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Illusory Memories in Amnesic Patients: Conceptual and Perceptual False Recognition

Daniel L. Schacter
Harvard University and Boston Veterans Affairs Medical Center

Mieke Verfaellie
Boston University School of Medicine and Boston Veterans Affairs Medical Center

Michael D. Anes
Boston Veterans Affairs Medical Center

Little is known about the neuropsychology of false recognition. D. L. Schacter, M. Verfaellie, and D. Pradere (1996) induced false recognition in amnesic patients and normal controls by exposing them to numerous semantic associates of a nonstudied word and found that amnesics showed significantly reduced levels of false recognition. To determine whether this outcome is specific to the semantic domain, the authors examined false recognition after exposure to lists of conceptually and perceptually related words. In the control group, conceptual false recognition was associated with "remember" responses and perceptual false recognition was associated with "know" responses. Amnesic patients showed reduced levels of conceptual and perceptual false recognition that were approximately equally divided between remember and know responses.

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False recognition occurs when people claim incorrectly that they previously encountered a particular word, object, or person. The experimental study of false recognition, first reported by Underwood (1965), has assumed renewed prominence in recent memory research (cf. Brainerd, Reyna, & Kneer, 1995; Jacoby & Whitehouse, 1989; Kroll, Knight, Metcalfe, Wolf, & Tulving, 1996; Norman & Schacter, in press; Payne, Elie, Blackwell, & Neuschatz, 1996; Reinitz, Verfaellie, & Milberg, 1996; Roediger & McDermott, 1995; Schacter, Curran, Gallucio, Milberg, & Bates, 1996; Schacter, Reiman, et al., 1996; Wallace, Stewart, Sherman, & Mellor, 1995). This revival is related to a more general increase in research concerning memory distortions and illusions (for reviews, see Johnson, Hashtroudi, & Lindsay, 1993; Roediger, 1996; Schacter, 1995, 1996) and to the relevance of false recognition for various theoretical accounts of memory (Hintzman, 1988; Reyna & Brainerd, 1995; Shiffrin, Huber, and Marinelli, 1995; Wallace et al., 1995).

Although the magnitude of false-recognition effects in laboratory studies is often rather modest, Roediger and McDermott (1995) recently described a procedure for inducing robust false recognition. They modified a paradigm introduced by Deese (1959). After exposing people to strong associates of a nonpresented target word, Deese found that they often intruded the nonpresented target on a free-recall test. Thus, for example, after studying *candy, sour, sugar, bitter* and other related words, people frequently "recalled" the nonpresented associate *sweet.* Roediger and McDermott replicated the false-recall effect initially reported by Deese and extended it to recognition memory. After studying associates of nonpresented target words such as *sweet,* participants frequently claimed with high confidence that *sweet* had appeared previously on the study list. Moreover, when asked to make remember–know judgments (Gardiner & Java, 1993; Tulving, 1985) indicating whether they maintained a specific recollection of having studied a word during list presentation ("remember") or thought that a word was on the list because it seemed familiar ("know"), people claimed to remember nonpresented associates nearly as often as they claimed to remember words that had actually appeared on the list (see also Norman & Schacter, in press; Payne et al., 1996). The data reported by Roediger and McDermott are striking both because of the frequency of the false-recognition effect and because of the high confidence and remembered vividness of participants' illusory memories.

We recently attempted to gain insight into the brain mechanisms associated with illusory recognition of nonpresented associates by examining performance on the Roediger and McDermott (1995) paradigm in a group of amnesic patients (Schacter, Verfaellie, & Pradere, 1996). We found that amnesic patients, as expected, showed reduced levels of veridical recognition memory when compared with a matched control group: Amnesics attained fewer hits than did controls to previously presented words and made more false alarms than did controls to nonpresented words that bore no

Daniel L. Schacter, Department of Psychology, Harvard University, and Memory Disorders Research Center, Boston Veterans Affairs Medical Center; Mieke Verfaellie, Boston University School of Medicine, and Memory Disorders Research Center, Boston Veterans Affairs Medical Center; Michael D. Anes, Memory Disorders Research Center, Boston Veterans Affairs Medical Center.

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Correspondence concerning this article should be addressed to Daniel L. Schacter, Department of Psychology, Harvard University, 33 Kirkland Street, Cambridge, Massachusetts 02138.

associative relationship to previously presented words. More important, amnesic patients made fewer false alarms than did controls to nonpresented associates such as *sweet.*

This latter finding suggests that false recognition of nonpresented associates depends on retention of associative or semantic information that also supports veridical recognition of presented words—information that is not available to amnesic patients. More specifically, we suggested that controls bind together studied items and generated associates, thereby forming and retaining a well-organized, focused representation of the semantic gist of the study list (cf. Johnson & Chalfonte, 1994; Norman & Schacter, 1996; Reyna & Brainerd, 1995). Related test distractors that match this semantic gist representation, such as *sweet,* are likely to be falsely recognized; unrelated distractors that do not match it are likely to be correctly rejected. We suggested further that amnesic patients do not form or retain a focused semantic representation of gist. On the one hand, this idea accounts for the finding that amnesic patients showed reduced false recognition of related distractors: There is little opportunity for a related test item to match a semantic gist representation. On the other hand, this suggestion can also account for amnesics' inflated false recognition of unrelated distractors: Whereas control participants can use their semantic gist representation to reject unrelated distractors that do not match it, amnesic patients are less able to do so. Encoding and retrieval of semantic gist information presumably depend on medial temporal lobe structures that are damaged in amnesia (cf. Schacter, Reiman, et al., 1996).

Our finding of reduced false recognition in amnesia and account of it in terms of a degraded semantic gist representation are related to contemporary discussions of preserved and impaired memory processes in amnesia. Blaxton (1989, 1995) has suggested that impaired conceptual or semantic processing accounts for memory deficits in amnesic patients, whereas perceptual processing is relatively preserved in amnesia. This idea is based on the pervasive finding of intact perceptual priming in amnesic patients (e.g., Gabrieli, 1995; Hamman, Squire, & Schacter, 1995; Schacter & Church, 1995). Although some recent evidence concerning perceptual explicit memory is inconsistent with this idea (Cermak, Verfaellie, & Chase, 1995; Vaidya, Gabrieli, Keane, & Monti, 1995), Blaxton's proposal raises the possibility that Schacter, Verfaellie, and Pradere's (1996) finding of reduced false recognition in amnesic patients is specific to the domain of semantic gist. If memory for perceptual information in amnesic patients is better preserved than memory for conceptual information, then amnesic patients might show similar levels of false recognition when distractor words are perceptually, rather than semantically, related to previously studied items.

This possibility is also related to dual-process accounts of recognition memory, which hold that one component of recognition involves a controlled process of recollection and another involves an automatic process of fluency or familiarity (e.g., Jacoby, 1991; Jacoby & Dallas, 1981; Mandler, 1980). It has been proposed that (a) false recognition is based on automatic, fluent processing of a stimulus that is misattributed to the study episode (e.g., Jacoby, 1991) and (b) fluency or familiarity is based on the same or similar processes that mediate spared priming and other forms of implicit memory in amnesic patients (e.g., Cermak, Verfaellie, Sweeney, & Jacoby, 1992; Mandler, 1980). According to this perspective, amnesic patients should show at least as much false recognition as matched controls. The results of Schacter, Verfaellie, and Pradere (1996), however, provide evidence against this idea and suggest that false recognition depends on explicit memory processes that are impaired in amnesic patients.

However, Wagner, Gabrieli, and Verfaellie (1997) have recently shown that there are different forms of familiarity. They found a dissociation between a conceptually mediated familiarity component that operates in recognition and a perceptually mediated familiarity component that operates in perceptual repetition priming. In Wagner et al.'s study, familiarity in a word recognition task, as indexed by both inclusion–exclusion (Jacoby, 1991) and remember–know (Gardiner & Java, 1993; Tulving, 1985) procedures, was greater for items studied as pictures than for items studied as words. In contrast, familiarity in perceptual implicit memory, as indexed by priming in perceptual identification and word stem completion, was greater for items studied as words than for items studied as pictures. Wagner et al.'s data raise the possibility that a conceptually sensitive familiarity component of recognition memory may be impaired in amnesic patients, whereas a distinct perceptual familiarity process that operates in perceptual priming tasks is preserved. It remains unknown whether perceptual familiarity might also support amnesics' recognition memory when a task manipulates perceptual variables.

With respect to false recognition, the data and perspective of Wagner et al. suggest that Schacter, Verfaellie, and Pradere's (1996) finding of reduced false recognition in amnesia may be specifically linked to the semantic–conceptual nature of the relation between associated distractors and studied items: These items may have tapped a semantic component of recognition memory that is impaired in amnesic patients. Perhaps amnesic patients would show normal levels of false recognition for perceptually related distractors, which would presumably depend on perceptual familiarity processes that are spared in amnesic patients.

In view of the foregoing considerations, it is crucial to compare false recognition of conceptually and perceptually related items in amnesic patients. On the one hand, memory for both conceptual and perceptual gist may be mediated by explicit memory processes that are impaired in amnesic patients. If so, then amnesic patients should show reduced false recognition of nonpresented words that are related either semantically or perceptually to previously presented words. On the other hand, if perceptual—but not conceptual—memory depends on familiarity–fluency processes that are spared in amnesic patients, then amnesics should show relatively normal levels of false recognition for perceptually related distractors together with reduced levels of false recognition for semantically related distractors. We report two experiments that examine these issues.

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Experiment 1

To compare conceptual and perceptual false recognition, we used materials described by Shiffrin et al. (1995). In their experiment, participants studied word lists consisting of conceptually related items (e.g., *twister, funnel*) or perceptually related items (e.g., *hate, mate*). A subsequent old–new recognition test consisted of previously studied words, unrelated lure items, and lure items related to studied items either conceptually (e.g., semantic prototypes such as *tornado*) or perceptually (e.g., orthographically and phonemically related words such as *fate*). Shiffrin et al. found that participants in their experiment made more false alarms to conceptually or perceptually related lure words than to unrelated lure words.

We refer to the difference between false-alarm rates to conceptually related and unrelated lures as memory for *conceptual gist* and refer to the difference between false-alarm rates to perceptually related and unrelated lures as memory for *perceptual gist*. Based on Schacter, Verfaellie, and Pradere's (1996) finding of reduced false recognition to semantic associates in amnesia, we expected that amnesic patients would exhibit lower levels of memory for conceptual gist than would controls. The critical question was whether amnesic patients would also exhibit reduced levels of memory for perceptual gist.

Method

Participants. Sixteen amnesic patients (12 men, 4 women) and 16 individuals with intact memory functioning (controls; 12 men, 4 women) participated in the experiment. The amnesic patients had all been screened at the Memory Disorders Research Center of the Boston Veterans Affairs Medical Center (VAMC). Eight patients had a diagnosis of alcoholic Korsakoff syndrome and 8 patients had a variety of nonalcoholic etiologies (anoxia, encephalitis, thalamic infarct). Because the alcoholic and nonalcoholic amnesics performed similarly on the experimental task, they were treated as a single amnesic group. The amnesic group had a mean age of 58.4 years and a mean of 12.9 years of education. The amnesic patients' mean verbal IQ score as measured by the Wechsler Adult Intelligence Scale—Revised (WAIS–R) was 99. Their attentional capabilities were also intact, as indicated by a mean score of 99 on the Attentional Index of the Wechsler Memory Scale—Revised (WMS–R). These patients had severe memory deficits as seen in a variety of explicit memory tasks, with a mean General Memory Index of 78 and a mean Delayed Memory Index of 59 on the WMS–R.

The control group consisted of 16 participants, half of whom had a history of alcoholism. The control participants had a mean age of 55.4 years and a mean of 13.1 years of education. The control participants' mean verbal IQ score was 106.

Materials, design, and procedure. Materials were based on the word sets published by Shiffrin et al. (1995). We selected eight sets of conceptually related words and eight sets of perceptually related words, using for each set 9 of the 11 words in the Shiffrin et al. pool. In addition, for each set we selected the conceptually or perceptually related lure used by Shiffrin et al. For the conceptually related sets, we attempted to use common nouns as target words (e.g., for the related lure *tornado,* the list words were *funnel, twister, spiral, cyclone, spinning, whirling, typhoon, gusts,* and *windstorm*). For the perceptually related sets, four of the nine words contained the same initial consonant as the related lure and five did not (e.g., for the related lure *fate,* the list words were *fade, fame, face, fake, mate, hate, late, date,* and *rate*). Because Shiffrin et al. selected their two sets of items to be maximally different, the conceptually related words were longer than the perceptually related words: Mean word length = 7.69 and 3.50, respectively; $t(142) = 18.21, p < .001$.

For both conceptually and perceptually related word sets, we constructed two presentation lists; each list was composed of 36 target words (four sets of 9 words each), preceded and followed by three unrelated recency and primacy buffer items, yielding a total of 42 words per list. Within each set of 36 related words, order of presentation was random. List presentation was blocked such that participants first studied two lists of perceptually related words or two lists of conceptually related words, followed by a recognition test for those words; next they studied the two remaining lists of either conceptually related words or perceptually related words, followed by a recognition test for those words. Thus, the order of study and test was Perceptual List I, Perceptual List II, Recognition Test; Conceptual List I, Conceptual List II, Recognition Test. The experiment was counterbalanced such that perceptually related lists were studied and tested first (as above) or conceptually related lists were studied and tested first equally often.

During study list presentation, words appeared for 3 s each on a computer screen. Participants were instructed to read aloud each word and were told to remember them. After studying each list, participants completed simple arithmetic problems for 1 min. Two recognition test lists were constructed, one for the conceptually related lists and one for the perceptually related lists; each test list consisted of 48 words. Twenty-four words were old (we will refer to them as *true targets*): three words were selected from each of the eight sets of studied words (items 1, 5, and 7 from each of the sets). Twenty-four words were new, including 8 that were related either conceptually or perceptually to one of the previously studied sets (we will refer to related lures as *false targets*). We also chose additional lure words from the remaining Shiffrin et al. (1995) sets that were not used for the study phase of the experiment. Specifically, we included as lure items 4 words from each of four conceptually related word sets. Three of the 4 words in each of these four sets had been used as study items by Shiffrin et al., and they served as control words for our old items (we will refer to them as *true-target controls*); the remaining items in each set had been used as false targets by Shiffrin et al. and served as unrelated lures for our false targets (we will refer to them as *false-target controls*). Thus, the designations of true-target controls and false-target control simply refer to the fact that the true-target controls had been studied in the Shiffrin et al. experiment (i.e., they were true targets), whereas the false-target controls had been nonstudied, related lures in Shiffrin et al.'s experiments (i.e., they were false targets). We followed a similar procedure for the perceptually related lists, using four sets of 4 words that were unrelated to any of the sets studied by the participants yet were perceptually related to one another. However, we constructed the 4 perceptually related word sets ourselves (using Shiffrin et al.'s criteria) because there were not sufficient numbers of lists left over from the Shiffrin et al. materials to use as lure words.

Each of the 48-word recognition tests for the conceptually and perceptually related word lists was constructed so that approximately the same proportion of true targets, false targets, true-target controls, and false-target controls occurred in each third of the list. During the recognition test, participants were presented with 1 word at a time, using a sliding mask placed over a paper sheet containing the test items. Participants were instructed to indicate whether each word was old or new and were asked to make remember–know judgments (Gardiner & Java, 1993; Tulving, 1985) for old words. Using instructions similar to those described by Rajaram (1993), participants were instructed to use the remember response when they recollected something specific about having seen the word previously in a study list and to use the know response when they failed to recollect anything specific about having studied the word, but still knew that the word appeared on the list because it seemed familiar.

Results

Table 1 presents the proportion of old responses to true targets, conceptually and perceptually related false targets, and unrelated true-target controls and false-target controls; it also displays the proportion of remember and know responses to each of the various word types. First we describe the overall recognition results and then consider the remember–know data.

Old–new recognition. As indicated in Table 1, amnesic patients attained fewer hits to true targets and made more false alarms to true-target controls than did participants in the control group for both the conceptual and perceptual lists. Analysis of variance (ANOVA) on the hit rates revealed a significant main effect of group, $F(1, 30) = 13.09$, $MSE = .103$, $p < .002$; a nonsignificant effect of item type, $F < 1$; and a nonsignificant Group × Item Type interaction, $F < 1$. Analysis of responses to the true-target controls revealed that the effect of group approached significance, $F(1, 30) = 3.46$, $MSE = .050$, $p = .073$. The effect of item type was not significant, $F(1, 30) = 2.27$, $MSE = .007$, nor was the Group × Item Type interaction, $F < 1$. Applying the standard high-threshold correction procedure, we subtracted the false-alarm rates for true-target controls from their corresponding hit rates. The analysis revealed a highly significant main effect of group, $F(1, 30) = 63.01$, $MSE = .040$, $p < .0001$, with no other effects approaching significance, $F < 1$.

The critical results concern the proportions of false alarms to conceptually and perceptually related false targets and to the unrelated false-target controls. Amnesic patients and controls made roughly similar numbers of false alarms to both conceptually and perceptually related false targets, and both groups made more false alarms to conceptually related than to perceptually related false targets. An ANOVA revealed a significant main effect of item type, $F(1, 30) = 10.55$, $MSE = .027$, $p < .003$, together with nonsignificant effects of group and Group × Item Type, both Fs < 1. However, the amnesic group made more false alarms than did the control group to false-target controls, particularly for the conceptual lists, as shown by a significant main effect of group, $F(1, 30) = 5.61$, $MSE = .092$, $p < .03$, and a significant Group × Item Type interaction, $F(1, 30) = 5.78$, $MSE = .029$, $p < .03$. The interaction reflects the fact that participants in the control group made more false alarms to false-target controls for the perceptual lists than the conceptual lists, whereas amnesic patients showed the opposite effect.

To obtain estimates of memory for conceptual and perceptual gist, we subtracted the proportion of old responses to false-target controls from the proportion of old responses to false targets. An ANOVA revealed a significant main effect of group, $F(1, 30) = 24.49$, $MSE = .043$, $p < .0001$, indicating that amnesic patients showed less gist memory than did participants in the control group. There was also a near-significant main effect of item type, $F(1, 30) = 3.45$, $MSE = .055$, $p = .073$, indicating that the conceptual gist effect was somewhat greater than the perceptual gist effect. In addition, there was a significant Group × Item Type interaction, $F(1, 30) = 5.70$, $MSE = .055$, $p < .03$, indicating that the observed differences in gist memory between amnesic patients and controls were greater for semantic gist (.42 vs. .02 for controls and amnesics, respectively) than for perceptual gist (.18 vs. .06 for controls and amnesics, respectively). Further analyses revealed that the group difference for semantic gist was highly significant, $F(1, 59) = 25.69$, $MSE = .049$. Despite a strong numerical trend for less perceptual gist in amnesic patients than in controls, the group difference for perceptual gist did not attain significance, $F(1, 59) = 2.22$, $MSE = .049$, $p = .14$.

The foregoing results indicate that amnesic patients showed little evidence of memory for conceptual or perceptual gist. For amnesic patients, the proportion of old responses to false targets (conceptual or perceptual) was not significantly higher than the proportion of old responses to the corresponding false-target controls (both ts < 1). By

Table 1
Recognition Memory Data for True Targets, False Targets, True-Target Controls, and False-Target Controls for Amnesic Patients (A) and Nonamnesic Controls (C) in Experiment 1

	Proportion of old responses											
	Conceptual lists						Perceptual lists					
	Overall		Remember		Know		Overall		Remember		Know	
Item type	A	C	A	C	A	C	A	C	A	C	A	C
True targets	.44	.73	.15	.45	.29	.28	.44	.73	.17	.40	.27	.33
True-target controls	.23	.11	.06	.03	.17	.08	.25	.16	.09	.03	.16	.13
True − control (corrected recognition)	.21	.62	.09	.42	.12	.20	.19	.57	.08	.37	.11	.20
False targets	.43	.55	.14	.32	.29	.23	.34	.38	.10	.12	.24	.26
False-target controls	.41	.13	.09	.03	.32	.10	.28	.20	.06	.03	.22	.17
False − control (gist memory)	.02	.42	.05	.29	−.03	.13	.06	.18	.04	.09	.02	.09

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contrast, for participants in the control group, both differences were significant, $t(15) = 6.88$ and $t(15) = 3.22$ for conceptually and perceptually related lures, respectively. These results are in part attributable to the fact that amnesics made a high proportion of old responses to false-target controls, particularly in the conceptual condition (.41 false-alarm rate). Although these false-target control words were unrelated to words presented previously in the study list, they were drawn from the same conceptual or perceptual category as the three true-target control words and hence were related to these control words. It is possible that false-alarm rates to the false-target controls were inflated by the within-test relations among these words, because false-target controls always appeared after at least one other target control word had been presented on the recognition test.

To examine this possibility, we analyzed false-alarm rates as a function of the position of target control words on the recognition test in relation to the other control words (first, second, third, or fourth). For the conceptual lists, amnesic patients made significantly fewer false alarms to the target control in the first position than to the target controls in the final three positions, $F(1, 15) = 7.40$, $MSE = .020$, $p < .02$; participants in the control group showed a similar effect, $F(1, 15) = 14.27$, $MSE = .007$, $p < .003$. Neither amnesics nor controls showed a corresponding position effect in responses to target controls for the perceptually related lists, although there was a trend in this direction for the controls ($F < 1$ and $F = 2.39$ for amnesics and controls, respectively). Thus, we may have underestimated the level of conceptual gist for both amnesics and controls because of conceptual relations among target control words on the recognition test. It should be noted, however, that the observed position effect on test-induced false alarms may reflect the operation of a kind of conceptual gist that merits further exploration.

Remember–know responses. Amnesic patients provided fewer remember responses to true targets than did participants in the control group for both the conceptual and perceptual lists. In contrast, they provided a roughly equal proportion of remember responses to true-target controls compared to the control group. Analysis of remember responses to true targets revealed a significant effect of group, $F(1, 30) = 17.11$, $MSE = .065$, $p < .01$, and nonsignificant effects of item type and Group × Item Type (both Fs < 1). Analysis of remember responses to true-target controls revealed nonsignificant effects of group, $F(1, 30) = 1.86$, $MSE = .017$; item type, $F < 1$; and Group × Item Type, $F(1, 30) = 1.03$, $MSE = .005$.

We also computed corrected remember scores by subtracting remember responses to target control words from remember responses to targets. This analysis revealed a significant effect of group, $F(1, 30) = 30.23$, $MSE = .050$, $p < .01$; a nonsignificant effect of item type; and a nonsignificant Group × Item Type interaction (both Fs < 1).

Know responses to true targets were numerically similar for amnesic patients and participants in the control group, but amnesic patients provided somewhat more know responses to true-target controls than did the nonamnesics (all Fs < 1.81). Although the corrected know scores were numerically lower for the amnesics than for the control participants (mean of .11 vs. .20 across list types), this effect only approached significance, $F(1, 30) = 3.04$, $MSE = .038$, $p = .091$.

The remember and know responses to false targets and their control words revealed a somewhat different pattern than that obtained for true targets and their controls. Amnesic patients provided fewer remember responses than did participants in the control group when false targets were conceptually related but not when they were perceptually related. An ANOVA on these data revealed a significant effect of group, $F(1, 30) = 5.28$, $MSE = .029$, $p < .05$, and item type, $F(1, 30) = 20.86$, $MSE = .011$, $p < .01$, as well as a significant Group × Item Type interaction, $F(1, 30) = 9.57$, $MSE = .011$, $p < .01$. Analysis of false-target controls revealed no significant effects.

To evaluate how often conceptual and perceptual gist memory were accompanied by remember responses, we calculated corrected remember scores by subtracting remember responses to false-target controls from remember responses to false targets. An analysis of these data revealed significant effects of group, $F(1, 30) = 12.91$, $MSE = .026$, $p < .01$, indicating that amnesics made fewer remember gist memory responses, and item type, $F(1, 30) = 8.47$, $MSE = .021$, $p < .01$, indicating more remember responses for conceptual gist than for perceptual gist. There was also a Group × Item Type interaction, $F(1, 30) = 7.26$, $MSE = .021$, $p < .05$. Follow-up analyses confirmed that the groups differed in their use of remember responses for conceptual lists, $F(1, 59) = 20.01$, $MSE = .023$, $p < .01$, but not for perceptual lists, $F < 1$.

In contrast to the foregoing, know responses to false targets were roughly equivalent for the two groups of participants and the two types of lists ($F < 1$), but amnesics provided many more know responses to false-target controls than did control participants, a finding that was most marked for the conceptual lists. Confirming these impressions, an ANOVA on the know responses to false-target controls revealed a near-significant effect of group, $F(1, 30) = 3.44$, $MSE = .082$, $p = .073$, and Group × Item Type interaction, $F(1, 30) = 3.89$, $MSE = .030$, $p = .058$, whereas the effect of item type was nonsignificant, $F < 1$.

To obtain estimates of the contribution of know responses to conceptual and perceptual gist, we also calculated corrected know responses. An analysis of these data revealed a significant effect of group, $F(1, 30) = 4.81$, $MSE = .043$, $p < .05$, and nonsignificant effects of item type and Group × Item Type interaction (both Fs < 1).

Discussion

The results of Experiment 1 replicate and extend those of Schacter, Verfaellie, and Pradere (1996) by showing that amnesic patients exhibited reduced false recognition of conceptually related false targets, despite making more false alarms to unrelated lures than did participants in the control group. The results concerning false recognition of perceptually related false targets were less clear-cut. On the one hand, we found evidence of reduced false recognition for

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perceptually related words in amnesia: Amnesic patients showed numerically less memory for perceptual gist than did controls (.18 vs. .06). Moreover, amnesics did not exhibit statistically significant levels of perceptual gist memory, whereas participants in the control group did. On the other hand, some of our results suggest that memory for perceptual gist may be less impaired by amnesia than is memory for conceptual gist: Analysis of gist scores revealed a significant interaction between group and item type. In addition, the numerical difference between amnesics and controls in perceptual gist did not attain significance.

These possible differences between conceptual and perceptual false recognition are particularly intriguing because the pattern of remember and know responses in the controls suggest possible qualitative differences between the two forms of false recognition: There were significantly more remember responses for conceptual than perceptual gist, together with similar proportions of know responses for the two types of gist memory. For conceptual gist there were more remember than know responses (.29 vs. 13), whereas for perceptual gist there were identical proportions of remember and know responses (.09). Thus, conceptual false recognition may be based primarily on recollective processes that are impaired in amnesia, whereas perceptual false recognition may be relatively more influenced by familiarity processes that are partly preserved in amnesia. Although the low levels of perceptual gist in amnesic patients prevent strong claims about preservation of perceptual processing, these observations are nonetheless partly consistent with the arguments of Blaxton (1989, 1995) and Wagner et al. (1997) that there may be a form of data-driven processing or perceptual familiarity that is relatively preserved in amnesia.

The idea that amnesic patients show more preserved levels of perceptual than conceptual false recognition, and the observation of apparent qualitative differences between conceptual and perceptual false recognition in remember and know responses, are both confounded by the overall differences in the amount of conceptual and perceptual false recognition that we observed in the control group. Although amnesic patients' gist memory scores were near floor for both conceptually and perceptually related word lists, participants in the control group exhibited significantly higher gist memory scores for the conceptually related lists (.42) than for the perceptually related lists (.17), $F(1, 30) = 9.01$, $MSE = .055$, $p = .005$. This observation raises the possibility that the apparent differences between amnesics and controls in relative susceptibility to conceptual and perceptual false recognition may simply reflect the fact that in conditions that yield high levels of false recognition (i.e., the conceptual condition), participants in the control group retain more of the available gist information that drives false recognition; in conditions that yield low levels of false recognition, less gist information may be available and differences between amnesics and controls are thus reduced. Moreover, the fact that conceptual and perceptual gist scores in amnesic patients did not significantly exceed zero makes it difficult to interpret apparent group differences in relative susceptibility to conceptual and perceptual false recognition.

Similar issues arise with respect to the remember and know responses. Rather than reflecting qualitative differences between conceptual and perceptual false recognition, the relatively greater proportion of remember responses observed for conceptual false recognition may simply reflect quantitative differences: There was more gist memory (in the control group) for conceptual than perceptual false recognition (cf. Donaldson, 1996). It is possible that the observed differences between perceptual and conceptual gist with respect to remember and know responses would disappear if the overall levels of conceptual and perceptual gist were similar, or that perceptual gist would be associated with more remember responses than conceptual gist under conditions in which the overall level of perceptual gist exceeds that of conceptual gist.

To investigate these issues, we conducted an additional experiment in which we altered several features of Experiment 1.

Experiment 2

In Experiment 1, half of the participants studied two lists of conceptually related words followed by a recognition test for both lists and then studied two lists of perceptually related words followed by a recognition test for these lists; for the other half of the participants, the perceptual lists came first. Presenting and testing the two types of lists in separate blocks could encourage participants to adopt different strategies for the conceptual and perceptual lists. For instance, controls made more false alarms to perceptually related false targets when the perceptual lists were presented and tested first (.44) than when they were presented and tested second (.31); a smaller but similar trend was observed for conceptual lists (.58 and .52 when tested first and second, respectively). Although these trends were not statistically significant, we attempted to reduce the possibility that participants would use different strategies for perceptual and conceptual lists in Experiment 2 by having them study one conceptual list and one perceptual list before being given a recognition test for both lists.

We also made changes in Experiment 2 to the true- and false-target controls. As noted earlier, the fact that these words were related to one another probably was responsible for recognition test-induced false alarms to false-target controls for conceptually related lists. This may have contributed to the complete absence of conceptual gist effects in amnesic patients—a result that contrasts with our previous finding that amnesic patients showed significant, albeit reduced, levels of conceptual false recognition (Schacter, Verfaellie, & Pradere, 1996). Accordingly, in Experiment 2 all of the true- and false-target controls were unrelated to one another as well as being unrelated to words from the study list.

Method

Participants. Sixteen amnesic patients (12 men, 4 women) and 16 individuals with intact memory functioning (controls; 12 men, 4 women) participated in the experiment. The amnesic patients had all been screened at the Memory Disorders Research Center of the Boston VAMC. Eight patients had a diagnosis of alcoholic Korsakoff syndrome and 8 patients had a variety of nonalcoholic etiologies (anoxia, encephalitis, thalamic infarct); 6 of the Korsakoff patients and 7 of the non-Korsakoff patients had participated in Experiment 1. Because the alcoholic and nonalcoholic amnesics performed similarly on the experimental task, they were treated as a single amnesic group. The amnesic group had a mean age of 58.1 years and a mean of 13.9 years of education. The amnesic patients' mean verbal IQ score as measured by the WAIS–R was 100. Their attentional capabilities were also intact, as indicated by a mean score of 99 on the Attentional Index of the WMS–R. These patients had severe memory deficits as seen in a variety of explicit memory tasks, and on the WMS–R they obtained a mean General Memory Index of 78 and a mean Delayed Memory Index of 59 on the WMS–R. The control group consisted of 16 participants, half of whom had a history of alcoholism. The control participants had a mean age of 56.6 years and a mean of 13.4 years of education. The control participants' mean verbal IQ score was 106.

Materials, design, and procedure. We constructed a new set of experimental materials, consisting of eight perceptual word sets and eight conceptual word sets. Each set contained nine words. One word was designated a false target (and thus was not presented during the study phase of the experiment), and the remaining eight words were used as study items. For the perceptual sets, all of the items rhymed with the false target, differing only in the initial consonant or consonant cluster; word length ranged from 5 to 8 characters ($M = 5.69$). For the conceptual sets, all of the items were semantically associated to the false target. Word length ranged from 4 to 10 letters ($M = 5.63$), which did not differ from the length of the words in the perceptual sets ($t < 1$). Words for the conceptual sets were taken from a variety of sources, including Deese (1959), Roediger and McDermott (1995), Shiffrin et al. (1995), as well as experimenter-generated stimuli.

Words for the perceptual sets were experimenter generated, using a rhyming dictionary. Four of the eight perceptual word sets were combined to form one perceptual study list and the other four word sets were combined to form a second perceptual study list. Four of the eight conceptual word sets were combined to form one conceptual study list and the other four sets were combined to form a second conceptual study list. Stimuli in each of these lists were arranged in a pseudorandom order, so that no words from a particular perceptually related or conceptually related set either adjoined each other or were more than seven words apart. Finally, different sets of three study filler words were added to the beginning and end of each of the four study lists (two perceptual, two conceptual) to control for primacy and recency effects.

Participants studied one conceptual list and one perceptual list, using the same presentation time and instructions as in Experiment 1. Presentation of each list was again followed by 1 min of simple arithmetic problems, after which participants were given a recognition test for both lists. The same procedure was then repeated for an additional conceptual list and perceptual list. An equal number of participants received a perceptual or conceptual list as the first list of each study session.

Two recognition lists were constructed. Each was composed of 24 old words (true targets). Twelve of these old words were taken from the four studied conceptual sets and the other 12 were taken from the four studied perceptual sets (items 1, 3, and 8 of each set). Each recognition list also contained 24 new words. These included 8 false targets, 4 conceptually related to studied true targets and 4 perceptually related to studied true targets. There were 8 new words that served as controls for true and false targets. These items were taken from additional, unstudied conceptual and perceptual item sets. Only one item from each set occurred in a recognition list to ensure that target controls were unrelated to each other. Finally, 8 unrelated, unstudied, filler items were added to each recognition list, for a total of 48 items.

For each recognition list, two versions were constructed that differed only with regard to the true- and false-target controls. This was done to ensure that if an item from an unstudied conceptual or perceptual set functioned as a true-target control in one version of the test, a different item from the same set functioned as a false-target control in the other version of the test. The experiment was counterbalanced so that an equal number of participants received each version of each recognition list.

The recognition test lists were constructed so that each third of a list contained approximately the same proportion of true targets, false targets, true-target controls, and false-target controls. Instructions to participants during the recognition test were the same as in Experiment 1.

Results

Table 2 displays the proportion of old responses to true targets, conceptually and perceptually related false targets, and unrelated true-target controls and false-target controls.

Table 2
Recognition Memory Data for True Targets, False Targets, True-Target Controls, and False-Target Controls for Amnesic Patients (A) and Nonamnesic Controls (C) in Experiment 2

	Proportion of old responses											
	Conceptual lists						Perceptual lists					
	Overall		Remember		Know		Overall		Remember		Know	
Item type	A	C	A	C	A	C	A	C	A	C	A	C
True targets	.49	.75	.21	.50	.28	.25	.51	.83	.19	.48	.32	.35
True-target controls	.22	.11	.11	.00	.11	.11	.14	.08	.02	.00	.12	.08
True − control (corrected recognition)	.27	.64	.10	.50	.17	.14	.37	.75	.17	.48	.20	.27
False targets	.41	.32	.17	.16	.24	.16	.31	.43	.10	.17	.21	.26
False-target controls	.25	.08	.09	.00	.16	.08	.19	.03	.05	.00	.14	.03
False − control (gist memory)	.16	.24	.08	.16	.08	.08	.12	.40	.05	.17	.07	.23

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The table also shows the proportion of remember and know responses in each of the experimental conditions.

Old–new recognition. As in Experiment 1, amnesic patients attained considerably fewer hits to true targets and made more false alarms to true-target controls than did participants in the control group on both the conceptual and perceptual lists (Table 2). An ANOVA on the hit rates revealed a significant main effect of group, $F(1, 30) = 15.67$, $MSE = .086$, $p < .001$, and also a significant effect of item type, $F(1, 30) = 4.23$, $MSE = .011$, $p < .05$, reflecting a higher hit rate for perceptual than conceptual lists. Although the Group × Item Type interaction was not significant, $F(1, 30) = 1.57$, $MSE = .011$, further analyses revealed that the hit rate was significantly greater for perceptual than conceptual lists in controls, $F(1, 30) = 5.48$, $MSE = .011$, $p < .03$, but not in amnesic patients, $F < 1$.

Analysis of responses to the true-target controls revealed that neither the effect of group, $F(1, 30) = 1.25$, $MSE = .095$; item type, $F(1, 30) = 1.98$, $MSE = .024$; nor Group × Item Type interaction, $F < 1$, reached significance. When we subtracted the false-alarm rates for true-target controls from their corresponding hit rates, we found, as in Experiment 1, a highly significant main effect of group, $F(1, 30) = 39.62$, $MSE = .057$, $p < .001$. We also found a significant effect of item type, $F(1, 30) = 4.45$, $MSE = .042$, $p < .05$, and a nonsignificant Group × Item Type interaction, $F < 1$.

Turning to the proportions of false alarms to conceptually and perceptually related false targets, we found that amnesic patients and controls made roughly similar numbers of old responses to false targets, with amnesics making more false alarms on conceptually related lists than on perceptually related lists, and controls showing the opposite pattern. An ANOVA revealed nonsignificant effects of group and item type ($F < 1$), together with a significant Group × Item Type interaction, $F(1, 30) = 8.32$, $MSE = .021$, $p < .01$, confirming the above impressions. However, amnesic patients made more false alarms to false-target controls than did participants in the control group, $F(1, 30) = 4.76$, $MSE = .091$, $p < .05$. There was also a numerical tendency for both amnesics and controls to make more false alarms to false-target controls for the conceptual lists than for the perceptual lists, but this effect failed to reach significance, $F(1, 30) = 2.14$, $MSE = .022$. The interaction between group and item type also was nonsignificant, $F < 1$.

To obtain estimates of memory for conceptual and perceptual gist, we subtracted the proportion of false alarms to false-target controls from the proportion of false alarms to false targets. An ANOVA revealed a significant main effect of group, $F(1, 30) = 5.06$, $MSE = .098$, $p < .05$, indicating that amnesic patients showed less gist memory than did participants in the control group. The effect of item type was not significant, $F < 1$, but there was a near-significant Group × Item Type interaction, $F(1, 30) = 5.70$, $MSE = .055$, $p < .09$, indicating that the observed differences in gist memory between amnesic patients and controls were greater for perceptual gist (.40 vs. .12 for controls and amnesics, respectively) than for conceptual gist (.24 vs. .16 for controls and amnesics, respectively). Further analyses revealed that the group difference for perceptual gist was highly significant, $F(1, 54) = 8.24$, $MSE = .070$, $p < .01$. In contrast, the group difference for conceptual gist was not significant, $F < 1$. Thus, as in Experiment 1, the condition that yielded higher levels of gist memory in controls was the condition in which amnesic patients showed significantly reduced levels of false recognition.

In Experiment 1, amnesic patients did not exhibit significant levels of perceptual or conceptual gist, a result that we attributed to high levels of false alarms to false-target control words. The results in Table 2 show that, as expected, using words that are unrelated to one another in this condition reduced amnesic patients' old responses to the false-target control words. In contrast to the results of Experiment 1, amnesic patients made significantly more old responses to false targets than to false-target control words for both conceptual lists, $t(15) = 2.34$, $p < .05$, and perceptual lists, $t(15) = 2.07$, $p < .06$. Participants in the control group also showed significant levels of gist memory for both conceptual lists, $t(15) = 5.97$, $p < .001$, and perceptual lists, $t(15) = 3.38$, $p < .01$.

Remember–know responses. As in Experiment 1, amnesic patients provided fewer remember responses to true targets than did controls. An ANOVA of remember responses to true targets revealed a significant effect of group, $F(1, 30) = 13.51$, $MSE = .097$, $p < .001$, and nonsignificant effects of item type and Group × Item Type (both Fs < 1). Analysis of remember responses to true-target controls revealed significant effects of group, $F(1, 30) = 5.00$, $MSE = .012$, $p < .05$; item type, $F(1, 30) = 5.87$, $MSE = .006$, $p < .05$; and Group × Item Type interaction, $F(1, 30) = 5.87$, $MSE = .006$, $p < .05$, indicating that amnesics provided more remember responses than did nonamnesics to true-target controls in the conceptual lists, $F(1, 30) = 11.74$, $MSE = .006$, $p < .01$, but not in the perceptual lists, $F < 1$.

When we subtracted remember responses to true-target controls from remember responses to true targets, we obtained, as in Experiment 1, a significant effect of group, $F(1, 30) = 24.24$, $MSE = .080$, $p < .001$, and nonsignificant effects of item type, $F < 1$, and Group × Item Type interaction, $F(1, 30) = 1.71$, $MSE = .021$.

Know responses to true targets were similar for amnesics and control participants, with both groups providing more know responses to true targets in the perceptual than in the conceptual lists. Amnesics and controls also provided similar numbers of know responses to true-target controls. Confirming the above impressions, the analysis of know responses to true targets revealed a significant effect of item type, $F(1, 30) = 7.91$, $MSE = .012$, $p < .01$, whereas the effect of group, $F < 1$, and Group × Item Type interaction, $F(1, 30) = 1.42$, $MSE = .012$, were nonsignificant. In the analysis of know responses to true-target controls, none of the effects reached significance (all Fs < 1). When we subtracted know responses to true-target controls from know responses to true targets, we obtained results identical to those for true targets: a significant effect of item type, $F(1, 30) = 4.012$, $MSE = .029$, $p = .05$, and nonsignificant effects of group, $F < 1$, and Group × Item Type interaction, $F(1, 30) = 1.76$, $MSE = .029$.

Turning to remember responses to false targets and their controls, we found that amnesic patients gave roughly equal numbers of remember responses to false targets as did participants in the control group, but they gave more remember responses to false-target controls than did the nonamnesics. The analysis of remember responses to false targets revealed nonsignificant effects of group and item type (both Fs < 1) as well as a nonsignificant Group × Item Type interaction, $F(1, 30) = 2.11$, $MSE = .014$. The analysis of remember responses to false-target controls revealed a significant effect of group, $F(1, 30) = 5.45$, $MSE = .015$, $p < .05$, and nonsignificant effects of item type and Group × Item Type interaction (both Fs < 1).

When we analyzed corrected remember scores, obtained by subtracting remember responses to false-target controls from remember responses to false targets, we obtained a near-significant effect of group, $F(1, 30) = 3.28$, $MSE = .047$, $p = .08$, indicating that gist memory was associated with remember responses more frequently for participants in the control group than for amnesic patients. In contrast to the results of Experiment 1, this was true both for conceptual and perceptual gist, as neither the effect of item type nor Group × Item Type interaction approached significance (both Fs < 1).

The incidence of know responses to false targets was roughly similar for amnesic patients and control participants, but whereas the controls gave more know responses to false targets in perceptual than in conceptual lists, the opposite was true for the amnesics. For both types of lists, amnesic patients also gave more know responses to false-target controls than did nonamnesic participants. The analysis of know responses to false targets revealed a significant Group × Item Type interaction, $F(1, 30) = 4.62$, $MSE = .014$, $p < .05$. The analysis of know responses to false-target controls revealed a near-significant effect of group, $F(1, 30) = 3.04$, $MSE = .046$, $p = .091$, and nonsignificant effects of item type and Group × Item Type interaction (both Fs < 1).

We also analyzed corrected know scores, obtained by subtracting know scores to false-target controls from know scores to false targets. The effects of group, $F(1, 30) = 2.39$, $MSE = .041$, and item type, $F(1, 30) = 1.80$, $MSE = .035$, failed to reach significance, but the Group × Item Type interaction approached significance, $F(1, 30) = 2.81$, $MSE = .035$, $p = .10$. Follow-up tests indicated that the control group made significantly more know responses for perceptual gist than for conceptual gist, $F(1, 30) = 4.55$, $MSE = .035$, $p < .05$; there was no such difference for amnesic patients, $F < 1$. In addition, amnesic patients provided fewer know responses associated with perceptual gist than did controls, $F(1, 60) = 5.16$, $MSE = .038$, $p < .05$, but no group differences in know responses were obtained associated with conceptual gist, $F < 1$.

General Discussion

The two experiments reported here provide new information about the nature of false recognition in amnesic patients. We began by asking whether our previous finding that amnesics exhibit reduced levels of false recognition for conceptually related false targets (Schacter, Verfaellie, and Pradere, 1996) extends to perceptually related false targets. Experiment 1 replicated our earlier finding concerning conceptual false recognition but provided equivocal evidence of reduced perceptual false recognition in amnesic patients, in part because the overall magnitude of the perceptual gist effect was rather modest. In Experiment 2, we increased the magnitude of the perceptual gist effect and found that amnesic patients now exhibited significantly less perceptual false recognition than did controls. By contrast, there was a smaller conceptual false-recognition effect in controls and only a trend for reduced conceptual false recognition in amnesic patients.

Taken together, the two experiments indicate that when there is a large gist memory effect in the control group, amnesic patients exhibit reduced false recognition—conceptual or perceptual. Thus, our experiments do not support the possibility raised earlier that Schacter, Verfaellie, and Pradere's (1996) finding of reduced false recognition in amnesic patients is restricted to the domain of conceptual gist or that perceptual processes that are spared in amnesia play a special role in false recognition of perceptually related words. Instead, it looks like amnesic patients show reduced retention of both the conceptual and perceptual gist information that drives false recognition in nonamnesic individuals.

The different levels of true and false recognition across experiments for conceptual and perceptual lists in the control group probably reflect differences in item characteristics. Specifically, differences in word frequency between the conceptual and perceptual lists probably account for some of the observed performance differences. In Experiment 1, the Shiffrin et al. (1995) materials were not equated for either word length or frequency, with items from the conceptual lists having a significantly lower frequency (Francis and Kucera, 1982) than items from the perceptual lists—5/million and 109/million for conceptual and perceptual lists, respectively; $t(142) = 3.16$, $p < .05$. In Experiment 2, we equated word length between the two types of lists, but items in the perceptual lists had a significantly lower frequency than items in the conceptual lists—60/million and 121/million for perceptual and conceptual lists, respectively; $t(126) = 2.19$, $p < .05$. In view of the well-known finding that low-frequency words are generally better recognized than high-frequency words (e.g., Gregg, 1976), frequency seems likely to be involved in the differences we observed between conceptual and perceptual lists. Although low-frequency words are typically associated with fewer false alarms than high-frequency words, this finding has been obtained for false alarms to unrelated lures (i.e., false-target controls), in contrast to false alarms based on gist memory. Because frequency has not been previously implicated in gist memory and false recognition, future studies that systematically investigate frequency effects in this domain are desirable.

Whatever the exact reasons for the differences we observed in overall levels of recognition across lists, we think that the tendency for conditions that yield greater gist memory effects in controls to produce greater differences

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between amnesics and controls may provide clues to processes that produce false recognition. Consider our results in relation to those of Schacter, Verfaellie, and Pradere (1996) on the one hand, and to the results of an earlier experiment by Cermak, Butters, and Gerrein (1973) on the other. In our experiments, participants studied either nine words (Experiment 1) or eight words (Experiment 2) that were related to a false target, and the overall mean of the corrected false recognition or gist memory effect for controls was .31 (.33 for conceptual gist and .29 for perceptual gist); for amnesics, the overall mean was .09 (.09 for both conceptual and perceptual gist). In the Schacter, Verfaellie, and Pradere (1996) experiment, participants studied 15 words that were related to a false target, and the overall magnitude of the gist effect was .57 for controls and .16 for amnesic patients. Thus, in their experiment, there was a larger gist effect for controls than in our experiments, and the absolute difference between controls and amnesics was even greater than the difference observed here. The differing magnitudes of the gist effects in the two experiments are undoubtedly related to the number of related items presented during study, because previous research has shown that the magnitude of false-recognition effects increases with increasing numbers of related study list items (Hintzman, 1988; Shiffrin et al., 1995).

Consider next the different pattern of results reported by Cermak et al. (1973), who examined false recognition in a continuous-recognition paradigm similar to that initially employed by Underwood (1965). False targets were preceded by a single homophone, associate, or synonym. Compared to the false-alarm rate for unrelated lures, nonamnesic controls showed a small false-recognition effect for homophones, associates, and synonyms ($M = .05$), which is entirely in keeping with the above-noted relation between number of related items presented at study and the magnitude of subsequent false-recognition effects. In striking contrast to our results, however, amnesic patients showed a higher overall level of corrected false recognition ($M = .16$) than did controls (this was attributable to high false-alarm rates for the homophones and associates; for reasons that are not entirely clear, amnesics in this experiment did not show significant false recognition to synonyms).

Noting the contrast between Cermak et al.'s (1973) results and their own data, Schacter, Verfaellie, and Pradere (1996) suggested that when numerous associates of a false target are presented, as in the Roediger and McDermott (1995) paradigm, normal controls establish a well-organized gist representation that enhances the sense of familiarity or recollection associated with a matching false target, and thus increases the magnitude of the false-recognition effect. Amnesic patients, by contrast, encode or retain less gist information and hence show reduced levels of false recognition. However, when only a single related item precedes a false target, as in the Underwood (1965) paradigm, controls establish a less robust gist representation and can use their intact explicit memory abilities to counteract or oppose (Jacoby, 1991) the sense of familiarity or recollection they may experience when encountering a false target. Thus, for example, a nonamnesic individual who encounters the false target *table* and can recollect having previously studied the associate *chair* can use this information to avoid making a false-recognition response (see also Brainerd et al., 1995). Amnesics, however, are less able to use recollection to oppose the sense of familiarity engendered by a false target and thus exhibit increased levels of false recognition as compared with nonamnesic controls.

Applying these ideas to the present results, our data appear to represent an intermediate case that falls somewhere between the massive false-recognition effect observed in the Roediger and McDermott (1995) paradigm, where false recognition in controls is enhanced by numerous associates, and the modest false-recognition effect observed in the Underwood (1965) paradigm, where controls can use their intact recollective abilities to oppose or inhibit relatively weak gist information but amnesic patients cannot. These ideas suggest that it should be possible, within a single experiment, to produce increased or decreased false recognition in amnesic patients relative to controls by varying the number of related items presented during the study phase (cf. Schacter, Verfaellie, and Pradere, 1996).

Further insight into our results, and in particular into the relation between conceptual and perceptual false recognition, is provided by the remember–know data. In a previous experiment examining recognition memory in amnesic patients, Knowlton and Squire (1995) found that amnesic patients made many fewer remember responses to studied words than did controls and also found a more modest, albeit significant, reduction in the proportion of know responses that amnesics gave to previously studied words. Our results for true targets and true-target controls are roughly similar to Knowlton and Squire's data: Corrected remember scores were dramatically lower in amnesic patients than in the control group for the perceptual and conceptual lists in both experiments, and there were some trends for lower corrected know scores in the amnesics. Although this latter tendency was observed for both perceptual and conceptual lists in Experiment 1, the difference did not quite attain statistical significance; in Experiment 2, we observed a nonsignificant trend in the same direction for the perceptual lists but observed a slight trend in the opposite direction for the conceptual lists. Thus, our data are somewhat ambiguous on the question of whether amnesic patients show reduced levels of know responding, as Knowlton and Squire found, and we prefer to leave the issue open for future investigation.

More directly related to our central concerns with false recognition and gist memory, both experiments yielded some evidence that conceptual false recognition is associated with a relatively higher proportion of remember responses and lower proportion of know responses than perceptual false recognition. This pattern was most evident in the data from controls, because amnesic patients showed low and near-floor levels of gist memory. In Experiment 1, there were significantly more remember responses associated with conceptual than perceptual gist and no differences in know responses. In Experiment 2, conceptual and perceptual gist were associated with similar proportions of remember responses, but perceptual gist was associated with

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significantly more know responses than was conceptual gist. Thus, when conceptual gist was greater than perceptual gist (Experiment 1), the difference was expressed as an increase in remember responses; when perceptual gist was greater than conceptual gist (Experiment 2), the difference was expressed as an increase in know responses. Along the same lines, in Experiment 1, controls' remember gist memory scores were higher than their know gist memory scores for the conceptual lists (.29 vs. .13), whereas remember and know gist memory scores were identical for the perceptual lists (.09). In Experiment 2, conceptual gist was associated with more remember than know responses (.16 vs. .08), whereas the opposite was observed for perceptual gist (.17 vs. .23). These observations suggest that the types of conceptual and perceptual gist information that drive false recognition may differ qualitatively, the former being associated with recollective processes involved in remembering and the latter being associated with familiarity processes involved in knowing (e.g., cf. Gardiner & Java, 1993; Knowlton & Squire, 1995). Amnesic patients appear to exhibit less of both forms of gist memory and associated false recognition.

At the conclusion of Experiment 1, we noted that apparent qualitative differences between conceptual and perceptual false recognition might be attributable to quantitative differences, because the overall magnitude of the gist memory effect was larger for conceptual lists than for perceptual lists. Donaldson (1996) has shown that many seemingly qualitative differences between remember and know responses may simply reflect differences in the strength of the underlying memorial representation: Remember responses tend to be given when "strong" traces are accessed, know responses tend to be given when "weak" traces are accessed, and differences between the two result from the use of stricter criteria for remember than for know responses. Although not definitive, the results of Experiment 2 provide evidence against this possibility: Although the perceptual gist effect was larger than the conceptual gist effect, we still found that nonamnesic controls provided more know responses for perceptual gist than for conceptual gist. According to a strictly quantitative interpretation of remember and know responses, we should have found more remember responses for perceptual than for conceptual gist.

The question of whether conceptual and perceptual false recognition differ qualitatively requires further study. The key point to emerge from our experiments is that amnesic patients show reduced levels of memory for both conceptual and perceptual gist, as well as reduced levels of conceptual and perceptual recognition for words that were actually studied. It is important to attempt to strengthen this conclusion in future studies in which levels of perceptual and conceptual memory are equated in normal controls; because of observed differences between the conceptual and perceptual lists, we must be cautious about comparisons between them. Nonetheless, by documenting reduced perceptual gist in amnesic patients, our data support previous results indicating that within the domain of explicit remembering, perceptual memory processes are not fully preserved in amnesic patients (cf. Cermak et al., 1995; Vaidya et al., 1995). Recent neuroimaging data have revealed differences in brain activity during perceptual and conceptual memory tests (Blaxton et al., 1996). However, with respect to amnesic patients, evidence for preserved perceptual (or conceptual) memory processes has been found only within the domain of implicit memory (for recent discussions, see Blaxton, 1995; Gabrieli, 1995; Hamman et al., 1995; Schacter & Church, 1995). Additional studies of false recognition and gist memory in amnesic patients should provide new perspectives on the nature of normal and abnormal remembering.

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