

# MEMORY AND CONSCIOUSNESS

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## ABSTRACT

Speculations supported by empirical observations are offered concerning different memory systems (procedural, semantic, and episodic) and corresponding varieties of consciousness (anoetic, noetic, and auto-noetic), with special emphasis on episodic memory and auto-noetic consciousness as its necessary correlate. Evidence relevant to these speculations is derived from a case study of an amnesic patient who is conscious in some ways but not in others, as well as from simple experiments on recall and recognition by normal subjects. Auto-noetic (self-knowing) consciousness is the name given to the kind of consciousness that mediates an individual's awareness of his or her existence and identity in subjective time extending from the personal past through the present to the personal future. It provides the characteristic phenomenal flavour of the experience of remembering. The extent to which auto-noetic consciousness is engaged in recall and recognition of word-events was measured in two demonstration experiments whose results were systematically related to the conditions under which the recovery of knowledge about the events was observed.

Of all the mysteries of nature, none is greater than that of human consciousness. Intimately familiar to all of us, our capacity to contemplate the universe and to apprehend the infinity of space and time, and our knowledge that we can do so, have continued to resist analysis and elude understanding.

After its banishment as an epiphenomenon by behaviouristic psychology, consciousness has recently again been declared to be the central problem of psychology (Hilgard, 1980; Miller, 1980; Neisser, 1979). A few psychologists have taken up the challenge posed by the many problems of consciousness, but contemporary psychology at large has continued to overlook this uniquely human property of the human mind.

Nowhere is the benign neglect of consciousness more conspicuous than in the study of

human memory. One can read article after article on memory, or consult book after book, without encountering the term "consciousness." Such a state of affairs must be regarded as rather curious. One might think that memory should have something to do with remembering, and remembering is a conscious experience. To remember an event means to be consciously aware now of something that happened on an earlier occasion. Nevertheless, through most of its history, including the current heyday of cognitive psychology, the psychological study of memory has largely proceeded without reference to the existence of conscious awareness in remembering.

The literature on consciousness is rich, with many contributions by philosophers (e.g., Dennett, 1969), psychologists (e.g., Gray, 1971; Mandler, 1975; Natsoulas, 1978, 1981; Posner & Klein, 1973; Shallice, 1972; Underwood, 1982; Underwood & Stevens, 1979, 1981), neuroscientists (e.g., Eccles, 1977; Sperry, 1969), and others (e.g., Globus, Maxwell, & Savodnik, 1976; Griffin, 1976, 1984; Josephson & Ramachandran, 1980). But much of it consists of "epistemological, metaphysical, and existential" theorizing — to borrow the apt phrase from Peter Dodwell (1975) — without corresponding empirical facts. Even when attempts are made to relate consciousness to the activity of the brain, the situation is not much better, as observed by Gazzaniga and LeDoux: "When the inevitable topic of consciousness is approached in the light

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of modern brain research, the experienced student has come to brace himself for the mellifluous intonations of someone's personal experience and ideas on the matter, as opposed to data" (1978, p. 141).

The psychological literature relevant to the problem of the relation between memory and consciousness differs from the larger literature on consciousness by the dearth of both ideas and facts. There has been little apart from the idea that primary memory can be identified with consciousness (e.g., Craik & Jacoby, 1975; James, 1890), the idea that rehearsal of information in primary memory is a conscious process (e.g., Atkinson & Shiffrin, 1971; Wickelgren, 1977), and the idea that latent memory traces are unconscious, whereas activated ones are conscious (e.g., Underwood, 1979). And just about the only facts concerning memory and consciousness come from shadowing experiments in which the level of conscious awareness of to-be-tested materials has been manipulated (e.g., Eich, 1984; Moray, 1959; Norman, 1969).

The present paper describes an attempt to relate memory to consciousness in terms of data obtained through clinical observation and laboratory experiment. Its basic pre-theoretical assumption is that progress in the scientific understanding of consciousness — as against its epistemological, metaphysical, or experiential understanding — requires not only the postulation and identification of different *kinds* of consciousness but also their *measurement* as an aspect of experience, or as a dependent variable.

The paper consists of six parts. First, a hypothetical scheme is described in which different varieties of memory are related to different varieties of consciousness. Second, clinical observations from a case study, together with relevant evidence and ideas from other sources, are used to describe and characterize a particular kind of consciousness and conscious awareness, referred to as auto-noetic (self-knowing) consciousness. Third, the concept of auto-noetic conscious awareness is further elaborated. In the fourth part, auto-noetic consciousness is related to the synergistic ephory model of recall and recognition (Tulving, 1982, 1983). In the fifth part, two demonstration experiments are described in which auto-noetic awareness was measured and shown to vary systematically with conditions under which recall and recognition were observed. Finally, the question of the biological utility of episodic memory and auto-

noetic consciousness is briefly discussed.<sup>1</sup>

### Varieties of Memory and Consciousness

Let us assume that there are three different kinds of memory, or three memory systems: procedural, semantic, and episodic (Tulving, 1983). They are alike in that they all make possible the utilization of acquired and retained knowledge. But they differ in the kind of knowledge that they handle, and in the ways in which different kinds of knowledge are acquired or used.

Procedural memory (Anderson, 1976; Tulving, 1983; Winograd, 1975) is concerned with how things are done — with the acquisition, retention, and utilization of perceptual, cognitive, and motor skills. Semantic memory — also called generic (Hintzman, 1978) or categorical memory (Estes, 1976) — has to do with the symbolically representable knowledge that organisms possess about the world. Episodic memory mediates the *remembering* of personally experienced events (Tulving, 1972, 1983).

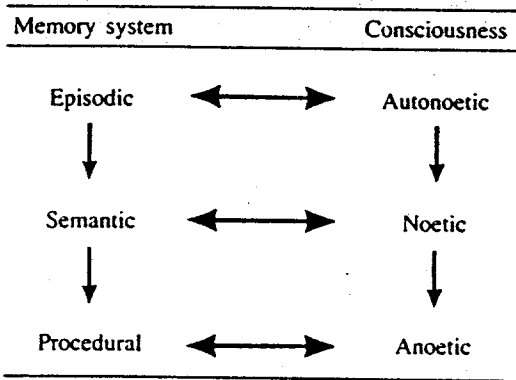
Ideas about the relations between the three systems have varied. Not too long ago (Tulving, 1983), I thought of the three systems as representing two different levels in a hierarchy: memory as a whole subdivided into two general types, procedural and propositional, with episodic and semantic constituting two *parallel*, albeit interacting and overlapping, subsystems of propositional memory. Recently, however, I was led by a number of critics to the view that a more reasonable assumption concerning the relation between the episodic and semantic system is one according to which episodic memory constitutes a single distinct subsystem of semantic memory (Tulving, 1984).

It seems reasonable to extend this idea to cover all three systems and to assume that they constitute a class-inclusion hierarchy in which procedural memory entails semantic memory as a *specialized* subcategory, and in which semantic

<sup>1</sup> Although the terms "consciousness" and "conscious awareness" (or simply "awareness") are closely related, and sometimes used interchangeably, in the present discussion they are used in different senses. "Consciousness" refers to a particular capability of living systems, whereas "awareness" refers to the internally experienced outcome of exercising this ability in a particular situation. (Another closely related term, "attention," even though not used in this paper, would refer to the control that the organism, or environmental events, can exert over the direction of consciousness in the selection of "contents" of awareness.)

TABLE I

A schematic diagram of the relations between memory systems and varieties of consciousness



memory, in turn, entails episodic memory as a specialized subcategory. According to this scheme, it is impossible for an organism to possess episodic memory without the corresponding semantic memory, and impossible for it to possess semantic memory without the corresponding procedural memory, although semantic memory systems can exist independently of episodic systems, and procedural systems independently of semantic systems.

Each of the three memory systems, in addition to other ways in which it differs from others, is characterized by a different kind of consciousness. I will refer to the three kinds of consciousness as anoetic (non-knowing), noetic (knowing), and autonoetic (self-knowing). Their relation to each other and to the three memory systems is schematically depicted in Table 1.<sup>2</sup>

The procedural memory system is characterized by anoetic consciousness. Anoetic consciousness is temporally and spatially bound to the current situation. Organisms possessing only anoetic consciousness are conscious in the sense that they are capable of perceptually registering, internally representing, and behaviourally responding to aspects of the present environment, both external and internal. Anoetic consciousness does not include any reference to non-present extraorganismic stimuli and states of the world.

Semantic memory is characterized by noetic consciousness. Noetic consciousness allows an organism to be aware of, and to cognitively operate on, objects and events, and relations among objects and events, in the absence of these objects and events. The organism can flexibly act upon such symbolic knowledge of the world. Entering information into, and retrieval of information from, semantic memory is accompanied by noetic consciousness.

Of special interest in the present paper is autonoetic consciousness, correlated with episodic memory. It is necessary for the remembering of personally experienced events. When a person remembers such an event, he is aware of the event as a veridical part of his own past existence. It is autonoetic consciousness that confers the special phenomenal flavour to the remembering of past events, the flavour that distinguishes remembering from other kinds of awareness, such as those characterizing perceiving, thinking, imagining, or dreaming.

Evidence for autonoetic consciousness will be drawn from clinical observations of an amnesic patient, to be described presently. The distinction between the other two kinds of consciousness is based on conjecture. But it is not without precedent. Consider, for instance, a classification of different kinds of memory proposed by Hermann Ebbinghaus, who is usually thought of as the inventor of the nonsense syllable and as responsible for psychology's long preoccupation with rote learning. Ebbinghaus distinguished between three kinds of effects of "mental states which were at one time present in consciousness and then have disappeared from it" (1885, p.1). In the first place, he suggested, we call back into consciousness a seemingly lost state that is then "immediately recognised as something formerly experienced" (1885, p.1): that is, we *remember*. In the second case — Ebbinghaus said it occurs when we reproduce a mental state "involuntarily" — this accompanying consciousness may be lacking and "we know only indirectly that the 'now' is identical with the 'then'" (1885, p.2). In the third case, earlier processes leave consequences or effects that facilitate "the occurrence and progress of similar processes," although these effects "remain concealed from consciousness" (1885, p.2). Ebbinghaus's first case can be thought to correspond to autonoetic, the second to noetic, and the third to anoetic consciousness.

<sup>2</sup>The terms "anoetic consciousness" (Vol. 1, p.50) and "noetic consciousness" (Vol. 2, p.11) have been used by Stout (1896) in somewhat different, but related, senses from those used here.

## A Man without Auto-noetic Consciousness: A Case Study

Evidence pertinent to auto-noetic consciousness comes from a case study of an amnesic patient whom I and my colleague, Daniel Schacter, have been observing at our Unit for Memory Disorders in Toronto. This young man, here referred to as N.N., suffered a closed head injury a few years ago as a result of a traffic accident.

N.N.'s amnesia for personal events is profound. It covers the time both before and after his accident. When he is distracted, he forgets something said to him almost immediately. Although his immediate memory span is eight digits, on a picture-memory recognition test on which normal subjects score 60 to 70% correct, his score is zero. On a cued-recall test of categorized words, he does not distinguish between correct responses and category intrusions. Although he knows a few things about his past — for instance, what year the family moved into the house where they live now, the names of the schools he went to, or where he spent his summers in his teens — he cannot recall a single event or incident from the past. Like the patient S.S. described by Cermak and O'Connor (1983), N.N.'s knowledge of his own past seems to have the same impersonal experiential quality as his knowledge of the rest of the world.

His language skills and general knowledge are relatively intact. He can define words such as "evasive," "perimeter," and "tangible"; he can provide a reasonably good verbal description of the "script" of going to a restaurant or making a long-distance telephone call; he can describe the typical daily activities of a university student; he knows what the North American continent and the Statue of Liberty look like, and can draw their outlines. He also knows the meaning of the term "consciousness." When asked what consciousness is, he says, "It's being aware of who we are and what we are, and where we are."

N.N. has no difficulty with the concept of chronological time. He knows the units of time and their relations perfectly well, and he can accurately represent chronological time graphically. But in stark contrast to his abstract knowledge of time, his awareness of subjective time seems to be severely impaired. When asked what he did before coming to where he is now, or what he did the day before, he says that he does not know. When asked what he will be doing

when he leaves "here," or what he will be doing "tomorrow," he says he does not know.

Here is part of the transcript of an interview, with me as the interviewer:

E.T.: "Let's try the question again about the future. What will you be doing tomorrow?"

(There is a 15-second pause.)

N.N. smiles faintly, then says, "I don't know."

E.T.: "Do you remember the question?"

N.N.: "About what I'll be doing tomorrow?"

E.T.: "Yes. How would you describe your state of mind when you try to think about it?"

(A 5-second pause.)

N.N.: "Blank, I guess."

When asked, on different occasions, to describe the "blankness" that characterizes his state of mind when he tries to think about "tomorrow," he says that it is "like being asleep" or that "it's a big blankness sort of thing." When asked to give an analogy, to describe what it is like, he says, "It's like being in a room with nothing there and having a guy tell you to go find a chair, and there's nothing there." On another occasion he says, "It's like swimming in the middle of a lake. There's nothing there to hold you up or do anything with." When asked to compare his state of mind when he is trying to think about what he will be doing tomorrow with his state of mind when he thinks about what he did yesterday, he says it is the "same kind of blankness." N.N. makes all these observations calmly and serenely, without showing any emotion. Only when he is asked whether he is not surprised that there is "nothing there" when he tries to think about yesterday or tomorrow, does he display slight agitation for a moment and utter a soft exclamation of "Wow!"

N.N. clearly is conscious and he clearly has a good deal of preserved memory capability. At the same time his consciousness and memory are severely impaired, and impaired highly selectively. He knows many things about the world, he is aware of this knowledge, and he can express it relatively flexibly. In this sense he is not greatly different from a normal adult. But he seems to have no capability of experiencing extended subjective time, or chronognosia (Bouman & Grunbaum, 1929): even if he feels that he has a personal identity, it does not include the past or the future; he cannot remember any particular episodes from his life, nor can he imagine anything that he is likely to do on a subsequent occasion. He seems to be living in a "permanent present." In terms of the threefold classification

of consciousness proposed here, we could say that N.N. possesses both anoetic and noetic consciousness but not auto-noetic consciousness, and that his procedural and semantic memory systems are relatively unimpaired whereas his episodic memory is severely damaged.

We must obviously be very cautious when we generalize from observations of individual cases, particularly since no two amnesic patients are ever exactly alike. Nevertheless, it is reasonable to believe that N.N. does not represent an isolated occurrence of a severe impairment in the ability to apprehend and contemplate extended subjective time. His case tells us that amnesia can be characterized as a derangement of consciousness and not just a derangement of memory for past events.

### Auto-noetic Consciousness, Subjective Time, and Episodic Memory

Students of amnesia have noted before that some amnesic patients live in a "permanent present" (e.g., Barbizet, 1970, p.33). The context of the discussion of relevant cases usually implies that such patients are unaware of their *past*. But writers on amnesia have sometimes pointed out that because the patients cannot utilize the past, their future too must remain hazy, vague, and confused, leaving them "marooned in the moment" (e.g., Lidz, 1942, p.596). Our observations of N.N. corroborate the idea that the lack of conscious awareness of personal time encompasses both the past and the future. A normal healthy person who possesses auto-noetic consciousness is capable of becoming aware of her own past as well as her own future; she is capable of mental time travel, roaming at will over what has happened as readily as over what might happen, independently of physical laws that govern the universe. N.N. seems to be completely incapable of doing so. It is this fact that provides the basis for the conclusion that he is severely or completely lacking in auto-noetic consciousness.

David Ingvar has measured regional cerebral blood flow in normal people in a resting state, and has observed a "hyperfrontal" pattern of cortical activation (Ingvar, 1979). He has interpreted such hyperfrontality as reflecting properties of a consciousness that embraces the past, the present, and the future: "On the basis of previous experiences, represented in memories, the brain — one's mind — is automatically busy

with extrapolation of future events and, as it appears, constructing alternative hypothetical behaviour patterns in order to be ready for what may happen" (Ingvar, 1979, p.21). Ingvar has also suggested that the frontal lobes constitute the anatomical basis for people's "memory for the future" (Ingvar, personal communication; see also Ingvar, 1983). It seems reasonable to assume, however, that the kind of consciousness that Ingvar is concerned with is more like auto-noetic consciousness than consciousness at large.

The lessons learned from N.N. and the ideas suggested by Ingvar make it possible to speculate about the general nature of auto-noetic consciousness and to make up a tentative list of its properties. A summary of these properties is as follows:

1. Encompasses personal time: past and future
2. Necessary component of remembering of events
3. Appears late in development
4. Selectively impaired or lost in brain damage
5. Varies across individuals and situations
6. Can be measured

We have already discussed the first idea: auto-noetic consciousness encompasses extended subjective time, an individual's ability to apprehend her personal past and future. Although N.N. is conscious in many ways, he does not perceive the present moment as a continuation of his own past and as a prelude to his future. N.N. is like one of Jaynes's bicameral men, who did not have feelings of personal identity in our sense and "who could not reminisce because they were not fully conscious" (Jaynes, 1976, p. 371).

The second suggestion is that auto-noetic consciousness is a *necessary correlate* of episodic memory. According to the scheme I am describing, there is no such thing as "remembering without awareness" (cf. Eich, 1984; Jacoby & Witherspoon, 1982; Masson, 1984). Organisms can behave and learn without (auto-noetic) awareness, but they cannot *remember* without awareness. Nor can nonliving matter remember anything, even if it can act upon previously stored information (e.g., Robinson, 1976). Like many other amnesic patients described in the literature who can acquire a variety of new skills (Moscovitch, 1982; Cohen & Squire, 1980; Parkin, 1982), N.N. shows normal learning of the kind

referred to as priming effects in word-fragment completion (Schacter, 1984; Tulving, Schacter, & Stark, 1982). He can also learn new words, and new meanings of old words, although at a rather slow rate, as shown in ongoing research conducted by Elizabeth Glisky at the Unit for Memory Disorders. But he does not seem to be able to remember anything.

Third, auto-noetic consciousness appears later in an individual's development than do other forms of consciousness (e.g., Knapp, 1976). Many writers have suggested that very young children have neither episodic memory nor (auto-noetic) consciousness (e.g., MacCurdy, 1928; Neisser, 1978; Nelson & Gruendel, 1981). Nelson and Gruendel's observations are representative: "There is no evidence that the young child who remembers an episode remembers it as having taken place at a particular time in a particular temporal context — that is, that it constitutes an autobiographical memory of the type that older children and adults can draw on" (1981, p. 149). And Neisser has suggested that a young child may be conscious of an object when he perceives it, but "he is not aware that he, a person with a particular history and character and probable future," is seeing the object (1978, p. 172). Every young child is an extremely capable learner: her behaviour and experiences can have readily identifiable consequences for her future behaviour and experiences. Yet she need not have any (auto-noetic) conscious awareness as to the origin of these consequences: there need be no remembering (Lockhart, 1984; Schacter & Moscovitch, 1984). As episodic memory follows semantic memory in normal development (Kinsbourne & Wood, 1975), so auto-noetic consciousness emerges from noetic consciousness.

The fourth property of auto-noetic consciousness is its selective dependence on particular brain processes: the case of N.N. shows that certain kinds of brain damage may result in its impairment, or loss, without comparable impairment in other forms of consciousness. Correlation with brain mechanisms must be regarded as one of the more important criteria for distinguishing between different kinds of consciousness. If such correlations did not exist, and if differential impairment of different kinds of consciousness had never been observed, classification of consciousness into distinct varieties would remain yet another metaphysical exercise.

The fifth property of auto-noetic con-

sciousness concerns its variability among individuals and its variable occurrence in different situations (e.g., Roth, 1980). Individuals presumably vary in the extent to which they "possess" and benefit from auto-noetic consciousness in their daily activities, as they vary with respect to other mental characteristics. Similarly, auto-noetic consciousness can be expected to vary systematically with the conditions under which it is observed.

Finally, auto-noetic consciousness is measurable. Although perhaps a trite point in some ways, it is worth making because of the current state of research on consciousness. If it were not possible to make quantitative statements about auto-noetic consciousness, its usefulness as a scientific concept would be greatly diminished.

### Recovery of Knowledge about Past Events

I have argued that N.N. possesses neither episodic memory nor auto-noetic consciousness. Yet it is a fact that he can make veridical statements about his past. The resolution of this apparent contradiction between the argument and the fact lies in the assumption that people can have and can express knowledge about things that have happened to them even if they can rely only on their semantic memory (Schacter & Tulving, 1982; Schacter, Harbluk, & McLachlan, 1984). That is, even when a person does not *remember* an event, she may *know* something about it. Such knowledge is created in the same way, and it is of the same quality, as the knowledge about the temporally and spatially extended world and its abstract features existing independently of the person.

If it is possible to recover knowledge about past events from either the episodic system or the semantic system, then the phenomenal experience that accompanies the recovery of such information may be one of remembering (auto-noetic awareness) or knowing (noetic awareness), or a mixture of the two. It follows, then, that one way of measuring auto-noetic awareness could take the form of asking people, when they recall or recognize a previously encountered item, whether they *remember* the event or whether they *know* in some other way that it occurred. The probability of the "remember" judgement can serve as an index of the extent to which auto-noetic consciousness is involved in recovery of knowledge about past events in a particular situation.

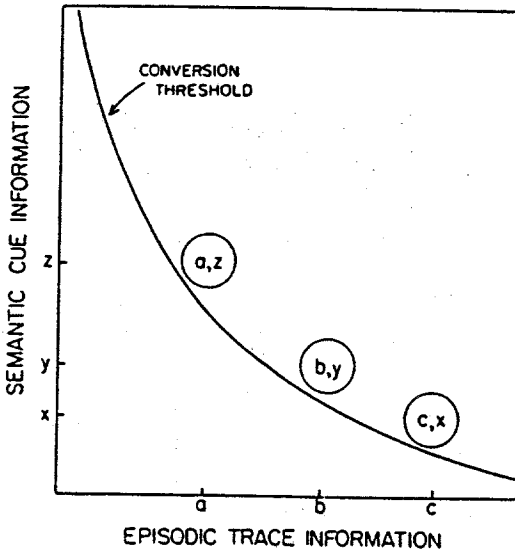


FIGURE 1

Schematic diagram of the synergistic ephory model of retrieval

Different situations in which auto-noetic consciousness can be expected to vary and where its measurement may be informative can be specified in terms of the synergistic ephory model of recall and recognition (Tulving, 1982, 1983). The central assumption of the model is that both the general nature and specific characteristics of recollective experience (the phenomenal experience of remembering a past event) are determined jointly by episodic and semantic information. A schematic representation of the model is shown in Figure 1. The horizontal axis of the coordinate system represents episodic trace information, the vertical axis represents semantic retrieval information, and the two-dimensional space defined by the two axes represents so-called ephoric information. It is this ephoric information, an amalgam of episodic and semantic information, that determines the general nature as well as specific content of recollective experience.

The curved line in the diagram represents the *conversion threshold* for a particular level of overt behaviour that serves as an indicant of the rememberer's mental state. This overt behaviour, or memory *performance*, can take different forms. One such form, for instance, is recall of the name of a previously observed event. Another one is recognition, such as identification of a test item as "old." Each type of performance has its own conversion threshold, although only

one is shown in Figure 1. The conversion threshold divides the space of ephoric information into two regions. Ephoric information above the threshold is sufficient for the required performance, whereas that below the threshold is not.

The model shows how overt memory performance can be supported by different combinations of episodic trace information and semantic retrieval information. A trade-off relation exists between these two kinds of information such that impoverished episodic traces can be compensated for by richer retrieval cues, and vice versa. From the hypothesized correlation between episodic memory and auto-noetic consciousness it follows that the kind of conscious awareness that characterizes an act of recollection varies with the nature of the "mix" of trace and cue information — that is, with the location of the bundle of ephoric information in the sketch in Figure 1.

That the three bundles of ephoric information designated as *a.z*, *b.y*, and *c.x*, representing combinations of corresponding bundles of trace information (*A*, *B*, *C*) and retrieval information (*X*, *Y*, *Z*), are all above the conversion threshold indicates that the behavioural response (e.g., correct recall) would be equally possible in all three cases. Yet, according to the logic outlined here, the recollective experience underlying or accompanying memory performance corresponding to ephoric information *c.x* would be expected to be characterized by a greater degree of auto-noetic consciousness than *b.y*, which in turn would be expected to represent a greater degree of auto-noetic consciousness than *a.z*.

### Measurement of Auto-noetic Consciousness

We will next discuss two experiments in which (a) situations were created corresponding to different points above the conversion threshold in the ephoric space of Figure 1, and (b) auto-noetic conscious awareness accompanying retrieval in these different situations was assessed.

In the first experiment, 79 university students heard, on a single presentation trial, a list of 27 category names and single category instances (e.g., *musical instrument* — VIOLA; *a fruit* — PEAR). The students' memory performance was subsequently tested in three successive tests that yielded *three sets* of recalled items. The first test was a free-recall test: subjects were asked to

TABLE 2  
Recall and "remember" judgements in Experiment 1

	Free recall	Category recall	Letter recall
Probability of recall	.51	.35	.10
Probability of recall conditionalized on remaining items	(.51)	.54	.74
Probability of "remember" judgement	.88	.75	.48

recall as many instances as they could, in any order. The second was a cued-recall test: names of categories to which the studied instances belonged were given as specific retrieval cues. The third was a cued-recall test: the initial letter of each category instance was given as a cue in addition to the name of the category to which the word belonged.

The logic here is as follows: The ephoric information (mixture of trace and cue information) of the first set of items, those recalled in *free* recall, corresponds to the ephoric bundle *c,x* in Figure 1: relatively rich episodic trace information combined with relatively impoverished retrieval information. The ephoric information of the second set of items, those recalled in the category-cued recall *but not recalled in free recall*, corresponds to the ephoric bundle *b,y* in Figure 1: richer retrieval information combined with poorer trace information. The trace information of the second set of items can be assumed to be of lower quality than that of the first set because otherwise these items too would have been accessible for retrieval in free recall. Extending the same logic to the third set of items, those recalled to category names and initial letters, *but not recalled in the other two tests*, we can think of ephoric information of these items as represented by the bundle *a,z* in Figure 1: rather plentiful retrieval information combined with relatively impoverished trace information.

The extent to which subjects' recollective experience was characterized by auto-noetic awareness for the three sets of items was assessed by asking subjects, in each of the three tests, to indicate, for each item they recalled, whether they actually "remembered" its occurrence in the list or whether they simply "knew" on some other basis that the item was a member of the study list. The proportion of recalled items for which subjects made "remember" judgements was calculated separately for the three sets of recalled items, and taken as an estimate of the

presence of auto-noetic awareness in recollection. The expectation was that the proportion of "remember" judgements would be greatest for free-recall items, next highest for items recalled in response to category names but not previously recalled in free recall, and lowest for items recalled only in response to both category names and initial-letter cues.

The results of the first experiment are summarized in Table 2. The three sets of recalled items — those given in free recall, those given in category-cued recall but not in free recall, and those given in the category- and initial-letter-cued condition but not in the other two conditions — are designated as free-recall items, category-recall items, and letter-recall items in Table 2.

Three descriptive statistics were calculated for each of the three sets of recalled items: (a) proportion of items in the set, (b) this proportion expressed with respect to the items *remaining* to be recalled after the first, or the second, test, and (c) the mean proportion of the items in the set that were judged as having been "remembered" by the subjects. The important data for our present purposes are given by the latter measures.

As Table 2 shows, the proportion of "remembered" items was highest for free-recall, next highest for category-recall, and lowest for letter-recall items. These data suggest that the involvement of auto-noetic consciousness in recall of past events varies directly with the contribution of the episodic (trace) information to ephoric information on which recall is based.

The second experiment can be summarized briefly, since its logic was very much the same as that used in the first experiment. "Remember" and "know" judgements were collected from a small group of 10 subjects in two recognition tests, one (for half the items) given in the same experimental session in which 36 to-be-remembered words were presented for study, the other



TABLE 3  
Recognition data and "remember" judgements in Experiment 2

Test items	Measure	Test	
		Day 1	Day 8
Old	Hit rate	.86	.62
	p("remembered")	.83	.55
New	FA rate	.17	.27
	p("remembered")	.45	.40

TABLE 4  
Distributions of confidence judgements for items judged "remembered" and items judged "known" in Experiment 2

Recognized items	Confidence judgements			Mean
	1	2	3	
"Remembered"	9	40	143	2.74
"Known"	25	63	35	2.08

(for the other half) given 7 days later. The logic here is based on the assumption that the episodic trace information would be reduced in "richness" over the 7-day retention interval, with corresponding decreases in auto-noetic awareness, and that, therefore, bundles of ephoric information underlying recognized items would be more heavily weighted with semantic retrieval information after the longer than after the shorter retention interval. Thus, the expectation was that the proportion of "remember" judgements would decline with the retention interval.

As the data summarized in Table 3 show, these expectations were borne out: With the hit rates decreased and the false-alarm rate increased over the 7-day retention interval, the proportion of "remember" judgements for correctly recognized words was lower on Day 8 than on Day 1. We conclude that auto-noetic conscious awareness is more clearly present in the recollection of recently encountered events than in that of events encountered a longer time ago.

In the second experiment we also collected conventional confidence judgements from the subjects. As shown in Table 4, in which the data for "old" test items are pooled over both short and long retention intervals, there was a tendency for subjects to be more confident about their recognition of those items that they classified as "remembered" than those classified as "known": a positive correlation between con-

fidence and "remember" judgements.

#### Adaptive Value of Auto-noetic Consciousness

The results of the two experiments have shown that the distinction between "knowing" and "remembering" previous occurrences of particular events is meaningful to people, that people can make corresponding judgements about their memory performance, and that these judgements vary systematically with conditions under which retrieval of information takes place. The success of the experiments in conforming to the expectations derived from the hypothesized correlation between episodic memory and auto-noetic consciousness, and from the synergistic ephory model, provides support for the assumption that people can retrieve information about personally experienced events without auto-noetic "remembering" of the event, simply on the basis of their noetic "knowledge" that the event happened. A new problem arises, however. If recovery of information about past events can occur independently of episodic memory and auto-noetic consciousness, why should the episodic system and auto-noetic consciousness have emerged at all in the course of evolution? Wherein lies their adaptive advantage?

One possible answer to this question, supported by the data showing positive correlation between confidence ratings and "remember"

judgements in our second experiment, is that the adaptive value of episodic memory and auto-noetic consciousness lies in the heightened subjective certainty with which organisms endowed with such memory and consciousness believe, and are willing to act upon, information retrieved from memory. Knowledge about environmental regularities certainly has adaptive value. By enhancing the perceived orderliness of an organism's universe, episodic memory and auto-noetic consciousness lead to more decisive action in the present and more effective planning for the future (cf. Griffin, 1976; Lachman & Naus, 1984). In this connection, it is worth noting that amnesia has been frequently charac-

terized by the patients' lack of subjective certainty about the mnemonic knowledge that they do in fact possess (e.g., Lidz, 1942; Talland, 1965; Weiskrantz, 1978).

We have often been told that the human brain is the most complicated piece of matter in the universe. We could also say that human consciousness is the most enigmatic manifestation of this piece of matter. Understanding consciousness, its emergence from the brain and its role in human intelligence and in human affairs, can only come, if it ever does come, at the end of a very long scientific journey. What I have tried to do in this paper is to discuss some of the steps with which the journey might begin.

### RÉSUMÉ

Cet article présente plusieurs conjectures soutenues par des observations empiriques pertinentes quant aux différents systèmes de mémoire (système de règles, mémoire sémantique, mémoire épisodique) et aux différents types de conscience qui y correspondent (conscience "anoétique", "noétique", "auto-noétique"). L'emphase porte surtout sur la mémoire épisodique et la conscience auto-noétique qui lui est associée. Les données pertinentes à ces conjectures proviennent d'une étude de cas d'un patient amnésique qu'on ne peut dire conscient que de certaines façons seulement, et proviennent aussi de simples expériences sur le rappel et la reconnaissance conduites avec des sujets normaux. Nous utilisons le terme conscience auto-noétique (qui se connaît) pour le type de conscience qui souligne la connaissance de sa propre existence et qui identifie les événements en fonction d'un temps subjectif, qui court du passé personnel au présent et au futur personnel. C'est ce type de conscience qui donne l'aspect phénoménologique à l'expérience de se rappeler d'un événement. L'importance de la conscience auto-noétique pour le rappel et la reconnaissance des mots peut être entrevue dans le cadre de deux expériences qui démontrent une relation systématique entre les performances et les conditions régissant la récupération des informations mnésiques.

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