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Episodic Effects on Picture Identification for Alcoholic Korsakoff Patients

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Experience with degraded pictures produces better subsequent identification of these pictures in amnesic patients. To examine the contribution of episodic memory to this facilitation, we compared identification of pictures that were identical to a studied picture, pictures that shared the same name with a studied picture, and new, unstudied pictures. In an initial phase of the experiment, patients clarified each picture until they could name it. During a second phase, they again clarified each picture and judged whether it was identical, similar (same-name), or different from pictures identified in the first phase. Korsakoff patients, as well as alcoholic controls, identified identical pictures faster than same-name pictures, and these in turn were identified faster than new pictures. The Korsakoff patients did show less facilitation than the alcoholic controls, but this difference was eliminated by testing the alcoholics after a week delay. The smaller facilitation in performance shown by amnesics and by alcoholics tested after a delay was accompanied by impaired recognition memory as well as by qualitative differences in recognition performance. The Korsakoff patients tended to label same-name pictures as different while alcoholic controls tested immediately called them identical, a tendency which disappeared when alcoholics were tested after a delay. These findings suggest that Korsakoff patients are influenced by specific episodic information even more than are alcoholic controls.

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For some time now, investigators of the amnesic syndrome have been intrigued by the finding that amnesic patients can identify fragmented pictures more readily upon their second presentation than upon their first. Warrington and Weiskrantz (1968) originally presented this as evidence that some retention must have occurred from one day to the next even for their densely amnesic patients. Admittedly, the extent to which perceptual identification was facilitated by previous exposure was less for the amnesics than for the controls, but the authors emphasized the fact that there were savings at all, because this was one of the first examples of any retention by amnesics. Noting the same effect with H.M., Milner, Corkin, and Teuber (1968) proposed that some form of perceptual learning may occur for the amnesics. They suggested that perhaps the additional facilitation enjoyed by controls was due to the fact that they remembered the names of the pictures as well as the percept. H.M., on the other hand, may have had to rely solely on his perceptual memory since verbal recall of the names of the pictures was lacking.

Most investigators have pointed to these two reports as the first observations of "priming" effects in amnesia. The contrast between the amnesics' good performance on the picture identification task and their poor performance on more traditional memory tasks such as recall and recognition has become the basis for postulating the existence of two dissociable memory systems (e.g., Cermak, Talbot, Chandler, & Wolbarst, 1985; Squire, 1987). One memory system is felt to be tied directly to the specific aspects of the initial presentation of the material. The other memory system is characterized as a store of abstract knowledge which can be activated generically, without requiring access to specific details of the previous learning episode. According to some authors, this activation occurs at the level of semantic or conceptual representations (Graf & Mandler, 1984; Cermak et al., 1985), while others (Gabrieli, Milberg, Keane, & Corkin, 1990; Schacter, Cooper, & Delaney, 1990) have proposed that perceptual representation systems, which represent information about the form and structure of words and pictures, may be critically involved. Irrespective of the exact nature of the representation involved, success by the amnesics, when it occurs, has usually been interpreted as being due to generic activation, not to retention of any aspect of the episode itself.

While these multiple memory systems theories have been extremely popular, an alternative view, derived largely from studies of normal memory (Jacoby, 1983; Roediger & Blaxton, 1987), has recently gained increasing attention as an explanation of priming effects in amnesia. According to this view, facilitation does not depend on the prior existence of generic representations (semantic or perceptual), but rather, it depends on specific memories of individual past experiences. Facilitation arises when the same processes occurring during the initial presentation of an

event reoccur at the time of its subsequent presentation. Jacoby, Baker, and Brooks (1989) have already provided evidence that normal subjects' performance on a picture identification task is highly influenced by their memory for prior episodes. In their task, subjects were presented with degraded pictures which could be clarified by pressing a key on the computer which gradually eliminated visual noise. The subjects continued to press the key until the picture became sufficiently clear to allow identification. Then, during a test phase, the subjects were again asked to clarify degraded pictures until they could identify them. Some pictures were identical to those previously presented, some shared the same name but were not identical to previously presented pictures (same-name pictures), and some pictures were new. Jacoby et al. found that subjects who had clarified the pictures in the study phase identified identical pictures with fewer key presses than same-name pictures. Same-name pictures, in turn, were identified faster than new pictures. Also, these subjects identified identical pictures faster than did a group of subjects who had named, but not clarified, the pictures during the study phase. Thus, for normal individuals, retention of the specific episode, as well as retention of the encoding operations in which subjects are engaged, affects subsequent identification performance. Whether the facilitation observed in amnesics is also tied to episodic retention is the topic of investigation here.

To specify the nature of the preserved abilities in amnesia, we compare the effects of prior exposure on identical and same-name pictures in the clarification task. An episodic account would be favored if amnesics, like normal controls, require fewer key presses to identify identical than same-name pictures, and both of these are identified with fewer key presses than new pictures. A finding of an advantage of identical over same-name pictures would provide evidence that amnesics are capable of new learning of the particular picture shown during training. In contrast, no difference between the identification of identical and same-name pictures would be expected if facilitation in picture identification reflects the activation of an abstract semantic or conceptual representation. Other investigators (e.g., Gabrieli et al., 1990; Musen & Treisman, 1990; Schacter et al., 1990) have used unfamiliar figures to show that amnesics are capable of new learning, and they have suggested that new learning reflects the operation of a perceptual representation system that is preserved in amnesia. According to this account, prior presentation of a picture should benefit only identical test pictures; same-name test pictures should hold no advantage over new test pictures. Of course, an advantage for same-name pictures could be predicted if it is assumed that same-name pictures are perceptually similar to old test pictures, and that there is generalization based on that similarity. But, including assumptions of that sort along with appropriate processing assumptions makes the perceptual representation account identical to an episodic account of

effects of prior experience on picture identification (Jacoby & Brooks, 1984; Jacoby et al., 1989).

Our use of the term "episodic" is likely to be confusing to some readers. By reference to episodic, we do not mean to imply that subjects are necessarily aware of the relation between a test picture and an earlier presented study picture and intentionally use that memory to identify the test picture. Jacoby et al. have used the term "recollection" to refer to this intentional use of memory. Rather, by episodic, we wish to refer simply to the specific effects on picture identification that must come from memory for a prior episode rather than from the activation of an abstract representation. Our use of the term episodic is meant to highlight the possibility that variables that affect performance in episodic memory tasks will affect perceptual clarification performance in the same way. One such variable, considered in the present experiment, is the effect of retention interval. To examine the effects of retention interval on clarification performance, the performance of amnesics given an immediate test is compared both with that of alcoholic controls given an immediate test and with that of alcoholic controls tested after a 1-week delay. Delaying the test of picture identification was expected to increase the similarity between the clarification performance of alcoholic controls and amnesics.

Earlier experiments with normal individuals (Jacoby et al., 1989; Hirshman, Snodgrass, Mindes, & Feenan, 1990) have found a dissociation between free recall performance and facilitation in speed of picture identification. In these experiments, subjects recalled the names of earlier presented pictures before engaging in a picture identification task that included those earlier presented pictures. A dissociation was shown by the finding that pictures whose names were recalled were not identified any more readily than were pictures whose names were not recalled. These findings bear directly upon Milner's earlier speculation that normal subjects retain the names of the pictures and that it is memory for names that gives them an advantage over amnesics at the time of test. The finding of a dissociation between name recall and picture identification for normal subjects seems to imply that name recall does not play a significant role in facilitation of performance, even for normal subjects.

Because we knew from prior research that amnesics would not be able to recall any of the names of the pictures, we examined the relation between identification and recognition performance. After patients had identified a picture, the picture was shown fully clarified and they had to judge whether the picture was, in fact, identical to an earlier presented picture, shared a name with an earlier presented picture, or was different from any picture presented earlier. Earlier descriptions of amnesics as showing near normal facilitation in picture identification along with near chance performance on direct tests of memory led us to expect a dissocia-

tion between facilitation of identification and recognition memory performance. As will be described, however, the results show a very close association between the two measures.

METHOD

Subjects. Three groups of adult male subjects participated in this experiment. The experimental group consisted of nine alcoholic Korsakoff patients residing at various private care facilities in the greater Boston area. All had histories of chronic alcoholism, were unable to recall day-to-day events, were disoriented to time and place, and had retrograde amnesias of varying degrees. These patients' mean age was 65 years, with an average of 12 years of education. The average WAIS-R VIQ score for this group was 100, WMS score was 84, WMS-R Attention score was 103, General Memory score was 63, and Delayed Memory score was 55. In addition, these patients received a full neuropsychological test battery upon admission to the Memory Disorders Research Center. On this battery, these patients scored significantly below normal on the Warrington Faces and Words Test, the Rey Auditory Verbal Learning Test, the California Verbal Learning Test, and Continuous Visual Memory Test, as well as retrograde memory assessments using the Boston Famous Faces and Events, Crovitz Autobiographical Questionnaire, and the Transient Events Test. They scored at or above normal on all nonmemory neuropsychological tests including, but not limited to, the Boston Naming Test, Boston Diagnostic Aphasia Examination, National Adult Reading Test, Wide Range Achievement Test, Line Orientation, Facial Recognition, and Drawing tasks.

The first control group consisted of 12 chronic alcoholics living in private homes or public half-way houses in the Boston area. None of the men evidenced any signs of neurological or psychiatric illness. All had abstained from alcohol for at least 4 weeks prior to testing according to relatives' or counselors' reports. Their average age was 57, with a mean of 13 years of education. This group's WAIS-R score was 107, WMS-R Attention score was 104, General Memory 107, and Delayed Memory was 106. They were at or above average on the neuropsychological screening tests included in the Memory Disorders Research Center Assessment Battery, described above.

The second control group included 10 chronic alcoholics also staying in private homes and public half-way houses in the Boston area. Like the first group of control patients, none of these men evidenced any signs of neurological or psychiatric illnesses. All had abstained from alcohol for at least 4 weeks prior to testing according to relatives' or counselors' reports. Their average age was 53 years, with a mean of 13 years of education. This group's mean WAIS-R score was 115, WMS-R Attention score was 108, General Memory 115, and Delayed Memory 113. They were at or above average on the neuropsychological screening tests included in the Memory Disorders Research Center Assessment Battery, described above.

Design and materials. A list of 16 line drawings of common objects was presented in the first phase of the experiment. Patients saw degraded versions of the linear drawings (e.g., a straightback wooden chair) and, in order to name them, had to clarify the pictures by pressing a key that increased the signal-to-noise ratio. The test list presented in the second phase of the experiment comprised 24 line drawings: 8 of these were identical to ones shown in the first phase of the experiment (e.g., the same straightback wooden chair), 8 shared a name with a drawing presented in the first phase (e.g., an overstuffed easy chair), and 8 were unrelated to any previously presented drawing (e.g., a frog). All drawings were presented in a degraded form in this test phase, and patients were required to clarify each drawing until the pictured object could be named.

Study and test lists were constructed from a pool of 24 pairs of line drawings of common objects previously used by Jacoby et al. (1989). These included items such as a chair, a frog, stairs, a sink, and shoes. Members of a pair of drawings shared the same name and the same overall visual structure, but were selected to differ in visual detail. The pool of drawings was randomly broken into three subsets of 8 pairs each to produce identical, same-name, and new test items. To check for possible inherent differences in the ease with which the three types of test items could be identified, these pictures were presented for clarification to a group of 12 age-matched control subjects, who had not been exposed to any of the pictures in the study list. On the basis of these results, one picture in the identical, same-name, and different set each was eliminated to ensure complete comparability. Thus, subsequent data represent means for seven pictures per set.

A digitizer in combination with an Apple IIe computer was used to vary the degree of degradation of presented pictures. Pictures were degraded by intermixing random points from a digitized line drawing with random noise points. When first presented as a degraded picture, only noise points were displayed. Pressing the space bar on the computer produced an increase in the ratio of points from the picture to noise points, thereby clarifying the picture. To fully clarify a picture and delete all noise points, a total of 255 key presses were required.

Procedure. Patients were seated facing an Apple IIe computer. During the Study phase, the computer displayed the message "press bar for next trial" at the onset of each identification trial. Pressing the space bar resulted in this message being replaced by random noise dots distributed across the screen. Patients then pressed the space bar to decrease the number of noise dots and to increase the number of dots from the picture until they thought they could identify the object being displayed. At this time they informed the experimenter of their hypothesis. If the hypothesis was correct, the examiner pressed the Escape key. This resulted in full clarification of the picture, which remained on the screen for 7 sec. During this time, patients were asked to memorize each picture. If the hypothesis was incorrect, the patients were instructed to continue clarifying the picture and producing hypotheses until they correctly named the picture. If they were unable to identify a picture even at the maximum full clarification, the examiner correctly identified the picture for them. The number of key presses patients required to correctly identify a picture was recorded by the computer. Hypotheses offered by patients prior to correctly identifying any picture were noted by the examiner.

A Practice phase, which contained five trials, allowed the patients to become familiar with this type of clarification task. Then the Study phase, consisting of a total of 18 pictures, proceeded in a similar manner. After presentation of the study list, the Korsakoff patients, as well as one of the groups of alcoholic control subjects, were given instructions for the Test phase. This began with the same basic procedure of pressing the space bar to clarify each picture until correctly identified. Once identified, the examiner again pressed the Escape key to display the complete picture on the screen. At this point, patients were asked to decide as quickly as possible if this fully clarified picture was identical to one they had seen earlier in the experiment, was similar but not exactly the same (shared the same name) as a picture seen earlier, or was a completely different picture that they had never seen before. As soon as the patient provided a recognition answer, the examiner again pressed the Escape key to remove the picture from the screen. This procedure was repeated until all 24 pictures had been presented.

Since this was a complex two-step task, the instructions to identify the picture and then make a recognition choice as quickly as possible were repeated between picture trials as often as needed. Also, to make the recognition task easier, three 3 × 5 index cards with the words: Identical, Similar, and Different were placed on the table in front of the computer for easy referral by the patients. Additionally, before beginning the Test phase, the examiner made certain that the patients understood the concept of identical, similar, and different pictures by use of four hand drawn practice examples.

The procedure for the second control group was identical to that of the other two groups except that 1 week elapsed between the Study and Test phases. During this week, the patient pursued his daily activities but was not engaged in other Memory Disorders Research Center projects. He was told that he would be expected to remember the items he had identified during the initial clarification (Study) phase of the task during his next visit but was not told how he would be tested for this. Upon his return, instructions for the Test phase of the experiment were given.

Results

Clarification

To examine the effects of repetition on picture identification, we computed the mean number of key presses required by each group to identify identical pictures during the Study and Test phases of the experiment. These results, which are presented in Fig. 1, were analyzed by means of an ANOVA with Group (Alcoholics immediate, Alcoholics delay, Korsakoff) as the between-subjects variable and Phase of the experiment (study, test) as the within-subjects variable. A significant Phase effect was obtained ($F(1, 28) = 82.3$, $p < .01$), as well as a Group by Phase interaction ($F(2, 28) = 8.78$, $p < .05$). This reflected the fact that no group differences were obtained in terms of the number of key presses required during the Study phase, but during the Test phase, alcoholics tested immediately identified pictures faster than either alcoholics tested at a delay ($t_{20} = 2.75$, $p < .05$) or Korsakoff patients ($t_{19} = 4.57$,

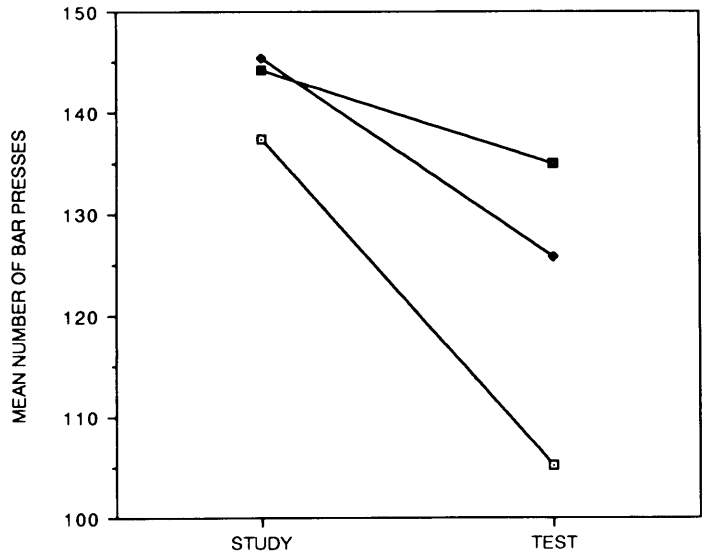

FIG. 1. Mean number of key presses for identification of identical pictures during the Study and Test phases. □, alcoholics immediate; ◆, alcoholics delay; ■, Korsakoff.

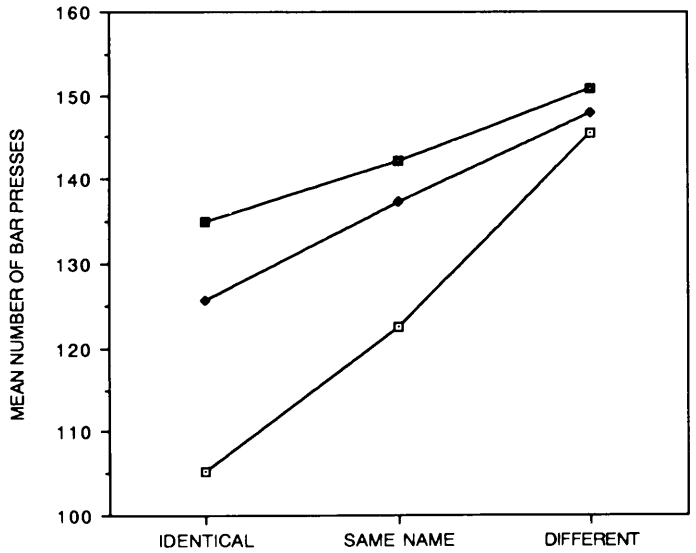

FIG. 2. Mean number of key presses for picture identification of identical, same-name, and different pictures during the Test phase. □, alcoholics immediate; ◆, alcoholics delay; ■, Korsakoff.

$p < .01$). The latter two groups did not significantly differ from each other. Although the alcoholics tested following a delay and the Korsakoff patients benefited less from previous exposure than the alcoholics tested immediately, both groups required fewer key presses during the Test phase than were required to identify those same pictures in the Study phase (alcoholic delay: $t_9 = 5.94$, $p < .01$; Korsakoff: $t_8 = 3.52$, $p < .01$).

During the Test phase, some pictures were identical to those presented for study, some shared the same name, and some were completely different. This allowed us to examine the effects of picture similarity on subsequent identification. Figure 2 depicts the mean number of key presses required by each group for each category of picture. These data were analyzed by means of an ANOVA with Group as the between-subjects variable and Picture category (identical, same-name, different) as the within-subjects variable. Results of this analysis revealed a significant main effect of Picture category ($F(2, 56) = 52.23$, $p < .01$), indicating that identical pictures were identified faster than similar ($t_{30} = 5.14$, $p < .01$) or different pictures ($t_{30} = 9.19$, $p < .01$). Similar pictures, in turn, were identified faster than different pictures ($t_{30} = 4.95$, $p < .01$). In addition, a significant Group by Category interaction was obtained ($F(4, 56) = 4.19$, $p < .01$). Follow-up analysis with tests of simple main effects revealed significant group differences in the effect of picture similarity. For Korsakoff patients, the only difference to reach significance

was that between identical and different pictures ($t_8 = 2.95$, $p < .05$). For both alcoholic groups, in contrast, identical pictures were identified faster than same-name pictures (immediate: $t_{11} = 4.38$, $p < .01$; delay: $t_9 = 2.65$, $p < .05$), and those in turn were analyzed faster than different pictures ($t_{11} = 5.43$, $p < .01$ for alcoholics tested immediately, and $t_9 = 2.39$, $p < .05$ for alcoholics tested after a delay). In addition, the alcoholics tested immediately required fewer bar presses to identify identical pictures than either the alcoholics in the delayed test condition ($t_{20} = 2.75$, $p < .05$) or the Korsakoff patients ($t_{19} = 4.57$, $p < .01$). The latter two groups did not differ from one another.

Recognition

Table 1 presents the probability of correctly classifying a fully clarified picture as being identical, similar (i.e., same-name), or different than one presented in the Study phase. These data were subjected to an arcsin square root transformation and entered into a 3 (Group) × 3 (Picture category) ANOVA. Results of this analysis revealed a significant main effect of Group ($F(2, 28) = 18.65$, $p < .001$) and Picture category ($F(2, 56) = 26.44$, $p < .001$). Overall, the recognition performance of the alcoholics tested immediately was more accurate than that of the alcoholics tested at a delay ($t_{64} = 1.91$, $p < .05$). The latter group, in turn, classified pictures more accurately than the Korsakoff patients ($t_{55} = 2.08$, $p < .05$). Even for the Korsakoff patients, however, performance was significantly better than might be expected by chance ($\chi^2 = 39.2$, $p < .001$). Also, all groups classified identical pictures better than same-name pictures ($t_{30} = 4.30$, $p < .01$), and there was a trend for different pictures to be classified better than identical pictures ($t_{30} = 2.03$, $p < .06$).

Since the Korsakoffs as well as the alcoholic controls produced a large proportion of recognition errors for the same-name pictures, we further evaluated the nature of these errors. Patients might be unable to see the categorical similarity and thus label same-name pictures as "different," or they might remember the category name but forget the visual details, thus calling them "identical." To distinguish between these possibilities, contingency tables were produced for each group (see Tables 2, 3, and 4).

TABLE 1
Recognition Accuracy during the Test Phase

	Stimulus type		
	Identical	Same-name	Different
Alcoholic immediate	94.0	46.4	100.0
Alcoholic delay	79.8	24.3	85.7
Korsakoff	41.3	28.6	73.0

TABLE 2
Distribution of Responses on the Recognition Task for Alcoholics Tested Immediately

	Stimulus type		
Subject's response	Identical	Same-name	Different
Identical	94.7	43	0
Similar	6	45	0
Different	0	12	100

TABLE 3
Distribution of Responses on the Recognition Task for Alcoholics after a Delay of 1 Week

	Stimulus type		
Subject's response	Identical	Same-name	Different
Identical	79	40	9
Similar	9	24	6
Different	12	36	85

TABLE 4
Distribution of Responses on the Recognition Task for Korsakoff Patients

	Stimulus type		
Subject's response	Identical	Same-name	Different
Identical	41	17	11
Similar	30	29	16
Different	29	54	73

For the alcoholic controls tested immediately, same-name pictures were incorrectly judged to be identical to previously seen pictures (43%) as frequently as they were recognized correctly (45%). Different responses, in contrast, were given relatively infrequently (12%). This pattern was less striking for the alcoholics tested after a week. Here, same-name pictures were equally likely to be judged identical (40%) or different (36%), and both these responses were more frequent than similar responses (24%). Finally, in comparison with the alcoholics tested immediately, Korsakoff patients showed a reversed pattern of errors. They most frequently labeled same-name pictures different (54%). Correct responses were given much less frequently (29%), but still more frequently than identical responses (17%). Of further interest, when Korsakoff patients did not correctly recognize identical pictures, they judged them to be

different pictures (29%) as frequently as they judged them to be same-name pictures (30%). The alcoholics tested following a delay recognized identical pictures with a much higher degree of accuracy, but a similar pattern was evident in their errors (12% different vs. 9% same-name).

Discussion

The results of this experiment replicate those of earlier experiments (e.g., Warrington & Weiskrantz, 1968; Milner et al., 1968) in that amnesic patients demonstrated facilitation in their picture identification performance as a consequence of prior exposure. However, it must again be emphasized that the facilitation demonstrated by the amnesics was much smaller than that observed in the alcoholic control subjects who had no memory disorder. This reduced facilitation was clearly not due to inherent differences in the ability to clarify degraded stimuli since, during the Study phase of the experiment, all groups required essentially the same number of key presses to identify pictures.

The below normal facilitation in picture identification shown by amnesics was accompanied by poor, but far from zero, recognition memory. Thus, while identification was present but not normal, recognition was deficient but not absent. Likewise, for the alcoholic controls, delaying the tests of memory produced a reduction in clarification performance and also reduced the accuracy of recognition performance, creating a pattern of results similar to those obtained by Korsakoff amnesics. Overall, this pattern of results provides no evidence for a dissociation between picture clarification and recognition. Rather, it suggests that the two measures may be associated. In support of this view, when we conditionalized clarification performance on whether or not a picture was recognized as being previously presented, we found that identical and same-name pictures which were recognized as being presented earlier tended to be clarified with fewer bar presses than pictures which were not recognized as being presented earlier ($F(1, 21) = 3.42$, $p < .08$).

Most recent theories of amnesia have tended to emphasize dissociations of memory in support of their proposal that there are separate memory systems, only one of which is impaired by amnesia. Indeed, it was to evaluate this proposal that we manipulated the similarity between study and test pictures in this experiment. If, as has been suggested, the facilitation in picture identification shown by amnesics reflects the priming of semantic information, then no differences should have been obtained in the identification of identical compared to same-name pictures. Alternatively, if such facilitation reflects the activation of a perceptual record, then same-name pictures should have been identified just as new pictures. What did occur was that while identical pictures were identified faster than same-name pictures, the advantage of identical over same-

name test pictures was much smaller for amnesics than for control subjects. This pattern of results could be described as a dissociation and could be interpreted as support for a semantic activation view. However, a closer examination of the results plotted in Fig. 2 reveals that performance on same-name pictures was almost perfectly intermediate to performance on identical and different test pictures for all three groups. This finding is inconsistent with any hypothesis that states that facilitation in the identification of previously presented pictures relies on activation of a generic representation, whether this representation be semantic or perceptual in nature. Instead, it suggests that delay between study and test have the same effect of reducing the accessibility of memory for specific earlier presented pictures for amnesics.

Not surprisingly, the amnesics' performance on the recognition test was significantly worse than that of the alcoholic controls tested immediately, but an intriguing qualitative difference between the patient groups did emerge. When presented with a same-name picture, the alcoholic controls tested immediately frequently mislabeled it as being identical. In contrast, the Korsakoff patients labeled same-name pictures as being different the majority of the time, and did so even more frequently than they (correctly) labeled them as being similar. This difference between the Korsakoff patients and alcoholics tested immediately was not merely the result of differences in response strategy since a signal detection analysis treating identical and similar pictures as signal and different pictures as noise revealed a significant difference in sensitivity between groups (Korsakoff's $d' = 1.14$; alcoholics $d' = 4.45$, $p < .01$), but not in response bias (Korsakoff's $\beta = 1.48$; alcoholics $\beta = 1.24$; ns). Like the Korsakoff patients, the alcoholics tested following a delay showed a high error rate in recognizing same-name pictures. However, their error pattern fell in between that of the Korsakoff patients and that of the alcoholics tested immediately, in that they were equally likely to call same-name pictures similar or different.

Quite likely, the alcoholic controls make more "identical" errors than do the amnesics on same-name pictures because they tend to retain *both* the specific picture presented during study and its generic representation. Korsakoff patients, on the other hand, might actually be more directly bound to a specific episodic representation and, thus, show less generalization to pictures which share the same name or the same structural characteristics. This was also true for the alcoholics tested following a delay, although not quite to the extent observed for the Korsakoff patients. Taken together, these results suggest that as memory for prior episodes decreases, it becomes less flexible and less applicable to pictures which share only a generic representation.

While the parallel effects of retention interval on picture clarification and recognition performance are clearly inconsistent with a multiple memory systems account, they do require further clarification of what

we have described here as an episodic memory account. Previous studies with normals (Jacoby et al., 1989; Hirshman et al., 1990) have shown that clarification performance can be dissociated from performance on a free recall task. Recognition performance, in contrast, was closely associated with clarification performance in the present task. These findings clearly reflect the importance of the compatibility between study processing and the requirements at test (Jacoby, 1983; Weldon & Roediger, 1987). Both picture clarification and recognition memory may depend primarily on the fluency with which specific visual details of a picture are processed. Free recall, on the other hand, requires conscious recollection of the study episode, a process which depends much more on the availability of relational information between studied pictures than on specific visual details. Importantly, these findings illustrate that both associations and dissociations between episodic memory tasks can be obtained, depending on the nature of the processes involved.

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