6

Knowing and Remembering: Some Parallels in the Behavior of Korsakoff Patients and Normals

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Based on a brief reading of the Korsakoff literature, it seems that most hypotheses about the memory loss suffered by the Korsakoff patient can be split between those that emphasize storage and those that emphasize retrieval. On the side of storage, it has been claimed that the Korsakoff patient does not spontaneously engage in semantic processing of the sort that will support long-term retention (Cermak, 1979). On the side of retrieval, it has been argued that the Korsakoff patient suffers from greater interference than does the normal person when attempting to retrieve information from memory (Warrington & Weiskrantz, 1973). Rather than argue in terms of storage versus retrieval, I want to explore commonalities in processing at the time of study and at the time of test. The notion is that there is some general deficit in processing that is reflected at both storage and at retrieval. Among the accounts of behavior of Korsakoff patients, that advanced by Wickelgren (1979) is most similar to the view that is advocated in this chapter.

The research described employs normal subjects and draws parallels between the memory performance of Korsakoff patients and that of normals. At an empirical level, I provide data to support two propositions. One is that subsequent retention performance suffers when a question is too easily answered. When conditions are such that normal subjects can answer a question automatically, they later show poor retention for presentation of the question or its solution. The second proposition is that there are two important classes of variables that control recognition memory performance. One class of variables, including frequency of presentation in the experimental situation, has relatively parallel effects in recognition memory and in perceptual identification. The other class, including manipulations of the processing of meaning, has strikingly different effects in recognition memory and in perceptual identification.

At a theoretical level, I argue that the specificity of processing is important for both storage and retrieval. When an item is processed in a habitual, automatic fashion, there is little to distinguish the resultant encoding of the item from that produced by prior occurrences of the same item. In contrast, when processing is adapted to a novel task, context is involved to a larger extent so that an item is specified in terms of context and a relatively distinctive encoding is produced. I suggest that the memory deficit suffered by the Korsakoff patient is partially due to the patient's failure to specify presented items in terms of their context and, thereby, produce a distinctive encoding that will support later retention performance. This failure to specify an item in terms of its context is related to one form of deficit in attention. Similar effects are produced when normals are encouraged to respond automatically either by providing prior experience with the task or by a limitation in resources created by the requirement to divide attention among tasks or by a physical state such as fatigue or intoxication.

For retrieval, it is argued that the judgment of reoccurrence, recognition memory, can be performed on the basis of two types of information: perceptual fluency and respecification. A subject can judge that he or she has seen an item before because his or her processing of the item is relatively fluent. As an example, subjects in recognition memory experiments often report that "old" items seem to "jump out" from the page. The fluency of processing these items is influenced by experience with the items during study. The notion is that subjects become aware of their more fluent perceptual processing of some items and correctly attribute their fluency to prior experience with those items in the experimental setting; differences in judged fluency are used as a basis for recognition memory. Employing the second basis of recognition, a subject could judge an item to be a reoccurrence because he or she could recover a unique specification of the item produced on its earlier occurrence. That is, the subject recovers information about the context in which an item was studied and, perhaps, information about the manner in which that context influenced the encoding of the item. The use of this basis of recognition depends on the degree of earlier specification and, probably, the meaningfulness of prior processing. Respecification cannot be used as a basis for recognition memory if the prior processing of an item was fully automatic so that the item was not specified in terms of its study context.

Although judged fluency can serve as a basis for recognition, it is not always reliable because fluency can be influenced by several factors in addition to presentation of the item in the experimental situation. Further, if an item is recognized on the basis of judged fluency alone, all the subject will be able to say is that the item seems familiar; he or she will not be able to provide details about the context in which the item was earlier presented. Respecification of an item in terms of its earlier context can serve as a more reliable or conservative basis for recognition memory but requires the same form of processing as was required to specify the item originally. That is, a more active or constructive form of pro-

cessing is required; the Korsakoff patient may be less capable of engaging in this form of processing and, consequently, respond in a more habitual fashion at the time of test as well as during study. The success of any attempt to force specification during study would then be limited by the Korsakoff patient's failure to use respecification as a basis for recognition memory.

In the first section, I describe the effects on retention of differences in processing during storage. Retrieval effects are examined in a second section along with evidence for a dissociation of perceptual identification and recognition memory in normals that is of the same form as others have described for Korsakoff patients. The relevance of the view taken in the present chapter to current theoretical issues is considered in the third section. Among these issues is the question of whether or not Tulving's distinction between episodic and semantic memory can be used to provide an adequate description of the behavior of Korsakoff patients.

DEFICITS IN ENCODING PROCESSES

Attempts to account for memory decrements in terms of deficits in encoding processes have been spurred by the levels-of-processing framework proposed by Craik and Lockhart (1972). By this view, deeper, more meaningful analyses of perceived events are associated with more durable memory traces than are relatively superficial analyses of the sound or appearance of incoming stimuli. It is a natural extension of this framework to claim that the poor memory performance of various special populations is due to a failure to process meaning. In review papers, Cermak (1979) and Butters and Cermak (1975) describe the results of several experiments showing that Korsakoff patients do not spontaneously engage in semantic processing of presented items. Similarly, Craik and Simon (1979) relate age decrements in memory and learning to differences in level of processing. As an example of experiments showing a deficit in the processing of meaning, an experiment reported by Craik and Simon demonstrates that the older subject is less likely to integrate fully a word with a sentence frame. For recall of a noun that had been studied in a sentence context, the name of the general category of which the noun was a member was a more effective cue for older subjects than was the adjective that had modified the noun in the studied sentence; opposite results were obtained for younger subjects. It was concluded that younger subjects elaborated the meaning of a word to integrate it with the sentence context whereas older subjects did not.

Although there are clearly differences in processing among subject populations, the levels-of-processing framework does not provide an adequate basis for describing these differences. The problem is that there is no satisfactory specification of what constitutes a meaningful analysis (Baddeley, 1978) nor any way of describing differences in retention produced by tasks that seem to demand the

same level of processing. For example, decision or response difficulty is positively related to subsequent memorability even when there are no obvious differences among tasks with regard to the level of processing that they require (Jacoby, Craik, & Begg, 1979; Kolers, 1973; Slamecka & Graf, 1978; Tyler, Hertel, McCallum, & Ellis, 1979). To account for results of this type, it has been suggested that the notion of distinctiveness be used to replace that of level of processing (Jacoby & Craik, 1979; Nelson, 1979). The notion of distinctiveness continues in the vein of the levels-of-processing framework by emphasizing the relationship between study processing and subsequent retention. By the distinctiveness view, however, meaning is not a discrete level of processing.

Within the levels-of-processing approach, a subject's processing of an item is typically described in terms of the question that is asked about an item and the answer that the subject gives. For example, it is assumed that semantic processing is required to answer a question about the category membership of an item. The difficulty with describing processing in this way is that a subject can arrive at a particular answer to a question by several different means. In response to an inquiry about the state of his or her health, as a commonplace example, a person can state that he or she feels fine for any one of several reasons. The response may be a "stock" automatic answer or an answer that is arrived at after a careful assessment of his or her general state of well-being. In the next section, I describe experiments to demonstrate that the manner in which a question is answered influences retention. Retention performance is shown to be very poor when a question is answered automatically. This effect of automaticity is attributed to differences in the distinctiveness of study processing. Standard memory phenomena and the memory performance of Korsakoff patients are then discussed in terms of differences in study processing.

Effects of Automaticity of Responding.   One means of encouraging normal subjects to answer questions automatically is by providing prior experience with a question and its solution. Due to this prior experience, the subject may not engage in extensive processing to arrive at a solution but, rather, answer the question in a relatively automatic fashion by remembering the solution that he or she has previously encountered.

Recent experiments have shown that subsequent retention performance suffers when subjects can answer a question automatically (Jacoby, 1978). In a first phase of those experiments, subjects engaged in a task that is similar to that of solving a crossword puzzle. A context word was presented along with a few letters and a series of blanks representing the missing letters of a word that was related to the context word (e.g., FOOT-S_____E). The subject's task was to solve the crossword puzzle by reporting the word that could be produced by filling the blanks ("shoe" in the example cited). In a second phase, the context word was given as a cue for recall of the solution word. Primary interest was in relating problem-solving activities in the first phase to retention as measured in the

second phase. In some conditions, the task of giving a solution to the problem in the first phase was trivialized by presenting the context word with the completed solution word prior to the puzzle (FOOT-SHOE: FOOT-S_____E). In these conditions, subjects could respond simply by remembering the solution they had previously read; they did not actually have to solve the puzzle. Retention performance in the second phase was substantially lower when a puzzle in the first phase was trivialized in this fashion. That is, when subjects could deal with a problem in a relatively automatic fashion by giving an easily recalled solution rather than by solving the problem to arrive at a solution, subsequent retention performance suffered.

A series of experiments carried out as a Master's thesis by Lauren Cuddy investigated the factors that determine when a previously read solution will be easily recalled so that a question can be answered automatically. Cuddy's experiments employed the crossword puzzle procedure described earlier. Again, there were two phases: a first phase in which crossword puzzles were presented and a second phase in which the context word from a crossword puzzle was given as a cue for recall of the solution word. The first phase included various forms of repetition of a puzzle. An example from each of the repetition conditions employed is provided in Table 6.1.

To assess the persistence of the effect of previously reading a solution, Cuddy compared two of the conditions described in Table 6.1. Subjects in a first condition read the solution to a problem and were then asked to construct a solution for the problem (Read-Construct). In a second condition, subjects first constructed a solution to a problem and then later read the solution (Construct-Read); thus, the second condition had the same number of exposures of the solution as did the first condition, but reading the solution came later so it could not trivialize the solving of the problem. When a solution is read long before presentation of the problem for which it is required, performance in the Read-Construct condition should converge with that in the Construct-Read condition. This is because at longer intervals the previously read solution should no longer be easily remembered, so it will not trivialize responding to the later problem. However, as shown in Fig. 6.1, the Read-Construct condition produced substantially lower retention performance in the second phase than did the Construct-Read condition

TABLE 6.1
Presentation Conditions from Phase 1 of Experiment by Cuddy (1979)

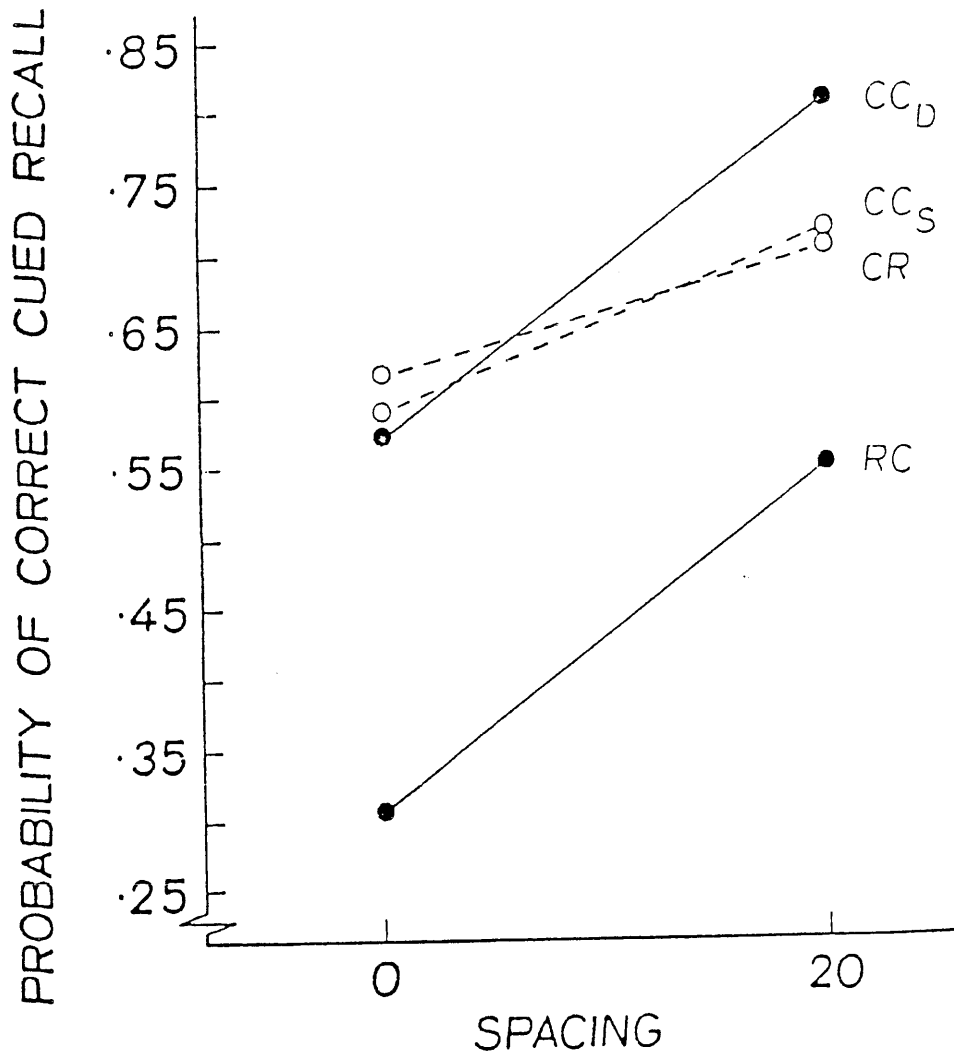| Condition	First Presentation		Second Presentation	
Read-Construct	LAWYER	COURT	LAWYER	C____RT
Construct-Read	LAWYER	C____RT	LAWYER	COURT
Construct-Construct/Same	LAWYER	C____RT	LAWYER	C____RT
Construct-Construct/Different	LAWYER	C____RT	LAWYER	__OUR__

FIG. 6.1.   Probability of cued recall for Read-Construct (RC), Construct-Read (CR), Construct-Construct/Same (CC$_S$) and Construct-Construct/Different (CC$_D$) conditions as a function of spacing interval.

even when the solution and problem had been separated by 20 intervening problems. A previous reading of a solution apparently acts over a substantial time interval to influence responding to a problem and to lower later retention performance.

Other conditions described in Table 6.1 allow one to assess the effect of changing the form of a problem between its presentations. In a "Construct-Construct Same" condition, a crossword puzzle problem was repeated with the

same letters being deleted from the solution word for each presentation, whereas in a "Construct-Construct Different" condition, different letters were deleted for each presentation of a problem. As shown in Fig. 6.1, presenting a problem a second time to be solved without changing its form did no more for later retention than did simply reading the solution to the problem (Construct-Construct Same Versus Construct-Read). When a problem was repeated in the same form, subjects could respond automatically by remembering the solution they had given previously. In contrast, when different forms of a problem were presented (Construct-Construct Different) and repetitions were widely spaced, this automatic responding was not possible so later retention performance did benefit.

It seems clear that later retention performance suffers when a question is answered by giving an easily remembered solution rather than by constructing a solution. However, why does constructing a solution enhance memory? One possibility is that retention performance reflects the amount of "effort" invested in storage processing (Tyler et al. 1979). As measured by performance on a subsidiary task, greater amounts of effort or attention are related to higher retention performance (Johnston & Uhl, 1976; Tyler et al., 1979). Although there are differences in effort, the manner in which effort operates to influence later retention performance is not explained. It seems perferable to couch our theoretical descriptions in terms of the cognitive operations themselves rather than in terms of effort. It is likely that a reduction in effort is gained by not processing some forms of information, and that it is the failure to process this information that accounts for poor retention performance.

The results of recent experiments are consistent with the suggestion that the processing of some forms of information is deleted when responding is automatic. Using the crossword puzzle procedure described earlier, it has been shown that subjects do less to integrate a problem and its solution when they are able to respond automatically (Jacoby, 1978b). When subjects must actually solve a problem rather than respond automatically, the context word that was presented in the problem is not only a better cue for the recall of the solution but the solution is also a better cue for recall of the context word. This symmetry in results is expected if solving a problem necessitates that the semantic relationship between the context word and solution is processed whereas responding automatically does not require the processing of meaning. Other experiments have also shown that the processing of semantic relationships is likely to be bypassed when conditions are such that subjects can respond automatically (Donaldson & Bass, 1980). As with Korsakoff patients (Cermak, 1979) and the aged (Craik & Simon, 1979), the failure to process meaning is associated with poor retention performance.

Although differences in processing are involved, I do not want to equate automatic processing with the lower levels of processing postulated by Craik and Lockhart (1972). Rather, I want to emphasize differences in the extent to which processing serves to specify the presentation of an item as being a unique event.

When an item is encountered in a novel task so that it cannot be processed automatically, processing is likely to relate an item to its context to produce a distinctive encoding and, thereby, enhance retention performance. By this view, prior experience with a task is as important as is the apparent form of a question that is asked. Even a question that would seem to require the processing of meaning, such as solving a crossword puzzle, can be accomplished in a relatively automatic fashion. The processing that a subject engages in influences retention but cannot be fully specified by describing the question that is asked or the answer that is given.

The Role of Attention in Standard Memory Phenomena.   Current theorizing about attention has led to a distinction between processing that is automatic (Shiffrin & Schneider, 1977) or effortless (Hasher & Zacks, 1979) and processing that requires attention to be carried out. Processing of the automatic form is usually described as not requiring intent nor involving consciousness, and as depending on factors such as the number of prior presentations of an event and the physical similarity among presentations. This automatic form of processing does not require attention but is less flexible than is processing that does require attention; attention is required to adapt the processing of an event to a novel task or context. The previously reported poor retention performance produced by prior experience with a question can be described as being due to automatic responding, a lack of attention during study processing. Similar conclusions about the relationship between attention and subsequent retention performance can be drawn by using other means of manipulating attention. Simon and Craik in a paper submitted for publication have shown that requiring a subject to divide his or her attention among tasks lowers retention performance, and have drawn parallels between the effects of divided attention and effects found with the aged.

Several memory phenomena can be interpreted in terms of the negative effects of automaticity. One general finding is that retention is higher when repetitions of an item are spaced rather than massed in a list (Hintzman, 1974). This effect of spacing items in a list may have the same basis as the earlier described effect of separating the presentation of a solution to a problem from presentation of the problem. To produce the spacing effect, the first presentation of a word makes available an appropriate encoding and thereby trivializes the processing associated with the second presentation of the word when repetitions are massed. As the spacing of repetitions is increased, processing of the second presentation becomes less automatic; consequently, retention is enhanced as a function of spacing repetitions (Jacoby, 1978).

The same form of argument can be used to interpret effects that are typically attributed to proactive interference. In his famous water jar experiments, Luchins (1942) demonstrated that presenting a series of problems that require the same *form* of solution produces faster solving of later problems but less flexibility in

the form of solution that is given. From the foregoing arguments, we would expect the faster solving of problems to be associated with poorer retention performance. A subject can automatically apply a procedure to obtain a solution for a presented problem; however, this automatic application of a procedure should result in poor retention of the presented problem and its solution. Similarly, when lists of words are learned, the processing of words may change as a function of experience with the task; a decline in retention performance across lists may, in part, be due to changes in encoding rather than an increase in interference, as is commonly assumed. This interpretation of proactive inhibition in terms of encoding is more fully described by Lockhart, Craik and Jacoby (1976).

Isolation effects can also be related to differences in encoding. A recent experiment by Friedman (1979) serves as an example by showing both positive and negative effects of expectation. In her experiment, pictures that contained both expected and unexpected objects were presented. For example, a picture of a kitchen scene contained a refrigerator as an expected object and might contain a cow as an unexpected object. Measurements of eye movements led to the conclusion that expected objects were identified more readily than were unexpected objects, yielding evidence for a positive effect of expectation. However, memory was more detailed for unexpected objects. Subjects were quite unlikely to notice if one token of an expected object was replaced by another token; they would not notice if the refrigerator was replaced by another refrigerator between study and test. However, subjects were likely to notice a comparable change in an unexpected object. It was concluded that more processing of the details of an unexpected object is necessary for original identification and that this further processing of details results in a rich enough memory for the object to allow subjects to discriminate between the previously presented object and other objects of the same class.

Memory phenomena that have traditionally been given quite different interpretations may have a partially common basis. In general, the argument is that an increase in the efficiency of performing a task can be gained by decreasing the processing of details that are unique to the occurrence of a particular event. This decrease in processing results in a less distinctive trace and poorer memory performance. As performance becomes more automatic, retention performance suffers.

Relevance to the Korsakoff Syndrome. Decrements in memory performance suffered by Korsakoff patients can be described as being partially due to a lack of distinctiveness in the encoding of information. The Korsakoff patient may process information in a more routine automatic fashion than does the normal subject. This automatic processing does not specify a presented item in terms of its context so the Korsakoff patient is left with a less distinctive encoding than would be produced by a normal subject. This less distinctive encoding does not

include sufficient information to distinguish the current presentation of an item from prior presentations of the same item; consequently, the Korsakoff patient has difficulty recalling or recognizing items as having occurred in a particular context.

As well as memory performance, an account in terms of automaticity implicates the lack of flexibility that is said to characterize the Korsakoff patient. For example, the difficulty that Korsakoff patients experience in changing tasks (Talland, 1965) can be attributed to a deficit in attention. What is suggested is further investigation of differences between the normal subject and the Korsakoff patient in problem-solving situations followed by an attempt to relate differences in processing to effects in retention. As an example, the Korsakoff patient may show more persistent effects of set in a problem-solving situation than does a normal subject, and these effects of set may be intimately related to retention performance. Others have also discussed defective attentional mechanisms in their description of Korsakoff patients (Oscar-Berman, 1973); however, further work is needed to relate deficits in attention to retention performance.

The foregoing discussion of automaticity and attention leads to an account of memory deficits in terms of deficiencies in study processing. If decrements in memory performance are due to deficient study processing, it may be possible to control processing by means of incidental learning procedures and, thereby, repair memory performance. Several experiments have been motivated by the levels-of-processing framework and have attempted to eliminate differences among subject populations by using incidental learning procedures (Cermak, 1979; Craik & Simon, 1979; Hartley, Birnbaum, & Parker, 1978). The mixed success of these attempts to repair memory performance may be due either to differences in storage or differences in retrieval that remain when incidental learning procedures are employed. With regard to storage, the problem is that the measure of performance of the incidental learning task may not be sensitive enough to reflect differences in processing that do exist. In the experiments described earlier, for example, a measure of whether or not a subject gave a correct solution to a crossword puzzle would not be an adequate index of processing; the correct solution could be given either by solving the puzzle or by remembering a previously read solution, and the means by which the solution was obtained influenced subsequent retention performance. Measures in addition to the answer that is given to a question are required to specify processing, and to relate differences in processing to retention performance. Even if differences in study processing could be eliminated, it is unlikely that the memory performance of the Korsakoff patient would equal that of normals. As is discussed later, the success of attempts to repair the memory performance of Korsakoff patients by controlling study processing is likely to be limited by deficiencies in processing at the time of test.

THE DISSOCIATION OF PERCEPTUAL AND
ELABORATIVE RECOGNITION

Although the Korsakoff patient performs very poorly when asked to recall or recognize items, he or she apparently is capable of new learning. By several accounts, Korsakoff patients show a dissociation of memory as expressed in perception or action and memory as measured by recognition and recall tests (See Baddeley, this volume, for a brief review.) As an example, Korsakoff patients are capable of improving their performance in a motor task such as rotary pursuit; however, when asked, patients do not remember having practiced the task. Although his or her performance shows that there is some form of memory from practice sessions, the Korsakoff patient will claim that it is the first time that he or she has ever attempted the task. This dissociation is striking for several reasons. First the Korsakoff data has something of the flavor of subliminal perception about it in that the patient shows effects in performance without being aware of, or being able to remember the events that caused those effects. Although we may have no justification, most of us feel that we, in contrast to the Korsakoff patient, know quite a lot about what influences our performance. Further, many have a tendency to think of memory as being unitary so that if an event is remembered, evidence of that memory is expected in both performance and in the subject's report of prior experiences. This expectation is clearly disconfirmed by the results of experiments employing Korsakoff patients.

In this section, experiments are described to show that the dissociation obtained with Korsakoff patients has a parallel in normal subjects. To draw this parallel, perceptual identification performance in normals is equated with the Korsakoff patient's performance of a perceptual or motor task whereas recognition memory is equated with the ability of the subject to report previous experience that is relevant to the task. For the normal as for the Korsakoff patient, effects in performance can be separated from the subject's ability to report the prior events that are responsible for those effects. Instances are described for which the presentation of an item influences later perceptual identification performance even though there is a low probability that the item will be recognized as having been previously presented. Evidence is provided to show that there are two classes of variables that influence recognition memory. The one class of variables influences recognition memory but does not influence perceptual identification whereas the other class of variables has parallel effects in the two types of task. As discussed, the existence of two classes of variables is understandable if there are two separate forms of recognition memory.

Parallel Effects. A first set of experiments provides evidence of parallel effects in perceptual identification and in recognition memory performance. An initial experiment was designed to investigate the effect of repetition and the

effect of spacing repetitions. In the first phase of that experiment, words were presented either once or twice for study at a 1-sec rate; when words were presented twice, repetitions were either massed or separated by 15 intervening items. In the second phase, either a test of recognition memory or a test of perceptual identification was given. The test list for both types of test was constructed by intermixing "new" items with items that had previously been presented for study. For the recognition memory test, subjects were to indicate which of the items had been presented during study. For the perceptual identification test, old and new items were presented individually for 35 msec, followed by presentation of a visual mask; subjects were simply to report the word that had been flashed. The measure of perceptual identification performance was the probability that a presented word could be correctly reported. The manipulations of study in the first phase was a within-subject variable while form of test was manipulated between subjects.

The results of the first experiment are displayed in Table 6.2. For recognition memory, there was an effect of both repetition and of the spacing of repetitions. The recognition memory results replicate those reported by others (Hintzman, 1974). Of greater interest are effects in perceptual identification. First, note that even a single presentation of a word had a substantial effect in later perceptual identification; the probability of identifying an item that had been presented once during study was .54 whereas that of identifying an item whose first occurrence was at the time of test was only .41. Further, the effect of repetition and the effect of spacing repetitions in perceptual identification paralleled effects found in recognition memory. For both forms of test, performance was enhanced when spaced rather than massed repetitions of an item were presented during study.

Further information about the factors that influence perceptual identification can be gained by examining intrusion errors. In general, a word that was given as an intrusion error was physically similar to the word that it replaced, appeared in the test list prior to the word that it replaced, and had been repeated during study with its repetitions being spaced. As evidence of the importance of physical

TABLE 6.2
Perceptual Identification and Recognition Memory as a
Function of Repetition

	New	Once Presented	Repeated Massed	Repeated Spaced
Recognition memory	.12*	.66	.78	.92
Perceptual identification	.41	.54	.58	.65

*Probability of a false alarm for recognition memory.

TABLE 6.3
Perceptual Identification and Recognition Memory as a
Function of Frequency in the Language

	New Items*		Study Items	
	Frequency		Frequency	
	High	Low	High	Low
Recognition memory	.09	.08	.63	.88
Perceptual identification	.68	.37	.84	.73

*Probability of a false alarm for recognition memory.

similarity, an intrusion error typically shared the majority of its letters with the word that it replaced; for example, "hound" often replaced "wound."

One of the most important variables influencing perceptual identification is frequency in the language of the word that is to be identified. Words that occur frequently are identified much more readily than are words that occur infrequently (Morton, 1969). Perhaps the effect of presenting an item for study, found in the prior experiment, is restricted to items that occur with a low frequency in the natural language. To check this possiblity and to see how easily effects of frequency in the language can be diminished by study, a second experiment was conducted. This second experiment had the same general form as did the first experiment. In a first phase, a list containing high- and low-frequency words was presented for study at a 1-sec rate. High-frequency words were among the A and AA words in the Thorndike–Lorge wordbook whereas low-frequency words were reported as occurring one to three times per million words. To construct a test list, an equal number of new high- and low-frequency words were intermixed with the old study words. As in the prior experiment, one group of subjects was given a test of recognition memory whereas a second group of subjects was given a test of perceptual identification.

The results of the second experiment are shown in Table 6.3. In agreement with prior research (Gregg, 1976), words that occur with a low frequency in the language were more likely to be correctly recognized than were words that occur with a high frequency in the language. An opposite pattern of results was found for perceptual identification performance; high-frequency words were more likely to be correctly identified than were low-frequency words. Looking at the effects of study, the effect in perceptual identification of a study presentation was larger for low-frequency words than for high-frequency words; however, even the effect with high-frequency words was substantial. Although not totally elimi-

nated, the effect in perceptual identification of frequency was greatly diminished after a single study presentation of high- and low-frequency words. Scarborough, Cortese, and Scarborough (1977) used a lexical decision task rather than a test of perceptual identification but report a similar interaction of frequency in the language with prior study in the experimental situation.

In terms of absolute level of performance, the effects of frequency in the language are clearly inconsistent with a claim of parallel effects in perceptual identification performance and recognition memory. Increasing frequency in the language has opposite effects in the two types of task; high-frequency words are more likely to be perceptually identified but are less likely to be recognized as having been presented earlier than are low-frequency words. However, parallel effects are found if one considers *change* in performance produced by prior study rather than absolute level of performance. The perceptual identification of low-frequency words benefits more from prior study and low-frequency words are also more likely to be recognized as having been presented previously than are high-frequency words.

An important question is: How long-lived are effects of prior study in perceptual identification performance? Evidence of recognition memory can be found even when a long delay intervenes between study and test. In contrast, it might be expected that the perceptual effects of prior study are short term. Effects in perceptual identification may rely on memory for "low-level" physical information, and many have argued that information of this form is lost very rapidly (Craik & Lockhart, 1972). The results of a third experiment show that the effects of prior study in perceptual identification performance are long lasting. In that experiment, a test of perceptual identification occurred immediately after, 15 minutes after, or 24 hours after study of a list that contained a portion of the words that were later presented for perceptual identification. The effects of prior study were not significantly diminished even by a 24-hr delay between study and test; even at the long retention internal, prior study had a large effect in perceptual identification. As an example, the probability of correct perceptual identification of a low-frequency word was .30. A single presentation of the word at a 1 sec rate 24 hours earlier was sufficient to increase this probability to .56.

To further assess memory of physical information, a later experiment manipulated the modality of study. Words were presented for study by means of either the auditory or the visual modality; a visual test of perceptual identification, of the form described earlier, followed study. A substantial effect of previously studying a word was found only when the modality of study matched that of the perceptual identification test. Consequently, it can be concluded that physical information is retained over the long term, and is largely responsible for the influence of prior study on perceptual identification performance. Others have found similar effects of changing modality in perceptual identification performance (Morton, 1977) and in the performance of a lexical decision task (Scarborough, Gerard, & Cortese, 1979).

A single presentation of a word is sufficient to produce a large effect in later perceptual identification performance as well as producing recognition memory for the presented word. Further, several variables have parallel effects in perceptual identification and in recognition memory performance. As described earlier, repetition and the spacing of repetitions have similar effects in the two tasks. Overlap in constituent letters among words is important for perceptual identification; similar effects are found in recognition memory (Raser, 1972). As further evidence of the importance of physical similarity, both perceptual identification and recognition memory (Kirsner, 1974) are enhanced when words are presented for study and tested by means of the same modality (auditory versus visual) rather than modality being changed between study and test.

Evidence of a Dissociation. A second series of experiments revealed effects of meaningful elaboration in recognition memory but no effects in perceptual identification. The experiments in this second series made use of incidental learning procedures. Questions were asked about presented items in a first phase and then either a test of perceptual identification or a recognition memory test was given in the second phase of each experiment.

In the first experiment, subjects answered a different question about each word in a long list. Three types of question were used: questions about the constituent letters of words (e.g., Contains the letter R?), rhyme questions (e.g., Rhymes with train?), and questions about the meaning of words (e.g., Is the center of the nervous system?). For each of the three types of question, half of the presented words required a "yes" response (e.g., BRAIN) and the other half required a "no" response (e.g., WOUND). As in experiments reported earlier, the perceptual identification task used in the second phase measured subjects' ability to report briefly presented words.

The recognition memory results are presented in the first row of Table 6.4. Recognition memory performance was higher after questions about meaning than after rhyme questions or questions about constituent letters. Further, questions

TABLE 6.4
Perceptual Identification and Recognition Memory
as a Function of Level of Processing

	New	Physical		Rhyme		Semantic	
		Yes	No	Yes	No	Yes ·	No
Recognition memory	.15*	.51	.49	.72	.54	.95	.78
Perceptual identification	.65	.78	.81	.82	.80	.80	.83

*Probability of a false alarm for recognition memory.

that required a "yes" answer produced higher recognition performance than did questions that required a "no" answer. This pattern of results replicates that found in levels-of-processing experiments (Craik & Tulving, 1975); however, the size of the levels effect is noteworthy. Recognition performance after a semantic question that required a "yes" answer was nearly twice as high as that after a question about constituent letters that required a "no" answer. Despite this large levels effect in recognition memory, there was no indication of effects in perceptual identification performance. As shown in the second row of Table 6.3, presentation of a word in the first phase did substantially enhance later perceptual identification; however, the form of question asked about the word in the first phase had no effect.

Other experiments in the same series produced a similar dissociation of perceptual identification and recognition memory. As in the experiment just reported, the first phase of those other experiments embodied the level-of-processing manipulation; in the second phase, subjects either solved anagrams or judged whether or not a presented item was a word (lexical decision task). Anagrams were solved faster when their solution words were presented in the first phase; however, the level of processing of the solution word in the first phase did not influence the speed of solving the anagram in the second phase. Similarly, lexical decisions were faster when the word that was being judged had been presented in the first phase of the experiment; again, level of processing of the word in the first phase did not influence the speed of lexical decision for the word in the second phase.

As does the Korsakoff patient, normal subjects show effects in performance that are independent of recognition memory. In the aforementioned experiments, the level-of-processing manipulation that has large effects in recognition memory did not influence performance in tasks that required access to a word in memory but did not require subjects to judge whether or not that word had been presented previously. An experiment by Kolers (1976) provides additional data that can be interpreted as showing a dissociation between memory as expressed in performance and recognition memory. In a study of reading transformed text, Kolers found a very low correlation between transfer as measured by the increase in the speed of reading a repeated sentence and recognition memory. Sentences that had been read a *year* earlier were read more quickly than were new sentences taken from the same source; this increase in speed of reading was largely independent of the subject recognizing the repeated sentence as being one that he had read earlier.

Others have also reported that perceptual similarity is more important than is meaningful elaboration for training effects in perceptual identification (Morton, 1977) and in a lexical decision task (Scarborough et al., 1979). However, both perceptual similarity and meaningful elaboration influence recognition memory. One way of accounting for these results is to suggest that there are two forms of recognition memory with only one of these two forms being dependent on mean-

ingful elaboration; the other form has a more perceptual basis and, perhaps, depends on judgments of relative perceptual fluency.

Two Forms of Recognition Memory. That there are two forms of recognition memory is not a novel suggestion. Mandler (1979) has done considerable work on this topic and provides a review of the work of others who have also suggested that there are two forms of recognition memory. The forms of recognition memory that I propose are in general agreement with those postulated by Mandler. My primary interest is in further delineating the forms of recognition memory and in relating recognition memory to perceptual performance. The experiments reported earlier revealed quite large effects of a single presentation of a word in later perceptual identification of that word. Further, several parallels between the effects of variables in recognition memory and perceptual identification were revealed. These results make it plausible that relative perceptual fluency serves as one basis for recognition memory. This view of recognition memory seems consistent with that held by some others (Kirsner, 1972; Kolers, 1973).

For recognition on the basis of perceptual fluency, the judgment might be of the relative fluency of performing acts that are judged to be immediate and ordinary, that is, acts such as discrimination and naming that are immediately performed in many different situations. Due to its prior exposure, an item appears to jump out from the page; because of this fluent processing, the item is judged to be "old." Perceptual fluency and the form of recognition memory that is based on fluency depend on factors such as the number and spacing of repetitions during study, and on the perceptual similarity of study and test versions of an item.

Note that it is relative perceptual fluency rather than absolute fluency that is postulated as a basis for recognition memory. The assumption that relative fluency is important is useful for interpreting the effects of frequency in the language. For both perceptual identification and recognition memory, low-frequency words benefit more from study presentation than do high-frequency words so the relative effects of study are the same for the two types of task. Opposite effects in the two tasks are found when absolute level of performance is considered; high-frequency words are more readily perceptually identified whereas low-frequency words are more likely to be recognized as having been presented earlier. If relative perceptual fluency serves as a basis for recognition meory, there is the problem of specifying the base line against which change in fluency is measured. Different base lines must be used for high- and low-frequency words. In any case, that relative rather than absolute perceptual fluency is important is favored by logical considerations. More complex tasks are typically more difficult to complete than are simpler ones, and this difference in difficulty is not fully removed by prior experience with the tasks. To serve as a valid basis of recognition meory, judgments of fluency must be relative to the difficulty of the task.

Relative perceptual fluency can only provide a basis for recognizing an item as being familiar; further evidence to support the recognition memory decision is not made available by information about fluency. An example can serve to clarify this point. If a telephone number has been learned through repetition alone, the only basis for confidence that we are remembering the correct number is the ease with which the number comes to mind. If challenged, all that we can say is that the number seems right or familiar. The use of a mnemonic device for memorizing a telephone number, in contrast, can provide additional criteria for judging the correctness of the number that we have recalled. Similarly, retrieving of study context can provide a more conservative basis for recognition memory. That is, an alternative to relative perceptual fluency as a basis for recognition memory is the respecification of an item in terms of its study context. It is this form of recognition memory that is influenced by the "level" or automaticity of processing items during study. A more distinctive encoding of an item during study can be used to provide more evidence for the validity of a later recognition memory decision.

Relevance to Korsakoff Patients.   Korsakoff patients perform very poorly even on a test of recognition memory. Further, when the patient does correctly identify an item as being "old" on a recognition test, he or she is often unable to justify this decision and claims to be only guessing (Weiskrantz & Warrington, 1975). This poor recognition performance and inability to justify recognition memory decisions is understandable if the Korsakoff patient primarily relies on relative perceptual fluency as a basis for recognition memory. The use of relative perceptual fluency does not take advantage of any elaborative or distinctive processing of items during study and provides little evidence that can be used to justify a recognition memory decision. Although respecification of an item in terms of its study context can provide a more reliable basis for recognition, respecification requires processing of the same form at test as was earlier described as being required during study to specify an item in terms of its context. Due to a deficit in attention, perhaps, the Korsakoff patient is unlikely to engage in this more flexible form of processing. For normals, memory for study context is irrelevant for perceptual identification of an isolated word, so meaningful elaboration during study has no effect. For Korsakoff patients, effects of meaningful elaboration during study also depend on the use of information about study context at the time of test; due to insufficient processing at the time of test a memory deficit may remain even when study processing is controlled by means of incidental learning procedures. Others have also discussed the importance of retrieval processes for predicting the effects of levels of processing manipulations during study (Cermak, this volume; Jacoby & Craik, 1979).

Summary and Applications.   The main concerns in this paper have been the effects in perceptual identification of training, and the relationship between per-

ceptual identification and recognition performance. The experiments reported earlier show that perceptual performance is easily modified and that effects in performance can be separated from the subject's ability to report the basis of those effects. In this regard, the dissociation between recognition memory and perceptual identification is similar to the discrepancy between introspective reports and effects in performance described by Nisbett and Wilson (1977). Subjects show effects in performance that are independent of more phenomenological measures— recognition memory in the present case. In some instances, however, there are parallel effects in perceptual identification and recognition memory performance. By the view proposed here, a subject can base a recognition memory decision on observations of his or her own behavior. If someone else easily performs a task that appears to be a normally difficult one, we conclude that he or she has practiced the task. Similarly, relative fluency in our own behavior may serve as a basis for recognition memory.

Further investigation of the relationship between perception and memory is important for both theories of memory and theories of perception. With regard to perception, investigations of the effects of study are important for specifying the means by which variables such as frequency in the language operate. That the effects of frequency in the language are so easily offset by study is not necessarily inconsistent with current theories of word perception (Morton, 1977) but still seems surprising in the context of those theories. With regard to memory, prior research has typically required the subject to be aware that he or she is remembering by asking the subject to recall or recognize items that were previously presented. In other areas of research, it is clear that prior experience is applied without awareness. Investigations of language, for example, show a great deal of regularity in language behavior; however, the native speaker of a language is often surprised when this regularity is pointed out. The two forms of recognition memory that were described earlier may parallel two more general modes of responding. Perceptual fluency may correspond to the fast automatic mode of responding that is typically attributed to guessing or intuition, whereas respecification corresponds to a more careful mode of responding that is mediated by consciousness. These two forms of responding are likely to be a function of different variables. By imposing the requirement of awareness, we may fail to uncover differences in memory that do exist.

There is no reason that the notions discussed here must be restricted to recognition of individual words. One can as readily speak of recognition of patterns as of recognition of words. That experience can influence perception of patterns is supported by studies of expertise. In DeGroot's (1966) study of chess players, the major difference between the expert and the novice seems to be perceptual in nature; the expert sees patterns that the novice does not. Again, the question arises concerning the possible dissociation between what a person can say about his or her prior experience and the effect of that prior experience on the performance of a perceptual task. One might find little difference between an expert

and a novice when the two are asked to talk about strategies, facts concerning the subject matter, etc. However, differences are apparent in a more perceptual task. Researchers in a neighbouring medical school and I are currently attempting to use these notions to test the expertise of medical students. With multiple-choice tests of the type that are often used to assess performance, the final-year medical student typically scores higher than does the physician who has been practicing successfully for several years. Consequently, one worries that these tests are not a good measure of expertise. We have devised a more perceptual task upon which the performance of the practicing physician far surpasses that of the student. Similar to the expert chess player, the practicing physician sees patterns among symptoms that the novice does not. In designing tests for an educational setting, one encounters many of the same issues as were encountered when examining the relationship between perceptual identication and recognition memory of individual words.

THEORETICAL ISSUES

A variety of hypotheses have been advanced to account for the memory loss suffered by the Korsakoff patient. A few of these hypotheses are sketched in this section and discussed in terms of the theoretical points made in earlier sections.

Levels of Processing. As discussed earlier, the use of incidental learning procedures may not result in complete control of study processing. Further, it is necessary to consider differences in processing at the time of test as well as differences during study. Both of these considerations limit the utility of the levels-of-processing framework as it was originally proposed (Craik & Lockhart, 1972). Further, a strong interpretation of the levels-of-processing view leads to the claim that physical information about a presented word is lost very rapidly so the processing of meaning is required to produce retention over the long term. However, the perceptual identification experiments described earlier show that physical information about a presented word is retained for at least 24 hours. It was apparently information about the physical properties of a word that was preserved and influenced subsequent perceptual identification performance; changing modality between study and the perceptual identification test largely eliminated the effects of prior study. Although level of processing is important for later recognition and recall, there seems to be a more perceptual form of learning and memory for which level of processing is irrelevant. It is likely that this perceptual form of learning is involved when Korsakoff patients improve their performance in a task although they do not recognize the task as being one that they have practiced. The level-of-processing framework does not allow for the dissociation of effects in performance and recognition memory.

Interference Hypothesis. A second hypothesis is that the amnesic syndrome is due to the Korsakoff patient suffering from greater interference than does the normal subject. In an interesting series of experiments, it has been shown that the memory performance of the Korsakoff patient is substantially improved when fragments of the to-be-remembered event are provided as cues for recall (Warrington & Weiskrantz, 1973; Weiskrantz & Warrington, 1975). For example, the memory performance of the Korsakoff patient is as high as that of the normal subject when initial letters of the target word are given as a cue for recall and those initial letters match the first letters of few words in the language other than the target word. On the basis of these results, it has been concluded that the memory deficit usually shown by the Korsakoff patient cannot be due to differences in storage but, rather, is due to differences in interference at the time of test. The provision of letter cues can minimize interference and thereby eliminate the deficit in memory performance.

The notions described earlier in this chapter can be used to provide an alternative account for the effectiveness of fragment cues. The suggestion is that the processes involved in completing a fragment cue to produce the target word are similar to those involved in perceptual identification. That is, cued recall with fragment cues can be treated by subjects as being a perceptual task so that it is largely uninfluenced by differences in processing during study. Compatible with this view is the finding that recall with fragment cues often surpasses recognition memory performance. Although Korsakoff patients respond correctly to a fragment cue, they are often not aware that they are remembering but, rather, claim to be only guessing (Weiskrantz & Warrington, 1975). Perhaps they are only giving a recently educated guess. The high performance of the Korsakoff patient when fragment cues are provided may be another axample of the dissociation of effects in performance and recognition memory. Again, we have the separate problems of accounting for effects in performance and explaining how the subject knows that he or she is remembering.

Further research with fragment cues may provide an excellent opportunity for gathering information that will shed light on the relationship between memory and perception. It is of interest to determine how the performance of normal subjects differs when they see the task as being one of word completion rather than as a test of cued recall. For normal subjects, meaningful elaboration during study is likely to have no effect if subjects are simply asked to engage in the more perceptual task of completing word fragments without being required to make a recognition memory judgment for the completed word; effects of meaningul elaboration may be present only when the task is to be treated as a test of cued recall. Korsakoff patients, in contrast, may be incapable of more elaborative forms of processing and, consequently, treat even the cued recall test as if it were a perceptual task that required only word completion.

Interference may play an important role in producing the amnesic syndrome. However, it seems necessary to inquire into the reasons underlying the greater

interference effects observed for Korsakoff patients as compared to normal sub-
jects. An attempt to describe the basis of these interference effects is likely to
bring one back to a discussion of differences in encoding and retrieval processes.
Further, the form of interference effects is likely to depend on the type of test
given. For a test of perceptual identification, factors such as the number of words
that share the majority of their letters with the target word, the frequency in the
language of the target word, and perceptual similarity of the study and test
versions of the target word are likely to be important. For recognition memory,
meaningful elaboration during study and at the time of test is important.

Cognitive Versus S-R Learning.   Wickelgren (1979) argues that the amnesic
syndrome is marked by an inability to form vertical associations of the type
required for "chunking." Chunking is described as the basis of more cognitive
forms of learning as opposed to stimulus–response learning. Although the Kor-
sakoff patient is said to be incapable of forming new cognitive memories, he or
she is seen as being capable of strengthening already existing associations.

The theoretical notions that I have presented are largely in agreement with
those advanced by Wickelgren. Perceptual identification may depend on the
stimulus–response form of learning whereas tasks that are attention demanding
and require more flexible processing can be described as involving cognitive
learning. Presentation of a word may increase the dominance of that word as a
response for later perceptual identification without resulting in the form of cogni-
tive learning that benefits recognition memory. As is Wickelgren, I am interested
in separating the two forms of learning. However, I want to emphasize dif-
ferences in attention and differences in processing. I have focused on the dissoci-
ation of effects in performance and recognition memory and want to explore the
means by which a person decides that he or she recognizes an event as having
been presented earlier.

Episodic and Semantic Memory.   Kinsbourne and Wood (1975) have used
Tulving's (1972) distinction between episodic and semantic memory to describe
the amnesic syndrome. They argue that the semantic memory of the Korsakoff
patient is intact but that there is a deficit in episodic memory. To illustrate the
two forms of memory, Kinsbourne and Wood describe a Korsakoff patient's
answers to questions about flags. The patient revealed evidence of semantic
memory by being able to give general information about flags such as the fact
that they are often seen in parades but was unable to give evidence of episodic
memory by reporting a particular episode in which he had seen a flag.

Although the semantic versus episodic distinction may be a useful one,
clarification is needed on a number of points before the utility of the distinction
for describing the behavior of Korsakoff patients can be assessed. First, what
does it mean to say that there is a deficit in episodic memory? Recall of a
personal experience is often given as an example of episodic memory. However,

suppose one is asked to describe some experience such as his or her wedding, a task that a Korsakoff is likely to be capable of completing. If the person has described his or her wedding a number of times, it is not clear whether he or she is remembering the event or remembering his or her prior descriptions of the event. With repeated telling, an account of an experience is often elaborated and seems to become les episodic in nature. To acknowledge this effect of repetition, it can be argued that telling a well-practiced story about a personal experience involves semantic memory. However, the earlier discussion of automaticity then becomes relevant to the distinction between semantic and episodic memory. Semantic memory is identified with the well-learned whereas episodic memory is identified with the novel. To claim that a patient has suffered a deficit in episodic memory is then much like saying the patient is unlikely to engage in less automatic, conscious forms of processing. If this is the claim that is to be made, it seems preferable to emphasize differences in processing and the role of attention rather than the distinction between episodic and semantic memory.

A second problem concerns the issue of awareness. The dissociation between effects in performance and awareness of the basis of those effects seems important for understanding the Korsakoff syndrome. However, the relevance of awareness to the semantic–episodic memory distinction is not clear. When a Korsakoff patient correctly recalls words from a previously studied list but claims to be only guessing, is he or she showing evidence of episodic memory? From the examples that are commonly given, episodic memory involves not only an influence of a prior episode on later performance but also the subject's awareness that he or she is remembering the prior episode. However, it is not clear how central this awareness is intended to be in the distinction between episodic and semantic memory. Other problems in applying the semantic–episodic memory distinction are discussed by Craik and Jacoby (1979).

CONCLUDING COMMENTS

For those of us who are primarily interested in the memory of normal subjects (that is, college sophomores), the Korsakoff literature is useful in that it points toward effects and dissociations that we might expect to find also with normals. In this regard, the distinction between effects in performance and awareness of the factors producing those effects may prove useful for understanding both the behavior of the Korsakoff patient and that of normal subjects. Due to a deficit in attention, the Korsakoff patient may be less able to engage in some forms of processing but still show effects in performance. For the normal subject, the realization that there can be effects in performance without the subject being aware of the cause of those effects has several implications that were sketched earlier. Among these, different means of testing expertise are suggested dependent whether one is interested in effects in performance or in measuring more

aware forms of memory. Perhaps the most interesting questions are concerned with the relationship between awareness and eventual effects in performance. Here the question is similar to that raised by people investigating the role of metamemory (Brown, 1975). How does one become aware of the operation of his or her own memory and how does that awareness influence subsequent performance? In any case, the experiments described earlier relate memory to attention by showing that conditions that encourage automaticity produce poorer retention. Other experiments that were reported demonstrate that effects in perceptual identification performance can be separated from recognition memory in normal subjects.

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