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Retrieval without Recollection: An Experimental Analysis of Source Amnesia

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Clinical observations suggest that patients with organic memory disorders sometimes exhibit the phenomenon of *source amnesia:* retrieval of experimentally presented information without any recollection of the episode in which it was acquired. To investigate source amnesia experimentally, a paradigm was developed in which either of two experimenters read subjects statements about fictional characteristics of well-known and unknown people; retention of items and sources was tested after varying delays. In Experiment 1, a group of patients with severe memory disorders exhibited source amnesia frequently after retention intervals of just seconds or minutes: On nearly .40 of the trials that they retrieved a target item, patients failed to recollect that *either* of the sources had imparted it to them. Experiment 2 demonstrated that when normal subjects' level of item recall was equivalent to that of amnesics, they exhibited significantly less source amnesia: Normals rarely failed to recollect that a retrieved item derived from either of the two sources, although they often forgot which of the two experimenters was the correct source. The results are discussed in terms of their implications for theories of normal and abnormal memory.

In 1911, Claparède observed a curious phenomenon in a case of organic amnesia associated with alcoholic Korsakoff's syndrome. Like other amnesics, Claparède's patient exhibited a profound inability to recall and recognize recently experienced events. Claparède noted, however, that she sometimes retained information without any knowledge of how she had acquired it. For instance, after he read her a story, the patient could sometimes recall details of it when questioned a few minutes later. But she failed to recollect that Claparède was the source of the retrieved information, and instead claimed that it was merely an idea that had passed through her mind by chance. Indeed, the patient flatly denied that she had been read a story (1911/1951, p. 69).

We shall refer to the phenomenon exhibited by Claparède's patient as *source amnesia* (Evans & Thorn, 1966): retrieval of experimentally presented information in the absence of a corresponding recollection of how it was acquired. A number of students of organic memory disorders have reported observations of source amnesia that are similar to those described by Claparède. MacCurdy (1928), for example, told several Korsakoff patients his name and address. When tested several minutes later, they chose the correct answers on a multialternative forced-choice recognition task, yet did not remember that MacCurdy was the source of the retained information. Zubin (1948) observed that a patient rendered temporarily amnesic by electroconvulsive therapy responded with above-chance accuracy on a forced-choice test of items presented prior to treatment, but

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claimed that the materials had never been shown to her previously. Luria (1976, pp. 284–285) described a case of amnesia secondary to a ruptured anterior communicating artery aneurysm in which the patient could learn a list of picture–word paired associates, and could produce the correct response when given the stimulus 2 days or 1 week after learning. The patient, however, had no knowledge of how he acquired the information, and could not recollect the learning episode when asked about it even after a brief delay.

More recently, Schacter, Tulving, and Wang (1981; described in Schacter & Tulving, 1982b) provided quantitative documentation of source amnesia in a case study of a young man who had developed a severe memory disorder after closed-head injury. The patient was asked a series of questions about little-known facts (e.g., Who holds the world's record for shaking hands? *Theodore Roosevelt*), and was told the answer by the experimenter. Twenty minutes later, the patient recalled or recognized the correct answer for over half of the items. However, given that he had retained a fact, the probability of remembering the source was only .11. On most trials, the patient either claimed that he had guessed the appropriate answer, or had read about it in a newspaper or magazine. By contrast, a matched control subject remembered the source on *all* questions that he answered correctly.

There is a somewhat dramatic flavor to the cited clinical descriptions and case studies of source amnesia that is probably attributable to the fact that patients forget so quickly the source of the newly acquired information. But these observations of source amnesia have told us little about the phenomenon other than that it can be observed in some cases. The purpose of the present article is to provide a systematic experimental analysis of source amnesia by examining some of its properties in a group of memory-disordered patients, and by exploring the extent to which the phenomenon can be produced experimentally in subjects with intact memory function.

Before describing the paradigms that are used in the present experiments, it is first necessary to consider exactly what is meant by the term *source amnesia*. One of the central characteristics of the phenomenon is that in a situation in which memory for two attributes of an event is probed, subjects demonstrate knowledge of one attribute but not the other. The remembered attribute corresponds to a fact or item that has been presented to the subject; the forgotten one is the source of the recalled information. It is not uncommon in the study of intact human memory to encounter situations in which subjects are tested for retention of multiple attributes of an event, and recall one or some of the to-be-remembered attributes at the same time that they do not remember others. For example, Anderson and Bower (1971) provided evidence that subjects can remember one attribute of a sentence (a verb) even though they are unable to recall another (an object). Jones (1976) reported an experiment in which normal subjects studied photographs that depicted an *object* of a particular *color* in a specific *location*. When tested by cued-recall methods, subjects occasionally remembered all or none of the attributes. Frequently, however, they recalled a particular attribute of an object (e.g., color) and failed to recall another one (e.g., location). Using a similar experimental paradigm, Jones (1979) has demonstrated that different attributes of a memory trace can be forgotten at different rates over the course of a retention interval.

Further evidence for the occurrence of partial attribute recall can be found in recent studies concerned with normal subjects' memory for the source of acquired information. Geiselman and Crawley (1983) found that presence versus absence of prior knowledge of a source's personal history did not affect subjects' recognition memory of sentences read by the source. Prior knowledge did, however, substantially aid subjects' ability to remember which of two sources had read a particular sentence. The finding that level of source memory changed across conditions while level of sentence memory remained constant suggests that there were at least some instances in which subjects recognized a sentence but did not remember its source. In a study by Rothkopf, Fisher, and Billington (1982), subjects watched three sources make a series of statements on either one or three television monitors. The number of monitors did not affect recall of statements, but source recall was substantially higher in the three-monitor condition than in the one-monitor condition. Again, such a pattern of results implies that subjects sometimes did not remember the source of recalled information. Similar evidence has also been reported in a study by Brown, Deffenbacher, and Sturgill (1977). They showed college students photographs of faces in two different rooms. Two days later, subjects were given a two-alternative forced-choice face recognition test, and were also asked to indicate in which of two rooms the face had been presented. Recognition performance was virtually perfect (.96), whereas memory for the presentation room was only slightly above chance (.58). Thus, these subjects frequently recognized a particular face without a corresponding memory for the room in which it was encountered.

The foregoing studies establish that when normal subjects attempt to remember multiattribute events, they often gain access to one attribute and do not gain access to another attribute. In view of these findings of partial attribute recall in normal memory, it could be argued that what has been called "source amnesia" represents yet another example of this apparently common phenomenon: Amnesics, like normal subjects, may sometimes retrieve one attribute of a memory trace but not another. If, like normals, they also forget different attributes at different rates, then it would not be particularly surprising that amnesics sometimes retain an experimentally presented fact and forget its source. On closer analysis, however, it is apparent that there may be an important difference between observations of source amnesia in memory-disordered patients and partial attribute recall in normals. Consider, for example, the Brown et al. (1977) study of face recognition. One could claim that subjects in this experiment exhibited "source amnesia": They retained information about an experimentally presented item, as indicated by accurate face recognition, but did not remember how it was acquired in the sense that they could not state accurately in which of two rooms a recognized face had been studied. But it is probably not unreasonable to assume that these subjects could remember that a recognized face had been encountered in *one* of the two contexts. By contrast, the most prominent feature of clinical observations of amnesia is that patients seem to have no recollection at all of the occurrence of a prior learning episode.

These observations suggest that it may be useful to distinguish between *source forgetting* and *source amnesia*. The difference between source forgetting and source amnesia lies in the type of source errors that subjects make when they recall or recognize an experimentally presented item. An *intraexperimental* source error occurs when subjects recall or recognize an item, and recollect that it was presented to them earlier in the experiment, but attribute it incorrectly to one of several possible experimental sources. An *extraexperimental* source error occurs when subjects remember an item, but fail to recollect that it had been presented by any experimental source, and attribute their knowledge to guessing or to an extraexperimental source such as radio or a newspaper. We can thus define *source forgetting* as recall or recognition of an experimentally acquired item that is accompanied by an intraexperimental source error. We define *source amnesia* as recall or recognition of an experimentally acquired item that is accompanied by an extraexperimental source error.

The literature discussed thus far suggests that source forgetting may be characteristic of normal subjects, whereas source amnesia is observed in memory-disordered patients. This suggestion, however, must be regarded cautiously because of the methodological limitations of relevant research. Studies of normal subjects have not been designed to permit examination of the possibility that normals do commit extraexperimental source errors and hence exhibit source amnesia. For example, in the Brown et al. experiment, the subjects were explicitly instructed to indicate the experimental room in which each face had been encountered. Under these instructional conditions, it would not have been possible for subjects to make an extraexperimental error, even if they did not remember seeing the face in either of the two rooms. Similar considerations apply to the experiments reported by Geiselman and Crawley (1983) and by Rothkopf et al. (1982): Their subjects were instructed to indicate which of the experimental sources had made a particular statement, and hence they could not commit extraexperimental source errors. Interpretation of clinical observations of source amnesia is also uncertain because of methodological limitations: Clinical demonstrations have not used more than one experimental source, so the only kind of source errors that patients could make in these situations were extraexperimental ones. To evaluate the extent to which source amnesia and source forgetting occur in a particular situation, it is necessary to create conditions in which subjects can commit either intraexperimental or extraexperimental source errors. For the present research, we have devised experimental paradigms that fulfill this requirement. These paradigms make it possible for us to study both source forgetting and source amnesia in memory-disordered patients (Experiment 1) and in subjects with intact memory function (Experiment 2).

Although the particulars of the experimental paradigms differ in the two experiments because of the substantial differences between the subject groups, there are several features that they share in common. First, to-be-remembered information is imparted to subjects by either of two people who act as experimental sources. Retention of to-be-remembered items is tested by cued recall; retention of the source is assessed by asking subjects how they acquired the recalled information. Second, the experimental materials are constructed in such a way that subjects could not have acquired knowledge of a previously presented item from other than an intraexperimental source (one of the two experimenters), yet still could plausibly attribute knowledge of a recalled item to an extraexperimental source. This was accomplished by using as to-be-remembered items statements that describe fictional characteristics of people, such as "Bob Hope's father was a fireman." Retention of the item is tested by presenting the name and asking about the characteristic (e.g., "What job did Bob Hope's father have?") A correct answer to this question could derive only from an intraexperimental source. When subjects are tested, however, they also encounter some previously unpresented *lure items* concerning commonly known characteristics of a person, such as "What country did Winston Churchill rule" or "What did Al Capone do?" We assume that when subjects are asked to indicate how they know the answer to these questions, they will respond with an extraexperimental source such as "newspapers" or "school." By including a number of test lures, we hoped to create a situation in which it is plausible for subjects to make extraexperimental as well as intraexperimental source attributions.

A third shared feature of the two experiments is that subjects are told about characteristics of either well-known people (e.g., Bob Hope) or unknown people whose names were generated by the experimenters (e.g., Alice Reznak). This *prior knowledge* manipulation was included for the purpose of delineating some of the properties of source amnesia: We wanted to determine whether source amnesia occurs across different types of materials, or whether it is observed only when subjects do or do not have some prior knowledge of to-be-remembered names.

Experiment 1

The patients included in this experiment are characterized by severe memory disorders (Table 1). For example, most of them are unable to recall more than one or two items from a 20-word categorized list on immediate free recall or cued-recall tests. It is necessary, of course, that patients recall some experimentally presented items for there to exist even a possibility of observing source amnesia. Pilot work indicated that presenting patients with lists of to-be-remembered items in a standard study–test format did not yield levels of item recall appreciably above zero. As an alternative to a study-test procedure, we developed what we shall refer to as a *continuous recall paradigm*. One of the two experimental sources asks the patient a question concerning a characteristic of a person, and supplies the correct answer (e.g., What job did Bob Hope's father have? *fireman*). The question is asked again by one of the sources after either *one* or *four* similar questions have been posed; the recurrence of the question constitutes the retention test for both the item and its source. Lure questions concerning well-known characteristics of well-known people are interspersed among the critical items. Pilot work indicated that at these extremely short delays, even severely amnesic patients could retain the answers to some of the questions.

Method

Subjects. The eight patients selected for the experiment are all characterized by severe difficulties in the storing and retrieving of new information. As indicated by Table 1, the memory disorders in the group result from diverse forms of neurological dysfunction that are commonly associated with memory deficits, including early stages of Alzheimer's disease, ruptured anterior communicating artery aneurysm, anoxia, closed-head injury, and encephalitis. The mean IQ (88.9) of the amnesics, as measured by the Wechsler Adult Intelligence Scale (revised), is in the low normal range, whereas their mean MQ (72.8) on the Wechsler Memory Scale (WMS) reflects substantial impairments (Table 1). None of the patients is aphasic, anomic, or agnosic.

The memory task that was used in the present experiment is extremely easy for people with intact memories. In pilot work, we examined the performance of four non-amnesic control subjects, who were matched to the memory-disordered patients with regard to age and intelligence, and found that performance in all cases was at ceiling in all conditions (over 90% fact and source recall). In light of this result, and because we compared patients' performance to that of the normal subjects tested in Experiment 2, we did not include a separate set of control subjects in this experiment.

Design and materials. The experimental design is a 2 × 2 within-subjects factorial in which the two independent variables are retention interval and level of prior knowledge of study materials. Retention interval was varied by manipulating the number of items intervening between the first and second presentations of a test question: In the *short*-delay condition there was one intervening item, and in the *long*-delay condition there were four intervening items. Two levels of prior knowledge—high knowledge and no knowledge—were used. Sixteen high-knowledge and sixteen no-knowledge names were used, yielding a total of 32 critical items. High-knowledge names were derived individually for each patient. This was accomplished by asking patients about approximately 30 famous entertainers and politicians in a separate session conducted about 6 months prior to the experiment. The patients were required to

TABLE 1
CHARACTERISTICS OF MEMORY-DISORDERED PATIENTS IN EXPERIMENT 1

Patient	Diagnosis	Age	Education (years)	WAIS-R[a]	WMS[b]
1	Alzheimer	58	13	86	62
2	Alzheimer	61	21	92	79
3	Alzheimer	60	17	90	74
4	Aneurysm	58	13	89	79
5	Anoxia	53	10	83	71
6	Head injury	50	8	88	74
7	Encephalitis	30	12	82	61
8	Undiagnosed	70	11	101	82
	Mean	55.0	13.1	88.9	72.8

[a] Wechsler Adult Intelligence Scale (revised).
[b] Wechsler Memory Scale.

state as many facts as possible about each of the names; the 16 names about which they generated the largest numbers of facts were used in the present experiment. Patients generated an average of 4.56 facts about each high-knowledge name. Sixteen fictitious names of both sexes were generated by the experimenters for the no-knowledge condition. Thirty-two fictitious characteristics of people were also generated by the experimenters, with the constraint that they would not be specific to sex or to known attributes of the high-knowledge names, and hence could be paired with any name on the list. In addition to the critical items, 10 questions were included as lures. Questions were selected to be relatively easy for patients to answer and to provide a variety of source responses other than the two experimenters. The lure questions were interspersed randomly among the targets and appeared only once. The combination of the 10 once-presented buffer items and the 32 twice-presented targets yielded a total of 74 questions on each list. Examples of materials are presented in Table 2 in the form of a typical experimental sequence of six questions.

Four forms of the continuous recall task were created so that each characteristic appeared equally often with a high-knowledge and no-knowledge name in the short-delay and long-delay conditions. Each of the 32 name-characteristic combinations appeared twice during the task in the form of a test question. Half of the questions in each of the four experimental conditions were asked initially by Source A, and half were asked initially by Source B. When the question recurred, on half the trials it was asked by the same source who asked it initially, and on the other half it was asked by the other source. In all cases, patients were first told to try to provide the appropriate characteristic in response to the question. When they could not do so, they were then required to state whether or not the question had been put to them previously by either of the experimental sources. If patients said "No," the answer to the question was then provided by the experimenter who had just posed it. If patients said "Yes," they were then required to state which of the two sources had asked them

TABLE 2
EXAMPLES OF QUESTIONS USED IN THE CONTINUOUS RECALL TASK IN EXPERIMENT 1

1. What job did Bob Hope's father have? (fireman)
2. What did Al Capone do? (gangster)
3. What is Alice Reznak addicted to? (nicotine)
4. What sport did Babe Ruth play? (baseball)
5. What is Alice Reznak addicted to? (nicotine)
6. What job did Bob Hope's father have? (fireman)

the question previously, and they were then told the answer to the question.

When patients guessed the appropriate characteristic on the *first* appearance of a question, they were told that they were incorrect, and a second, "backup" answer was then introduced as the correct response. This procedure was adopted to counter the possibility that apparent item retention on the second appearance of a question could be attributed to guessing. When patients provided the correct characteristic on the *second* appearance of a question, they were asked to indicate the source of their knowledge. If they said that one of the experimenters had told them the item, they then indicated which experimenter had done so; if they claimed to be guessing, or confabulated a source, they were asked to state whether or not they had heard the question at any point in the experiment.

Procedure. Patients were informed that they would be asked a series of questions about some well-known and some unknown people. They were also told that they would probably know the answers to some of the questions, but that in many cases, the answers were bits of trivia that most people did not know. It was explained that when they could not answer the question correctly, the experimenter who had asked it would provide the right response. They were instructed that their task was to remember the characteristic of the person and who had told it to them, because many of the questions would be asked again a few minutes after initial presentation.

All testing was done individually. The two experimental sources (one male and one female) were seated at opposite ends of a testing table across from the patient, who sat midway between the two sources and faced them. Patients were given about 15 s to respond to each question, and were encouraged to guess. When an experimenter provided the answer to a question, he or she first stated the characteristic (e.g., "The answer is a *fireman.*"), and then repeated it in the form of a complete sentence ("Bob Hope's father was a fireman."). Questions concerning the source of the response, and the prior occurrence of the question in the experiment, were asked in the manner described in the previous section. The entire procedure took about 30 s per item, although it was several seconds shorter if patients provided a rapid correct response to a buffer or to a second appearance of a critical item.

Results

Item recall. All of the memory-disordered patients were able to recall some of the experimentally presented items. Combined across experimental conditions, the proportion of items recalled by individual patients ranged from .16 to .50. Moreover, all of the patients recalled at least one item in each of the four experimental conditions, with the exception of one patient who did not recall any in the no-knowledge, long-delay condition. Incidence of correct guesses on the first appearance of a question was relatively low: There were only eight cases, distributed among five different patients, across all experimental conditions.

Both of the experimental variables had some influence on level of item recall. As indicated by the data in Table 3, recall of the fictional characteristic to high-knowledge names was higher at the short delay (.39) than at the long delay (.30). Recall to no-knowledge names was slightly lower, and in this condition, too, recall at the short delay (.33) exceeded recall at the long delay (.17). Analysis of variance revealed a significant main effect of delay, $F(1,7) = 14$, $p < .01$, $MS_e = .57$; the main effect of prior knowledge fell short of statistical significance, $F(1,7) = 2.52$, $p > .05$, $MS_e = 1.79$. There was a nonsignificant interaction between prior knowledge and delay, $F(1,7) = 1.4$, $p > .05$, $MS_e = .5$.

Level of item recall was also analyzed according to whether the same source asked a particular question twice, or whether different sources asked the question on the two trials. Overall item recall was virtually identical when test questions were posed by the same source (.29) and when they were posed by different sources (.31).

Source recall. Because two experimental sources were used in this experiment, patients could achieve .50 source recall on a chance basis *if* they remembered that a particular question had been asked previously by one of the experimenters. However, overall level of source recall was considerably lower than .50 in all experimental conditions (Table 3). In view of the low level of performance, it is not surprising that the experimental variables did not significantly influence level of source recall: There were nonsignificant main effects of both retention interval, $F(1,7) = 3.94$, $p > .05$, $MS_e = 1.53$, and prior knowledge, $F(1,7) = 1.87$, $p > .05$, $MS_e = .82$, as well as a nonsignificant interaction between these variables, $F(1,7) = .66$, $p > .05$, $MS_e = .42$. The low level of source recall by the memory-disordered patients is attributable to the fact that they made many extraexperimental source errors. Combined across levels of the two experimental variables, patients made .29 correct source responses, .26 intraexperimental source errors, and .45 extraexperimental source errors.

The critical data in the experiment concern patients' source responses conditionalized upon recall of experimentally presented items. The data in Table 4 indicate that even when patients did accurately recall a characteristic of a person, proportion of correct source recall was still low, ranging from .33 to .45 across individual experimental conditions. The observation that source recall given item recall was slightly higher at the long delay than at the short delay is probably attributable to variability associated with the small number of observations per condition, as indicated by the values in parentheses in Table 4. Recall of the target item accompanied by an extraexperimental source error—that is, source amnesia—occurred frequently in all conditions of the experiment. On about .35 to .55 of the trials on which they supplied the correct answer to a question, patients did not remember that the information had been imparted to them by one of the experimenters. Source amnesia occurred about as often when a characteristic was recalled concerning a high-knowledge name as it did when a characteristic was recalled about a no-knowledge name. Moreover, in each of the four experimental conditions, three to five patients made extraexperimental source responses for *all* of the items that they recalled accurately, and every patient exhibited source amnesia on at least one question.

Clinical observations of source amnesia suggest that patients frequently confabulate source responses. Across all experimental conditions patients confabulated sources on .30 of the trials on which they recalled an item and committed an extraexperimental error. For example, one amnesic who recalled the correct answer ("cats") when asked for the second time "What was Henry Fonda allergic to?", claimed that she had acquired this bit of knowledge from a newspaper article. On .70 of the extraexperimental source responses, patients either claimed to be guessing, or said that they had "deduced" or "figured out" the recalled characteristic on the basis of their knowledge of the person. Amnesics did, however, make appropriate extraexperi-

TABLE 3

PROPORTIONS OF ITEM RECALL AND SOURCE RECALL AS A FUNCTION OF RETENTION INTERVAL AND PRIOR KNOWLEDGE IN EXPERIMENT 1

	Item recall	Source recall
One-item delay		
High knowledge	.39	.36
No knowledge	.33	.28
Mean	.36	.32
Four-item delay		
High knowledge	.30	.28
No knowledge	.17	.25
Mean	.24	.27

TABLE 4
PROPORTIONS OF SOURCE RESPONSES CONDITIONALIZED UPON ITEM RECALL AS A FUNCTION OF RETENTION INTERVAL AND PRIOR KNOWLEDGE IN EXPERIMENT 1

	Correct source	Intraexperimental error	Extraexperimental error
One-item delay			
High knowledge (25)[a]	.36	.28	.36
No knowledge (21)	.33	.29	.38
Mean (46)	.35	.28	.37
Four-item delay			
High knowledge (19)	.37	.26	.37
No knowledge (11)	.45	.00	.55
Mean (30)	.40	.17	.43

[a] The raw numbers of observations per condition are in parentheses.

mental source attributions concerning the lure items that probed well-known characteristics of well-known people. All patients answered all of the ten lure questions correctly. In every case, they attributed their knowledge appropriately to sources such as school, television, radio, newspapers, and so forth.

Although patients frequently exhibited source amnesia, they were able to remember that recalled items derived from one of the experimental sources on close to .60 of the questions across all experimental conditions (Table 4). If we exclude those cases in which patients attributed a recalled item to an extraexperimental source, it is possible to evaluate their level of source recall with respect to the chance baseline of .50. Conditionalizing the data so that we consider only intraexperimental source responses, probability of choosing the correct source at the short delay was .56 to high-knowledge names and .58 to no-knowledge names. At the long delay, the corresponding numbers were .54 and 1.0. The last value should not be considered too seriously, however, because it is based on only five observations. When the data are collapsed across experimental conditions, probability of remembering the correct source of a recalled item, given an intraexperimental source response, is .61. This proportion does not significantly exceed the chance level, $Z = 1.47$, $p > .05$.

Analysis of the source recall data as a function of same versus different sources on study and test trials revealed that overall proportion of extraexperimental source responses did not change when sources were the same (.47) or different (.43). However, given an intraexperimental source response, there was a tendency for amnesics' source identification to appear more accurate when the source was the same (.74) versus when it was different (.42). In view of the finding that overall accuracy of source identification did not exceed the chance level, this trend probably reflects a response bias to state that the person asking the question at test also posed it earlier.

Discussion

The results of Experiment 1 provide evidence that substantial amounts of source amnesia can be observed in a group of memory-disordered patients under controlled experimental conditions in which it is possible to commit both intraexperimental and extraexperimental source errors: After a delay of just seconds or minutes, the amnesics frequently retained answers to questions in the absence of recollection of the occurrence of a prior learning episode. These data corroborate and extend previous clinical observations and case studies. However, contrary to most clinical observations, we found that source *confabulation* occurred relatively infrequently. Moreover, the data also indicate that not all of patients' poor source memory is attributable to source amnesia (i.e., extraexperimental errors); they exhibited appreciable amounts of source forgetting (i.e., intraexperimental errors).

Although Experiment 1 does permit us to conclude that source amnesia can be observed under specifiable conditions, it leaves open the question of how to interpret the theoretical significance of the phenomenon. A basic issue that needs to be addressed is whether source amnesia constitutes a qualitatively distinct characteristic of patients with severe memory disorders, or whether it can be produced in normal subjects by appropriate experimental manipulations. It was suggested in the introduction that source forgetting, but not source amnesia, may be characteristic of normal subjects. One way to address this hypothesis is to attempt to produce both source amnesia and source forgetting in a *laboratory simulation study* with normal subjects. The question of interest in a laboratory simulation study is whether patterns of performance observed in memory-disordered patients are unique features of amnesia, or whether they also can be produced in normal subjects when memory is "weakened" or "degraded" by appropriate manipulations. The logic that motivates such an approach is straightforward: If normals can be made to exhibit a phenomenon of amnesia under conditions of degraded memory, then it is difficult to argue that the simulated phenomenon constitutes a qualitatively unique feature of amnesia. Rather, such a finding suggests that the phenomenon may be observed whenever a generally weak or degraded memory trace is produced. Degraded memory can be defined operationally in terms of a decrement in performance on recall or recognition tests as a function of an experimental manipulation. In most laboratory simulation studies, degraded memory has been produced by interpolation of a long delay between study and test. The results of such studies indicate that a variety of phenomena observed in amnesic patients can be simulated by testing normals under conditions of degraded memory (Mayes & Meudell, 1981a, 1981b; Mayes, Meudell, & Som, 1981; Squire, Nadel, & Slater, 1981; Squire, Wetzel, & Slater, 1978; Tulving, Schacter, & Stark, 1982; Woods & Piercy, 1974; see Schacter & Tulving, 1982a, and Weiskrantz & Warrington, 1975, for discussion of methodological issues).

In Experiment 2, we investigated the hypothesis that source amnesia can be attributed to generally weak or degraded memory in a simulation study in which normal subjects were tested for recall of experimentally presented items and their sources at short and long delays after study. We assume that testing subjects at 1-week delay will produce degraded memory in the sense that level of item recall should be much lower after a 1-week retention interval than on an immediate test. Assuming that the expected decline in item recall is observed, the hypothesis that source amnesia can be attributed to generally degraded memory would receive support if two further experimental outcomes are obtained: (1) Source amnesia occurs more often after a long retention interval than after a short one and (2) normal subjects exhibit source amnesia as frequently as do memory-disordered patients when level of item recall is similar in the two groups.

EXPERIMENT 2

Experiment 2 is similar to Experiment 1 in several respects: Two experimental sources read to-be-remembered information to subjects, many of the same materials were used, and subjects were tested for retention of both item and source in the same manner as in Experiment 1. The experiments differed, however, in four ways. First, we used a study–test paradigm in this experiment because the continuous recall paradigm used in Experiment 1 is far too easy for normal subjects. Instead of testing subjects at one- and four-item delays, they were tested either 20 min or 1 week after study. Second, to obtain a relatively large number of observations per condition, we exposed subjects to a larger set of to-be-remembered materials than was used in Experiment 1. Third, we included three, rather than two levels of the prior knowledge variable to gain further insight into the consistency of source amnesia and source forgetting across different types of materials. Fourth, we used slightly different procedures to create a situation in which it is plausible for subjects to make extraexperimental source errors. As in Experiment 1, we included lure questions concerning well-known characteristics of well-known people at the time of test to encourage subjects to make extraexperimental source responses. We also included similar *buffer* statements on the study list that were not subsequently tested (Table 5), so that subjects could not infer that the appearance of a test question probing a well-known fact about a well-known person signaled an extraexperimental source response. In addition, we also included test lures that probed fictitious characteristics of both fictitious and well-known people (Table 5). These lures were included so that subjects could not use the appearance of a test question that probed a fictitious characteristic to infer that the item derived from an intraexperimental source.

Method

Subjects. Twenty-four University of Toronto undergraduates participated in the experiment to fulfill class requirements. Subjects were tested in small groups of 2–5.

Design and materials. The design of the experiment was a 2 (retention interval) × 3 (prior knowledge) mixed factorial. The between-subjects variable was retention interval (20-min or 1-week delay); the within-subjects variable was level of prior knowledge of the names that constituted part of the to-be-remembered information (high, low, or no).

Fifty-four fictitious characteristics of people were included on the study list. Thirty-two characteristics were the same as those used in Experiment 1. The others were generated by the experimenters. Level of subjects' prior knowledge of the to-be-remembered names was determined in a separate norming study in which 13 University of Toronto undergraduates were given a list of 70 well-known entertainers and politicians and were asked to generate as many facts as they could about each person. One minute was provided to generate facts about each of the 70 people.

TABLE 5
EXAMPLES OF STUDY AND TEST MATERIALS USED IN EXPERIMENT 2

Type of item	Number	Study	Number	Test
High knowledge	18	Jane Fonda refuses to eat chicken.	18	What does Jane Fonda refuse to eat?
Low knowledge	18	Leonard Bernstein has never owned a television	18	What has Leonard Bernstein never owned?
No knowledge	18	Alice Reznak is addicted to nicotine.	18	What is Alice Reznak addicted to?
Buffer	18	Agatha Christie writes mystery novels.	—	—
Lure	—	—	24	What was Pablo Picasso's profession?
Lure	—	—	12	What does Frank Sinatra read every night?
Lure	—	—	12	What does Anna Wood grow in her orchard?

Names for which one or more people were unable to generate any facts were excluded from consideration. Of the remaining items, the 18 names about which subjects generated the most facts were designated "high knowledge," and the 18 names about which subjects generated the fewest facts were designated "low knowledge." Mean number of facts generated about high-knowledge names was 5.50, and that about low-knowledge names was 2.37. The 18 no-knowledge names included those that were used in Experiment 1, and several others that were generated by the experimenters.

Input lists were constructed by dividing the 54 fictitious characteristics into three sets of 18. Items in each set were randomly paired with either high-, low-, or no-knowledge names in both the short- and long-delay groups. Across subjects, each characteristic was read equally often by each source at high, low, and no levels of prior knowledge. Eighteen buffer items were also included in the input list, consisting of well-known names paired with well-known facts. The order of the input lists was random with the constraint that no more than three of the same type of item (high knowledge, low knowledge, no knowledge, or buffer) occurred sequentially.

The test comprised 102 questions of the form displayed in Table 5. The order of testing the 54 items that had been previously studied was random with respect to input order. Forty-eight lure questions were also randomly interspersed throughout the test, for the reasons described earlier. Twenty-four lures probed well-known facts about well-known people, 12 probed fictitious facts about well-known people, and 12 involved fictitious facts about fictitious people.

Procedure. Two female experimenters sat at opposite ends of a large table; subjects sat facing the two sources about halfway between them. Subjects were told that each of the two experimenters would read some well-known and little-known characteristics of famous and not so famous people. They were instructed to try to remember the name–item associations, as well as who told them each item. The input list was read at the rate of 6 s per item. Following list presentation, all subjects crossed out specified numbers from a numerical array for 10 min, and then generated information about different cities for an additional 10 min. Long-delay subjects were then dismissed and told to return to the laboratory a week later, whereas short-delay subjects proceeded immediately to the retention test.

The test phase was initiated by distributing response booklets. Both sources were present during test. Subjects were encouraged to produce an answer in response to as many questions as possible, even if they had to guess. In addition, they were instructed to indicate the source of their response for every question. It was stressed that the information required to answer the questions would derive from a variety of sources, not from just the two experimenters. Examples of possible source responses were given (e.g., television, school, friends, and so on), and subjects were told that if they were not sure of the source of their response, they should indicate that they were guessing. In addition, subjects were instructed that if they could not recall the answer to a question, but did remember that the item had occurred during the study session, then one of the experimenters should be chosen when they made their source responses.

After completion of the test, subjects were debriefed concerning the nature of the materials and the purpose of the experiment.

Results and Discussion

Item recall. There are two important features of the item recall data that are presented in Table 6. First, level of item recall declined substantially as a function of delay: Subjects tested at the 1-week retention interval recalled fewer of the fictitious characteristics (.31) than did subjects tested

TABLE 6
PROPORTIONS OF ITEM RECALL AND SOURCE RECALL AS A FUNCTION OF RETENTION INTERVAL AND PRIOR KNOWLEDGE IN EXPERIMENT 2

	Item recall	Source recall
20-min delay		
High knowledge	.73	.79
Low knowledge	.56	.71
No knowledge	.36	.56
Mean	.55	.69
1-week delay		
High knowledge	.42	.55
Low knowledge	.30	.55
No knowledge	.19	.55
Mean	.31	.55

at the 20-minute retention interval (.55). Analysis of variance revealed a highly significant main effect of retention interval, $F(1,22) = 25.39$, $p < .001$, $MS_e = 1.13$. There was also a significant main effect of prior knowledge, $F(2,44) = 48.84$, $p < .001$, $MS_e = .55$, and a nonsignificant retention interval × prior knowledge interaction, $F(2,44) = 2.93$, $p > .05$, $MS_e = .03$. The second important result is that level of item recall at the 1-week delay (.31) was equivalent to the overall level of item recall attained by amnesics in Experiment 1 (.30). In addition, inspection of individual experimental conditions in Tables 3 and 6 indicates that normals' item recall to high-knowledge names at 1-week delay (.42) was similar to patients' item recall in the corresponding condition at one-item delay (.39), and that normals' delayed item recall to no-knowledge names (.19) was equivalent to amnesics' recall to no-knowledge names at four-item delay (.17).

Source recall. The crucial data in the experiment concern the distribution of subjects' source responses when they recalled a to-be-remembered item (Table 7). Given item recall, there were fewer correct source responses at the long delay than at the short delay, as indicated by a main effect of retention interval, $F(1,22) = 14.03$, $p < .01$, $MS_e = .08$. There were also significantly fewer correct responses with decreasing levels of prior knowledge, $F(2,44) = 3.48$, $p < .05$, $MS_e = .05$. There was a nonsignificant retention interval × prior knowledge interaction, $F(2,44) = .73$, $p > .05$, $MS_e = .05$.

The most striking feature of the data in Table 7 is that normal subjects committed an extremely small proportion of extraexperimental errors when they recalled to-be-remembered items at both the short and long delays: Subjects made .03 extraexperimental source responses at the short delay, and .06 extraexperimental source responses at the long delay. By contrast, there was a substantial increase in the number of intraexperimental source errors as a function of delay: Subjects committed .12 intraexperimental errors on recalled items at the short delay, and .36 at the long delay. Statistical evaluation of the differences between proportions of source errors made at short and long delays was based upon a nonparametric method for comparison of two proportions (Bennett & Franklin, 1964, pp. 611–615), because many subjects did not contribute data to all conditions. This analysis revealed that the proportion of extraexperimental source errors did not increase significantly as a function of delay ($p > .05$), whereas the proportion of intraexperimental errors did ($p < .01$).

Comparison of the proportion of extraexperimental source responses made by long-delay normals and by amnesic patients at similar levels of item recall reveals sizable and consistent differences. Collapsed across levels of the independent variables in Experiment 1, patients committed .39 extraexperimental source errors on recalled items, whereas long-delay normals, whose level of item recall was equivalent to that of the amnesics, committed only .06 extraexperimental source errors. When evaluated by the Bennett and Franklin test, the differences between these two proportions is highly significant ($p < .01$). The low proportion of extraexperimental errors made by long-delay normals is observed consis-

TABLE 7
PROPORTIONS OF SOURCE RESPONSES CONDITIONALIZED UPON ITEM RECALL AS A FUNCTION OF RETENTION INTERVAL AND PRIOR KNOWLEDGE IN EXPERIMENT 2

	Correct source	Intraexperimental error	Extraexperimental error
Short delay			
High knowledge (158)[a]	.91	.09	.00
Low knowledge (122)	.85	.13	.02
No knowledge (77)	.74	.18	.08
Mean (357)	.85	.12	.03
Long delay			
High knowledge (90)	.62	.32	.06
Low knowledge (64)	.55	.40	.05
No knowledge (40)	.58	.32	.10
Mean (194)	.58	.36	.06

[a] The raw numbers of observations per condition are in parentheses.

tently at each of the three levels of prior knowledge, and is significantly lower than the corresponding proportion made by amnesics in *any* individual experimental condition in which item recall of the two groups is similar. Inspection of individual subject's data revealed that only 5 of the 12 long-delay normals committed an extraexperimental error when they recalled a target item. By contrast, all of the memory-disordered patients committed an extraexperimental error on a recalled item in at least one condition.

Somewhat surprisingly, normal subjects demonstrated an apparently greater tendency to confabulate sources when they made extraexperimental errors on recalled items than did amnesics. At the short delay, five of the extraexperimental source responses were "guesses" and four were confabulations such as "television" and "newspapers." At the long delay, subjects confabulated sources on each of the 13 extraexperimental errors that accompanied recalled items. As noted earlier, amnesic patients confabulated sources on only .30 of extraexperimental errors. We cannot be too certain of our interpretation of normals' source confabulations, however, because postexperimental interviews suggested that some subjects may have used confabulating responses interchangeably with "guessing" responses.

The data in Table 7 indicate that when long-delay normals recall an item, probabilities of a correct source response are .62, .55, and .58 at the three levels of prior knowledge. All of these values are considerably higher than the corresponding proportions of correct source responses made by memory-disordered patients in any experimental condition (Table 4). The previous analyses indicated that the reason for this difference is the differential incidence of extraexperimental source errors made by the two groups. To compare level of source *forgetting* (i.e., proportion of intraexperimental errors) in normals and amnesics, we must exclude cases in which subjects made extraexperimental errors so that we can evaluate source recall with respect to the chance baseline of .50. When the data are conditionalized in this manner, probability of source recall is .67 to high-knowledge names, .57 to low-knowledge names, and .66 to no-knowledge names. The overall level of conditionalized source recall by long-delay normals (.64) is numerically quite similar to the level of conditionalized source recall by amnesics (.61). However, conditionalized source recall of long-delay normals significantly exceeds the chance level ($Z = 3.44$, $p < .01$), whereas patients' recall in Experiment 1 does not.

One feature of the unconditionalized source recall data (Table 6) merits commentary. Collapsed across item recall and nonrecall, source recall decreased as a function of retention interval, $F(1,22) = 11.17$, $p < .01$, and was also affected by the prior knowledge manipulation, $F(2,44) = 4.47$, $p < .05$ $MS_e = .08$. In addition, however, there was an unexpected prior knowledge × retention interval interaction, $F(2,33) = 4.91$, $p < .05$, $MS_e = .09$. This interaction indicates that differences among levels of prior knowledge observed at the short delay were absent at the long delay. It is possible, however, that the interaction is attributable to a floor effect on source recall at the long delay. Although the issue is not particularly critical with respect to the major concerns of the present experiment, it may merit exploration in future research.

General Discussion

The results of the present experiments have yielded information about the nature of source amnesia in memory-disordered patients and normal subjects that clarifies a number of aspects of the phenomenon. Experiment 1 demonstrated that source amnesia can be observed under controlled experimental conditions in a group of patients with severe memory disorders. On about .40 of the trials in which they recalled a target item, patients committed extraexperimental source errors. Source amnesia occurred reliably across subjects and different types of to-be-remembered materials. Experiment 2 indicated that when normal subjects' level of item recall is equated with that of amnesics by interpolation of a long retention interval, normals exhibit significantly less source amnesia: Given item recall, normals made between .05 and .10 extraexperimental source responses at the three levels of prior knowledge. A second important outcome of Experiment 2 is that incidence of source amnesia did not increase when memory was degraded by interpolation of a long retention interval.

The overall pattern of results suggests that the level of source amnesia exhibited by memory-disordered patients cannot be accounted for in terms of generally degraded memory. It is possible to argue, of course, that normal subjects might have demonstrated source amnesia as often as patients did if they were tested at much longer delays—perhaps months or even years after the study episode. It would not be particularly surprising if such an outcome were obtained: Everyday experience indicates that it is difficult to recollect the source of a bit of knowledge that was acquired during an episode in the distant past (e.g., do you remember who first told you that George Washington was the first President of the United States?). The important point, however, is that normals' level of item recall would have to be much lower than that of memory-disordered patients before they would exhibit comparable amounts of source amnesia. Such an outcome would be consistent with the idea that level of source amnesia in memory-disordered patients cannot be accounted for in terms of generally degraded memory.

In contrast to the source amnesia data, the present results lend some support to the idea that source forgetting may be a property of generally degraded memory: The incidence of intraexperimental source errors in normal subjects increased significantly over the retention interval, and it was similar in amnesics and long-delay normals. However, some interpretive caution must be exercised with respect to this point because amnesics' level of source recall, given an intraexperimental source response, did not differ statistically from chance, although this may be attributable to the small number of observations in the experiment. In addition, the tests of source recall and item recall differed in a significant way: The to-be-remembered item changed on every trial, whereas the two experimental sources remained the same. Thus, poor source recall of long-delay normals and amnesics, given an intraexperimental source response, may have occurred because each of the experimental sources was related to so many facts that it was difficult to discriminate accurately between them.

Although most laboratory simulation studies have found that phenomena of amnesia can be observed in normals with degraded memories (cf. Mayes & Meudell, 1981a, 1981b; Mayes et al., 1981; Woods & Piercy, 1974), two studies have been reported in which a phenomenon of amnesia was not simulated in normal subjects. Hirst and Volpe (1982) found that amnesics' memory for temporal order was significantly lower than that of controls under conditions in which level of item recognition did not differ. Squire (1982) found that only *some* amnesic patients' performance on a temporal discrimination task was poorer than would be expected on the basis of level of item recognition; others performed no worse on the temporal discrimination task than would be expected on the basis of item recognition performance. Squire found a strong positive correlation between patients' performance on the temporal discrimination task and their performance on certain neuropsychological tasks that are sensitive to frontal lobe pathology: Patients who performed poorly on the neuropsychological tasks tend to exhibit disproportionately poor performance on the temporal discrimination task. In the present study, every one of our memory-disordered patients did exhibit some source amnesia, but the proportion of extraexperimental source responses on recalled items varied from .06 to 1.0 across patients. Using a strategy similar to Squire's, we examined the possibility that this variation is associated with level of performance on neuropsychological tasks. The patients were ranked on the basis of their performance on two of the neuropsychological tasks used by Squire that are sensitive to frontal lobe pathology: the Wisconsin Card Sort (Milner, 1963), on which subjects sort stimuli on the basis of changing dimensions, and the Benton Word Fluency test (Benton, 1973), in which subjects produce words beginning with the letters F, A, and S during successive 1-min periods. Patients were also ranked according to the proportion of extraexperimental errors, given item recall, and proportion of items recalled. Mean rank on the two neuropsychological tasks was significantly positively correlated with proportion of extraexperimental errors given item recall ($r = +.74$, $p < .05$), but was not significantly correlated with proportion of items recalled ($r = +.34$, $p > .05$). In addition, the proportion of extraexperimental source errors was uncorrelated with either full scale WAIS-R IQ ($r = +.19$) or age ($r = -.03$). These observations must be treated cautiously, of course, because they are both correlational and post hoc, but they do suggest that disproportionately high levels of source amnesia may be associated with poor performance on neuropsychological tasks that are sensitive to frontal lobe dysfunction.

The foregoing data imply that patients who are characterized by signs of frontal lobe dysfunction, but not by severe memory impairment, might also exhibit high levels of source amnesia. To investigate this possibility, we administered a modified version of the task used in Experiment 2 to four patients (two after left-sided stroke and two after ruptured anterior communicating artery aneurysms) who were matched to the amnesics of Experiment 1 in terms of age, intelligence, and performance on the Wisconsin Card Sort. Twelve high-knowledge and twelve no-knowledge name–characteristic pairs, as well as seven buffer items, were read to the patients by either of two sources; the patients were tested at a 0.5-h delay in the same manner as were the college students in Experiment 2. Overall level of item recall was .17, which is below the level attained by amnesics in Experiment 1. But these patients did not commit any extraexperimental source errors on correctly recalled items. This finding indicates that the presence of severe memory impairment is a necessary condition for the occurrence of disproportionately high levels of source amnesia.

The overall pattern of results suggests that some memory-disordered patients—those with signs of frontal lobe dysfunction—have special difficulties remembering the episodes in which information has been acquired. This observation has implications for theories of amnesia. A number of investigators have suggested that the fundamental deficit in amnesia is the inability to remember the contextual features that define the occurrence of a particular episode in one's past (e.g., Claparède, 1911/1951; Kinsbourne & Wood, 1975, 1982; Korsakoff, 1889; Rozin, 1976; Schacter & Tulving, 1982a, 1982b; Stern, 1981; Winocur, 1982). By contrast, others have suggested that amnesics' retention of contextual or episodic information is no more impaired than is their retention of any kind of *declarative* information, including items, facts, and associations (e.g., Cohen, 1984; Squire, Cohen, & Nadel, in press). We would suggest that each of these ideas may be correct, but only when they are applied to specific types of amnesic patients: Amnesics who perform well on frontal-sensitive tasks may exhibit approximately equal mnemonic impairments for all forms of declarative information, whereas those who exhibit signs of frontal lobe dysfunction may have special deficits remembering the episodes in which items and facts have been acquired. Accordingly, an important task for future research is to clarify the nature of the deficits that are picked up by frontal-sensitive tasks, and to provide a detailed understanding of how the cognitive processes that are tapped by these tasks map onto different domains of mnemonic function. One possibility is that amnesics with signs of frontal lobe dysfunction have deficits of *processing resource* that restrict their ability to encode simultaneously an item and its context (see Rabinowitz, Craik, & Ackerman, 1982, for a resource-based account of memory deficit). Another possibility is that such patients have temporal discrimination deficits (Squire, 1982). Exploration of these and other hypotheses could provide insight into the cognitive functions that are necessary for the occurrence of episodic remembering.

The results of the present research also have implications for the way that we think about episodic remembering in normal human memory. It is frequently assumed that subjects' ability to reproduce the factual contents of an episode, such as a word on a list, constitutes evidence that they remember the occurrence of the episode during which the word was studied. Indeed, this idea was endorsed by Tulving (1972) in his initial description of the characteristics of episodic memory. Schacter and Tulving (1982b), on the basis of clinical observations of source amnesia, suggested that there may be a need to distinguish between retention of the factual contents of a learning episode and memory for the occurrence of the episode itself (see also, Tulving, 1983). The results of both Experiments 1 and 2 indicate the necessity of such a distinction: Amnesic patients, and normal subjects to a lesser extent, demonstrated retention of the factual contents of a learning episode in the absence of recollection of the prior occurrence of the episode. These results indicate that it may be unwise to infer episodic memory purely on the basis of subjects' ability to reproduce correctly an item or fact that was acquired during a particular episode. A similar theme has emerged from recent research concerning priming effects, in which normals' and amnesics' performance on tasks such as fragment completion and perceptual identification is facilitated by previously studied information, whether or not they recollect the episode in which they encountered the information (e.g., Graf, Squire, & Mandler, 1984; Jacoby & Dallas, 1981; Moscovitch, 1982; Scarborough, Gerard, & Cortese, 1979; Tulving et al., 1982; Warrington & Weiskrantz, 1974). Although the relation between source amnesia and the aforementioned priming effects is not yet clear, both phenomena illustrate that the multiple consequences of a learning episode can be expressed in a dissociated manner. Understanding the nature of this dissociation is a task that will no doubt occupy memory researchers for a good many years to come.

REFERENCES

ANDERSON, J. R., & BOWER, G. H. (1971). On an associative trace for sentence memory. *Journal of Verbal Learning and Verbal Behavior*, **10**, 673–680.

BENNETT, C. A., & FRANKLIN, N. L. (1964). *Statistical analyses in chemistry and the chemical industry*. New York: Wiley.

BENTON, A. L. (1973). The measurement of aphasic disorders. In A. C. Velasquez (Ed.), *Aspectos patologicos del lengage*. Lima: Centro Neuropsicologico.

BROWN, E., DEFFENBACHER, K., & STURGILL, W. (1977). Memory for faces and the circumstances of encounter. *Journal of Applied Psychology*, **62**, 311–318.

CLAPARÈDE, E. (1911/1951). Reconnaissance et moitié [Recognition and "me-ness."] *Archives de Psychologie*, 1911, **11**, 79–90. In D. Rapaport (Ed.), *Organization and pathology of thought*. New York: Columbia Univ. Press, 1951.

COHEN, N. J. (1984). Preserved learning capacity in amnesia: Evidence for multiple memory systems. In N. Butters & L. R. Squire (Eds.), *The neuropsychology of memory*. New York: Guilford.

EVANS, F. J., & THORN, W. A. F. (1966). Two types of posthypnotic amnesia: Recall amnesia and source amnesia. *International Journal of Clinical and Experimental Hypnosis*, **14**, 162–179.

GEISELMAN, R. E., & CRAWLEY, J. M. (1983). Incidental processing of speaker characteristics: Voice as connotative information. *Journal of Verbal Learning and Verbal Behavior*, **22**, 15–23.

GRAF, P., SQUIRE, L. R., & MANDLER, G. (1984). The information that amnesic patients do not forget. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, **10**, 164–178.

HIRST, W. (1982). The amnesic syndrome: Descriptions and explanations. *Psychological Bulletin*, **91**, 435–460.

HIRST, W., & VOLPE, B. T. (1982). Temporal order judgments with amnesia. *Brain and Cognition*, **1**, 294–306.

JACOBY, L. L., & DALLAS, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General*, **110**, 306–340.

JONES, G. V. (1976). A fragmentation hypothesis of memory: Cued recall of pictures and of sequential position. *Journal of Experimental Psychology: General*, **105**, 277–293.

JONES, G. V. (1979). Multirate forgetting. *Journal of Experimental Psychology: Human Learning and Memory*, **5**, 98–114.

KINSBOURNE, M., & WOOD, F. (1975). Short term memory and the amnesic syndrome. In D. D. Deutsch & J. A. Deutsch (Eds.), *Short-term memory*. New York: Academic Press.

KINSBOURNE, M., & WOOD, F. (1982). Theoretical considerations regarding the episodic-semantic memory distinction. In L. S. Cermak (Ed.), *Human memory and amnesia*. Hillsdale, NJ: Erlbaum.

KORSAKOFF, S. S. (1889). Étude medico-psychologique sur une forme des maladies de la memoire. *Revue Philosophique*, **5**, 501–530.

LURIA, A. R. (1976). *The neuropsychology of memory*. Washington, DC: Winston.

MACCURDY, J. T. (1928). *Common principles in psychology and physiology*. Cambridge: Univ. Press,

MAYES, A. R., & MEUDELL, P. R. (1981a). How similar is immediate memory in amnesic patients to delayed memory in normal subjects? A replication, extension, and reassessment of the amnesic cueing effect. *Neuropsychologia*, **19**, 647–654.

MAYES, A., & MEUDELL, P. (1981b). How similar is the effect of cueing in amnesics and in normal subjects following forgetting? *Cortex*, **17**, 113–124.

MAYES, A. R., MEUDELL, P. R., & SOM, S. (1981). Further similarities between amnesic and normal attenuated memory: Effects with paired-associate learning and contextual shifts. *Neuropsychologia*, **19**, 655–664.

MILNER, B. (1963). Effects of different brain lesions on card sorting. *Archives of Neurology*, **9**, 100–110.

MOSCOVITCH, M. (1982). Multiple dissociations of function in amnesia. In L. S. Cermak (Ed.), *Human memory and amnesia*. Hillsdale, NJ: Erlbaum.

RABINOWITZ, J. C., CRAIK, F. I. M., & ACKERMAN, B. P. (1982). A processing resource account of age differences in recall. *Canadian Journal of Psychology*, **36**, 325–344.

ROTHKOPF, E. Z., FISHER, D. G., & BILLINGTON, M. J. (1982). Effects of spatial context during acquisition on the recall of attributive information. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, **8**, 126–138.

ROZIN, P. (1976). The psychobiological approach to human memory. In M. R. Rosenzweig & E. L. Bennett (Eds.), *Neural mechanisms of learning and memory*. Cambridge, MA: MIT Press.

SCARBOROUGH, D. L., GERARD, L., & CORTESE, C. (1979). Accessing lexical memory: The transfer of word repetition effects across task and modality. *Memory & Cognition*, **7**, 3–12.

SCHACTER, D. L., & TULVING, E. (1982a). Amnesia and memory research. In L. S. Cermak (Ed.), *Human memory and amnesia*. Hillsdale, NJ: Erlbaum.

SCHACTER, D. L., & TULVING, E. (1982b). Memory, amnesia, and the episodic/semantic distinction. In R. L. Isaacson & N. E. Spear (Eds.), *The expression of knowledge*. New York: Plenum.

SCHACTER, D. L., TULVING, E., & WANG, P. L. (1981). *Source amnesia: New methods and illustrative data*. Paper presented to the International Neuropsychological Society, Atlanta.

SQUIRE, L. R. (1982). Comparisons between forms of amnesia: Some deficits are unique to Korsakoff's syndrome. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, **8**, 560–571.

SQUIRE, L. R., COHEN, N. J., & NADEL, L. (in press). The medial temporal region and memory consolidation: A new hypothesis. In H. Weingartner & E. Parker (Eds.), *Memory consolidation*. Hillsdale, NJ: Erlbaum.

SQUIRE, L. R., NADEL, L., & SLATER, P. C. (1981). Anterograde amnesia and memory for temporal order. *Neuropsychologia*, **19**, 141–144.

SQUIRE, L. R., WETZEL, C. D., & SLATER, P. C. (1978). Anterograde amnesia following ECT: An analysis of the beneficial effects of partial information. *Neuropsychologia*, **16**, 339–348.

STERN, L. D. (1981). A review of theories of human amnesia. *Memory & Cognition*, **9**, 247–262.

TULVING, E. (1972). Episodic and semantic memory. In E. Tulving and W. Donaldson (Eds.), *Organization of Memory*. New York: Academic Press.

TULVING, E. (1983). *Elements of episodic memory*. Oxford: Oxford Univ. Press.

TULVING, E., SCHACTER, D. L., & STARK, H. A. (1982). Priming effects in word-fragment completion are independent of recognition memory. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, **8**, 336–342.

WARRINGTON, E. K., & WEISKRANTZ, L. (1974). The effect of prior learning on subsequent retention in amnesic patients. *Neuropsychologia*, **12**, 419–428.

WEISKRANTZ, L., & WARRINGTON, E. K. (1975). Some comments on Woods' and Piercy's claim of a similarity between amnesic memory and normal forgetting. *Neuropsychologia*, **13**, 365–368.

WINOCUR, G. (1982). The amnesic syndrome: A deficit in cue utilization. In L. S. Cermak (Ed.), *Human memory and amnesia*. Hillsdale, NJ: Erlbaum.

WOODS, R. T., & PIERCY, M. (1974). A similarity between amnesic memory and normal forgetting. *Neuropsychologia*, **12**, 437–445.

ZUBIN, J. (1948). Memory functioning in patients treated with electric shock therapy. *Journal of Personality*, **17**, 33–41.

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