatment methods (Sargant & Slater, 1941), and to clarify the psychodynamic functions of amnesia (Kennedy & Neville, 1957). Over the past 20 years there has been very little research of any kind concerning functional retrograde amnesia.

There are, however, some data in the literature that are of interest to us. These data derive from clinical observations that describe patterns of preserved and lost mnemonic abilities during functional retrograde amnesia. Although these observations lack experimental rigor, they provide a picture that is in general agreement with the previously described research on organic and hypnotic amnesia. It has been noted that in spite of patients' dense amnesia for personal experiences—including failure to recall and recognize their name, relatives, home, and place of work—their organized knowledge of the world is largely preserved (Jones, 1909; Wilson *et al.*, 1950), although it has been suggested that "general knowledge" remains intact only in some patients (Abeles & Schilder, 1935). But even in the most severe cases, when patients temporarily lose the ability to name and appropriately use familiar objects, access to this kind of knowledge returns rapidly, well before the amnesia for personally experienced episodes clears (Coriat, 1907). Patients' ability to use and comprehend language, read, write, and fluidly process new information—in short, their ability to employ a wide range of cognitive skills and procedures—is also frequently unaffected by the amnesia (Abeles & Schilder, 1935; Gillespie, 1937; Kanzer, 1939; Prince, 1910).

A number of turn-of-the-century clinical observers found that patients were able to access some memories related to their personal past if the method of retrieval was "indirect," and did not require patients consciously to attempt to retrieve their personal memories. Jones (1909) reports a case in which the patient could provide some accurate information about his personal past when asked to "guess" about it. For instance, the patient could not remember the names of his wife and daughter, but when asked to guess them he did so correctly (p. 221). However, the retrieved information was not recognized as part of his own past. Coriat (1907) reports similar observations. He asked patients to focus their attention on a monotonous stimulus and to report whatever came into their minds. Under such conditions, a patient suffering from a dense functional retrograde amnesia was able to retrieve information that accurately depicted parts of her past. But the retrieved contents seemed strange and unfamiliar to her. Coriat's description of these "distraction memories" resembles descriptions of the free fragments observed in organic amnesics and hypnotized subjects:

> These memory automatisms... are not looked upon as memories, but as strange, unfamiliar and isolated phenomena, which Susan N. [the patient] well expressed by the term "wonderments"....
>
> A prominent feature of all these distraction memories was their complete isolation; they did not act as a nucleus around which other memories grouped themselves by association.... They were the emerging into her mind of isolated memory images, such as a name, a face or a place, which seemed to come from out of nowhere, without any connection with anything else. They did not bring with them any extended associations. (p. 106–107)

Kanzer (1939) reports similar phenomena in his amnesic patients. For instance, one young woman became amnesic after a distressing telephone conversation with her boyfriend. During the amnesic period she recalled "someting about a telephone" (p. 115), but could not relate this fragmentary information to her personal past. Prince (1910), in his study of functional amnesia in a case of multiple personality, notes the occurrence of fragmentary "visions" of past events: "The visions were pure automatisms, excrescences in her mind, without conscious association with the other experiences of the life which they pictured. When seeing a vision she did not recognize the pictorial experiences as her own" (p. 265). Highly similar observations are reported by other students of functional retrograde amnesia (Gillespie, 1937; Janet, 1901; Sidis, 1914).

The unsystematic nature of these observations must be kept in mind, of course, when attempting to interpret them. However, it does seem appropriate to note the similarity between the "automatisms," "visions," and "distraction memories" of functional retrograde amnesia and the free fragments of organic and hypnotic amnesia: The qualitative resemblance is striking. In all three types of amnesia, people access isolated bits of information that were acquired during specific episodes but are not part of organized semantic structures, and are not experienced as part of the personal past of the rememberer. As noted earlier, it is not yet clear how the episodic/semantic distinction can make sense of this phenomenon.

5.1. Episodic/Semantic Dissociation: An Experiment with an *N* of 1

As noted earlier, the literature on functional retrograde amnesia primarily consists of clinical descriptions of memory processes during the amnesic period. We recently had the opportunity to perform an experiment with a single patient suffering from functional retrograde amnesia.*

The clinical course of this case resembles many others described in

*This research was conducted in collaboration with Dr. Paul Wang.

the literature. A patient whom we shall refer to as P. N., a 21-year-old man, entered Mount Sinai Hospital in Toronto unable to remember his name, address, or any other information about himself or his past. He also complained of back pains. The patient's picture was published in one of the Toronto newspapers, and a cousin who saw it came to Mount Sinai the next day (P. N. did not recognize this cousin). She reported that P. N.'s grandfather had died several days earlier; the funeral was held in Toronto. P. N.'s parents had separated when he was 10 months old, and P. N. was apparently closer to his grandfather than to any other person. When asked about his grandfather and the recent funeral, P. N. could recall nothing—not even the fact that he had a grandfather. The amnesia cleared, in dramatic fashion, four days after it had begun, while P. N. viewed the concluding episode of the television series *Shogun*. As he watched an elaborate cremation and funeral sequence, P. N. reported that an image of his grandfather gradually appeared in his mind. He subsequently remembered his grandfather's death and the recent funeral. He then regained his sense of personal identity, and over the next few hours, the large sections of his personal past that had been inaccessible for the previous 4 days also returned.

Neuropsychological testing revealed that P. N.'s ability to process information, access his general knowledge of the world, and utilize a variety of cognitive and motor skills was intact, or marginally impaired, during the amnesic episode. Clinical observations suggested that in spite of his inability to remember the events of his personal past, P. N.'s memory for "public" events was relatively preserved. Our study of P. N focussed on these two types of memory.

We tested the patient for episodic and semantic memory on two separate occasions: during the amnesic episode and three weeks after its termination. Semantic memory was represented by memory for public events. It was assessed by the famous-faces test of the Boston Veterans Administration retrograde amnesia battery (Albert, Butters, & Levin, 1979). P. N. was shown photographs of well-known people from each of the past 6 decades and asked to identify them. When he did not properly identify a face, he was provided with semantic cues related to it, and then asked to try and select the appropriate name from a set of four. We examined P. N.'s episodic memory by using the cuing procedures for personal experiences developed by Crovitz and Schiffman (1974) and Robinson (1976). The *episodic-cuing* task was given twice in succession under different conditions. In both tests, P. N. was given a series of common English words and asked to produce a discrete personal memory in response to each of them. He was also asked to date the memory temporally. In the initial, *unconstrained* condition, P. N. was instructed

to retrieve a memory from any time in his personal past—minutes, days, weeks, months, or years ago. In the second, *constrained* condition, each cue was presented again, and P. N. was asked to retrieve a different memory in response to it. Now, however, P. N. was instructed to provide only memories that temporally preceded the onset of his amnesia. P. N. was tested on one form of both the famous-faces test and the episodic-cuing task during the amnesic period; a second form was administered after the amnesia had cleared.

P. N.'s performance on the famous-faces test was nearly identical across the two sessions. He was able to identify, or recognize the name of, 15 of the 24 faces tested during the amnesic period; he was correct on 16 of the 24 after the amnesic period. However, his performance on the episodic-cuing task substantially changed between test sessions. During the amnesic period, almost all (86%) of P. N.'s memory came from the 3 days that followed the onset of the amnesia. This pattern sharply contrasts with the performance of normals, who provide a relatively small proportion of memories (less than 25%) from the categories of minutes, hours, and days on the episodic-cuing task (Crovitz & Schiffman, 1974). When tested after the amnesia had cleared, P. N.'s performance drastically altered: Nearly all of his memories (92%) predated the onset of the amnesia. Similarly, the *median age* of P. N.'s memories in the unconstrained condition was much greater after the amnesic period than during it, and he was also much faster to retrieve episodic memories, in both the constrained and unconstrained conditions, after the amnesia passed.

P. N.'s performance in the constrained condition during the amnesic episode yielded some especially intriguing observations. When forced to retrieve memories predating the amnesic period, he recalled several pertaining to distinctive childhood episodes (e.g., that his finger was crushed in a door) and other isolated events. However, a large majority of his preamnesic memories derived from 2 months during 1979 when he worked for a Toronto courier service. P. N.'s descriptions indicated that this time was extremely happy for him. He was able to recall, in rich detail, many individual episodes associated with his courier job. Thus, although P. N. could not recall where he lived, what he was doing during the past year, who his family and friends were, or where he went to high school, he could recall the names and faces of his friends at the courier service, and many of the things they had done together. Observations of such "islands" of intact memory are common in studies of concussion amnesia (W. R. Russell, 1971), but have not yet been reported in cases of functional retrograde amnesia. When tested after the amnesic period, P. N. retrieved memories that were distributed

across many temporal intervals; there were no comparable islands of memory.

Data obtained from a single subject must be treated with interpretive restraint. Accordingly, we shall not attempt to draw firm conclusions from this case study of functional retrograde amnesia, but shall instead raise several possibilities for exploration in future research.

First, P. N.'s stable performance on the public events test across sessions, in conjunction with the marked changes on the cuing test, suggest a selective impairment of episodic memory in functional retrograde amnesia. Second, that cuing procedures did elicit some memories from the time period covered by the amnesia suggests that functional retrograde amnesia need not be as uniformly dense as indicated by the clinical literature. Third, the finding of a memory "island," structured around a particular time in the subject's life, raises questions concerning the organization of episodic memories. What factors permitted P. N. to remember in detail the events nested within the island at the same time that he could not access almost all other sectors of his personal past? The positive emotions P. N. expressed concerning the events within the island suggest the possible importance of affective factors, but it is not yet clear how to assess the influence of affect on retrieval of episodic memories. In any case, our data suggest that quantitative exploration of functional retrograde amnesia may yield interesting insights concerning the operation of episodic memory, and also indicate that cuing procedures may provide a useful tool for studying the phenomenon.

6. CONCLUDING COMMENTS

We have reviewed evidence from studies of organic, hypnotic, and functional amnesia and have discussed the implications of this evidence for the distinction between episodic and semantic memory. Specifically, we have suggested that the observations of amnesics' memory performance highlight three difficulties with the distinction as it is currently formulated: (1) There may be a need to distinguish between memory for the factual content of a learning episode and autobiographical memory for the episode; (2) the distinction does not satisfactorily account for the phenomenon of free fragments—bits of retained information that have become detached from their episodic contexts but do not seem to be attached to organized knowledge structures in semantic memory; and (3) the episodic/semantic distinction is mute on the role of procedural knowledge in memory.

We have suggested directions for research that may help to elucidate these problems and, consequently, to stimulate revisions, and perhaps extensions, of the episodic/semantic distinction. We shall now address two issues likely to arise during the course of such research.

6.1. Dissociation between Systems or Loss of Information?

One of the fundamental properties of amnesics' memory impairment is that it is not uniform across all types of tasks or materials. The impairment—in the organic, hypnotic, and functional cases—is *selective;* amnesics perform better on some memory tasks than on others. When amnesics perform in a relatively intact fashion on tasks that are assumed to draw primarily on a particular memory system, but perform poorly on tasks that are largely dependent on a different system, we have evidence for the dissociation of the two systems. Using such logic, it is possible to move from observations of amnesics' patterns of performance on different tasks to more general statements about similarities and differences between underlying memory systems.

There is, however, a problem with this line of reasoning in the present context. It can be argued that the selectivity of amnesics' memory impairment does not provide evidence concerning the relation between underlying systems, but instead reflects the fact that some kinds of information are forgotten faster than others. Consider, for example, the case of source amnesia. Source amnesia occurs when subjects are tested sometime after presentation of information, and can retrieve the information without knowing when and where they acquired it. The problem is, however, that it would be difficult to observe source amnesia if testing were carried out *immediately* after study: Even amnesic subjects would probably be able to recall both the information and its source. It is plausible to argue, then, that observations of source amnesia simply reflect the fact that one kind of information (episodic information) is lost faster than another (semantic information). The same kind of argument could be applied to observations of skill acquisition by amnesics in the absence of memory for the events of the learning episode: Knowledge of the episode may be lost faster than knowledge about how to execute a particular skill.

The contention that apparent dissociations between memory systems are better interpreted in terms of differential rates of loss of information is difficult to refute convincingly at present. However, there are two strategies for handling this problem that might be fruitfully employed in future research. One is to attempt to specify conditions under which the "lost" information can be recovered. It is well-known that information that is not accessible under one set of retrieval conditions may be accessed under some others (Tulving & Pearlstone, 1966). For instance, if it could be shown that in the source amnesia task conditions

exist under which subjects *can* retrieve information about the learning episode, then it would be difficult to contend that source amnesia is a consequence of rapid *loss* of episodic information. Indeed, this strategy has already been used in the work of Kihlstrom (1980), in which episodic amnesia was eliminated by the administering of a reversibility cue.

A second strategy is to look for *double dissociations* of memory function. In neuropsychology, double dissociations frequently take the form of crossover interactions between patient groups and tasks. If Patient Group A performs Task X better than Task Y, and Patient Group B performs Task Y better than Task X, then a double dissociation has occurred (cf. Shallice, 1979). In our context, it would be desirable to identify subject groups whose pattern of memory performance is *opposite* to the patterns of some of the subject groups discussed in this chapter. For example, if there are patients who retain information about the occurrence of an episode and its relation to their personal past but are pathologically unable to remember the factual content of the episode, then it would be difficult to maintain the argument that a phenomenon such as source amnesia reflects the fact that episodic information is lost faster than other kinds of information. In fact, Luria reports suggestive evidence along these lines (1976, p. 117).

6.2. How Many Memory Systems?

We have argued throughout that the distinction between episodic and semantic memory requires revision, and perhaps extension. We do not yet know if it is necessary to postulate additional systems beyond the two included in the distinction; and if additional systems are necessary, we do not know what they would be. Miller and Johnson-Laird (1976), for instance, have suggested the possibility of a fivefold classification: semantic, episodic, action, geographic, and person memories. Such a burgeoning of memory systems may be cause for concern to those who value parsimony in science: After one or two additional systems are suggested, the list may quickly become unmanagably long.

We acknowledge the possibility of an undesirable proliferation of memory systems. But we also recognize that it is a mistake to ignore distinctions that may have both heuristic and theoretical value. A taxonomy of memory systems, like taxonomies in other areas of science, should strike a balance between too many and too few distinctions. The problem is an old one, and was confronted by some of the founders of modern scientific taxonomy. Linnaeus, for instance, explicitly warned against the dangers of taxonomic excess: "If every minute difference, every trifling variation, is to establish a new species, why should I delay to exhibit ten thousand such species?" (Smith, 1978, p. 277). However,

he also acknowledged that failure to make useful distinctions was an equally serious error: "If, then, genera be distinct, why should not their names be kept perfectly so likewise?" (Smith, p. 257).

There are no clear-cut rules for achieving a balance between the two undesirable extremes—too few distinctions or too many—and we suspect that the development of a suitable taxonomy of memory systems will be guided by the trial-and-error procedures that are characteristic of a developing science such as psychology. Perhaps it is not too much to hope that such procedures will help to provide a basis for answering the question with which we began: How can we characterize the systems that comprise human memory?

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