Journal of Experimental Psychology:
Learning, Memory, and Cognition
1985, Vol. 11, No. 1, 22-36

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0278-7393/85/$00.75

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Do Alcoholic Korsakoff's Syndrome Patients Acquire Affective Reactions?

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In this study we report two experiments that investigate the acquisition of affective reactions. In Experiment 1, unfamiliar melodies were played to Korsakoff's syndrome patients and alcoholic and nonalcoholic control subjects who were matched with them according to age and education. Following a retention interval of 5 min, subjects received a preference test on old and new melodies. Korsakoff's syndrome patients showed the same increase in preference for old melodies as a consequence of prior exposures as control subjects did, but their recognition of melodies was significantly impaired in comparison with controls. In Experiment 2, the same subjects saw photographs of two men. Fictional biographical information depicted one as a "good guy" and the other as a "bad guy." After a retention interval of approximately 20 days, Korsakoffs recalled virtually none of the biographical information; however, 78% preferred the good guy, and impression ratings were less favorable for the bad guy. Korsakoff patients developed preferences and impressions even though they did not have voluntary access to the information on which the preferences were based. However, their impression ratings were less extreme than those of controls. The pattern of results of the two studies is discussed in terms of Johnson's (1983) MEM model of memory.

Johnson (1983) recently proposed a general model of memory called a multiple-entry modular memory system (MEM). This model characterizes long-term memory as a consequence of processes mediated by independent though interacting subsystems (sensory, perceptual, and reflection). The sensory and perceptual systems are largely responsible for preserving the consequences of perceptual processing, and the reflection system is largely responsible for preserving self-generated events. The sensory system develops associations or schemas involving elementary aspects of perception such as brightness, localization, and direction of movement. The perceptual system stores more complex patterns, those usually associated with the phenomenal objects of perception in relation to each other. The reflection system stores the consequences of such self-initiated activity as organizing, searching for mediators, comparing, and scheming. Reflection involves the conscious construction of patterns and relationships; it is our "commentary" on what is happening to us. Because the reflection system also identifies relations among ongoing events and events from the past and anticipated future of the individual, it is important for giving some memories a personal, "belonging-to-the-self" quality. According to the MEM model, the reflection system is largely responsible for our ability to voluntarily recall past events in the absence of specific external cues. Other demonstrations of memory (e.g., recognition, savings in perceptual processing) are more likely to draw upon the perceptual and sensory subsystems.

Johnson (1983) further suggested that the amnesia found in Korsakoff's syndrome patients results from a deficit in the reflection subsystem in the presence of relatively intact sensory and perceptual subsystems. A number of findings can be interpreted in this framework. For example, the major clinical symptom that defines Korsakoff patients is a profound disruption in their ability to recall

This research was supported by a grant from the National Institute of Mental Health (MH37222).

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events. They do not appear to remember conversations or many other events occurring after the onset of their illness. In more formal tests of memory, they recall virtually nothing of a short story read to them only 40 min before (Haxvy, 1981) and perform abysmally on standard paired-associate tasks (Ryan, Butters, Montgomery, Adinolfi, & Didario, 1980). Recent theorizing about the nature of this deficit converges on the idea that there is some malfunction in initial processing that accounts for such a marked failure of recall. The malfunction has been variously characterized; for example, it has been described as a deficit in semantic processing (Cermak, 1977), strategic processing (Crowder, 1982), episodic processing (Kinsbourne & Wood, 1975), distinctive encoding (Jacoby, 1982), initial learning (Huppert & Piercy, 1982), or a failure to establish vertical associations (Wickelgren, 1979). What these ideas seem to have in common is the suggestion that cognitive processing in the amnesic fails to go beyond the relatively immediate perceptual event. Either Korsakoff patients do not consider relations among events that later may create the conditions for one event cuing another or they cannot later access the products of such thought processes (Warrington & Weiskrantz, 1982). In the MEM framework, it is as if some reflective functions are not engaged in amnesics or as if the products of reflective activity cannot later be revived (Johnson, 1983).

On the other hand, certain other functions of memory seem largely spared in Korsakoff patients. Their knowledge of language and other everyday functions (e.g., how to eat or dress) appears normal. They engage in conversations and are able to comprehend instructions. They are also capable of some types of new learning. For example, in comparison with control subjects, Korsakoffs have shown normal learning of pursuit rotor tasks (Brooks & Baddeley, 1976; Cermak, Lewis, Butters, & Goodglass, 1973), normal benefit from prior exposure in identifying degraded words (Warrington & Weiskrantz, 1970), word completion (Graf, Squire, & Mandler, 1984) and learning to read inverted text (Cohen & Squire, 1980), and a tendency to spell homophones consistent with a recently biased interpretation (Jacoby, 1982).

The spared memory capacity in amnesics has also been variously characterized; for example, it has been described as reflecting an intact semantic memory (Schacter & Tulving, 1982), context-free learning (Kinsbourne & Wood, 1975), procedural knowledge (Cohen & Squire, 1980), memory without awareness (Jacoby, 1982), memory without reference to any particular episode (Moscovitch, in press), intact "horizontal" associations (Wickelgren, 1979), or stimulus–response learning (Warrington & Weiskrantz, 1982). It is harder to find a common idea among these suggestions about intact function than it is to find a common idea in the theoretical proposals about disrupted function. However, we feel one thing many situations resulting in spared memory capacity in amnesics have in common is that they draw on relatively nonreflective processes. They require little reflection either during the initial exposure to the material or during the subsequent test for memory; that is, the tasks are largely perceptual and stimulus-driven. In the MEM framework, performance in such situations is supported by entries in the sensory and perceptual systems, thus the suggestion that these systems are relatively intact in Korsakoff patients.

An important feature of the MEM model is that it emphasizes that memory includes feelings as well as perceptions and thoughts. Furthermore, emotion may originate with experiences that are immediate and perceptual (the smell in a subway station) or that are more self-generated (our speculation about a rumor passed along during a casual conversation). That is, feelings may be associated with specific sensory and perceptual stimuli, or they may be associated with more extensive reflections. Although there has been some controversy recently about the extent to which affect involves reflective processes (Lazarus, 1982; Zajonc, 1980), most affectively-toned experiences are probably combinations of the reflective and nonreflective. Hence, we can reexperience some of our original feeling by regenerating what we thought or by reperceiving some of the same stimuli. We are not completely dependent on either perceptual memories or reflective memories in order to gain access to affectively related responses such as preferences, impressions, attitudes,

and feelings. According to the MEM model, they are part of the information stored in all systems.

This characterization of emotion as embedded in several subsystems in memory suggests that a disruption of the reflection system, as proposed here to occur in Korsakoff's syndrome, would not eliminate the learning of affective responses. For example, MEM predicts that Korsakoff patients may well remember the affective component of events even while forgetting specific facts.

This proves to be a difficult hypothesis to test by examining the experimental amnesic literature. For example, affect, emotion, preference, attitude, or opinions are not discussed in the most recent books dealing with amnesia in general or Korsakoff's syndrome in particular (e.g., Butters & Cermak, 1980; Cermak, 1982). The patients are generally characterized as passive and apathetic after the onset of the syndrome (Butters & Cermak, 1980, p. 10; Talland, 1965, p. 30). Some investigators have speculated that amnesics' poor recall may be a result of a lack of affective reactions during events (see Talland, 1965, for a discussion of this hypothesis). What little attention has been paid to affect and amnesia has not been directed at the acquisition of affective reactions themselves.

Do Korsakoff patients ever change their opinions about, for example, television programs or racial stereotypes? Do they develop new food preferences and aversions? Do they form attachments or antipathies to the people they interact with daily? Questions of this sort do not seem to have been systematically explored. There is some hint that Korsakoff patients may retain emotional reactions over substantial intervals. Baddeley (1982, p. 325) reported an observation by Claparede (1911). Claparede concealed a pin in his hand and pricked an unsuspecting Korsakoff patient. On a subsequent visit, the patient withdrew when Claparede extended his hand, although the patient's memory for the previous incident was quite vague. The observation suggests that feelings may persist in the absence of specific recall.

The present two experiments were an attempt to begin to address the issue of whether Korsakoff patients might acquire general, affective impressions in spite of disruption in their recall for specific detail. The studies were conducted concurrently but are reported separately for clarity.

Experiment 1

Experiment 1 explores the acquisition of affective responses in amnesics by using the exposure effect paradigm (Harrison, 1977; Zajonc, 1968). The exposure effect refers to "the phenomenon of increasing preference for objects that can be induced by virtue of mere repeated exposure" (Zajonc, 1980, p. 160). Zajonc (1980) argued that affect does not depend on extensive cognitive processing. As empirical evidence for this idea, Zajonc described studies on the exposure effect showing that preferences build up with mere repeated exposures even when subjects cannot recognize having experienced the stimulus before (Kunst-Wilson & Zajonc, 1980; Matlin, 1971; Moreland & Zajonc, 1977, 1979; Seamon, Brody, & Kauff, 1983; Wilson, 1975, 1979).

Although MEM proposes that emotion is supported by all three subsystems, the relative involvement of each system is different depending on the situation. As mentioned earlier, some affective responses result mostly or partly from extensive reflective activities. On the other hand, there are other affective responses that depend little on reflections. According to MEM, preferences shown in the exposure effect may depend largely on reactions associated directly with sensory and perceptual information. Assuming that alcoholic Korsakoff patients have a disrupted reflection system in the presence of relatively intact sensory and perceptual systems, we expected that Korsakoff patients should be normal in developing preferences through mere exposures even though they might not remember having been exposed to the materials before.

In Experiment 1, unfamiliar melodies from Korean songs were played. We thought that preferences for previously unfamiliar melodies should be a good example of the type of affective response that may develop in the absence of extensive reflective activity. In the case of melodies, preferences often feel like relatively direct responses to perceptual qualities of stimuli. Throughout the study phase,

some melodies were played 1 time, some 5 times, and others 10 times. Following a 5-min retention interval, equal numbers of old and new melodies were played, and the subjects were asked how much they liked each melody. About 3–4 days later, subjects heard new sets of melodies. Again, some melodies were played 1 time, some 5 times, and others 10 times. This time a recognition test followed a 5-min retention interval. We expected the amnesics to be normal (or relatively unimpaired) on the preference test and to show the usual clear deficit on the recognition test.

Method

Subjects. The amnesic group consisted of nine alcoholic Korsakoff patients located at various nursing homes in the Minneapolis–St. Paul area (eight men and one woman). The ages of eight of the patients ranged from 57–69 (mean = 63.1). One patient was 41-years-old (the mean age including this patient was 60.7). The patients had between 8 and 14 years of education (mean = 12.1). The WAIS verbal comprehension deviation quotients (VDQ; mean VDQ = 101.43) and the perceptual organization deviation quotients (PDQ; mean PDQ = 97.03) were available for seven patients. The prorated IQ of the eighth patient (on the basis of 5 out of 6 verbal tests and 4 out of 5 perceptual tests) was 113. WAIS scores are not available for the ninth patient. In contrast to the normal IQ range indicated by these scores, the patients were severely disrupted in their ability to recall new information. For example, all subjects were tested for paired-associate learning and paragraph recall with the lists and procedures used by Cohen and Squire (1981). The mean score of our patients across three trials of paired-associate learning on 10 unrelated pairs was 0.6, 0.9, and 2.1 (the same values reported by Cohen and Squire for their Korsakoff sample). For paragraph recall, the mean number of ideas out of a total of 21 for immediate and 12-min delayed recall were 4.5 and 0.2, respectively. Again, these values were very close to those reported by Cohen and Squire (4.1 for immediate recall and 0 for delayed recall).

Two control groups (one group of alcoholics and one group of nonalcoholics) were matched with the Korsakoff patients for age and education. The nonalcoholic control group consisted of nine men between the ages of 58 and 69 (mean = 65.3), with between 9 and 15 years of education (mean = 12.7). Participants were recruited from a church and from a senior citizens center. The alcoholic control group consisted of six men between the ages of 54 and 65 (mean = 60.2), with between 8 and 13 years of education (mean = 11.2). The alcoholics were members of Alcoholics Anonymous who had long-term drinking histories and who reported being sober for at least 90 days prior to the experiment. Scores for the alcoholic controls were obtained for the WAIS verbal comprehension deviation quotient (mean = 115.15) and the perceptual organization deviation quotient (mean = 101.5). Their mean paired-associate scores across three trials were 4.61, 7.39, and 8.28. Means for immediate- and delayed-paragraph recall were 10.38 and 8.88, respectively. All subjects were paid for their participation.

Materials. In order to have unfamiliar, neutral melodies for stimulus material, 48 melodies from Korean songs were prepared. Each melody was played on a piano in single notes and lasted 6–8 s. Initially, more than 48 melodies were recorded, and five people (who did not otherwise participate in the study) rated them for attractiveness and initial impression. Melodies that were rated as very strange, unpleasant, or familiar were excluded.

Each subject received four sets of melodies, 12 melodies per set. Half of the subjects received Set 1 and 2 on the first day and Set 3 and Set 4 on the second day; the other half received Set 3 and Set 4 on the first day and Set 1 and 2 on the second day. In each set there were two versions, *A* and *B*. *A* and *B* were counterbalanced so that half of the subjects were assigned to the *A* version and the other half to the *B* version. In the *A* version, six items in each set were used as old items and the remaining six items in each set were used as distractors on the later preference or recognition tests. Old and new items were reversed in the *B* version. Among old items, two melodies were played just once, two melodies were played 5 times, and two melodies were played 10 times in the acquisition phase. On the basis of the initial ratings of the five judges, melodies were assigned to the three different number of exposure conditions (1 time, 5 times, or 10 times) in such a way that the average initial ratings of preference for melodies in those three conditions were approximately the same.

With two melodies played once each, two melodies 5 times each, and two melodies 10 times each, the acquisition phase consisted of 32 items. Four different acquisition orders were made so that any particular melody was not played consecutively, and melodies from each condition (1 time, 5 times, or 10 times) were equally distributed across acquisition orders.

The test list for each set consisted of six old melodies and six distractors. The order of each test list was prepared such that each pair of consecutive melodies (one old and one new) could serve as one forced-choice trial.

Procedure. Each subject was tested individually. On Day 1, subjects had two sets of melodies. In each set of melodies, subjects were told that this study was to find out what makes music sound like one style or another (for example, what aspects of music make it sound American or Chinese). The subjects were instructed to listen to each melody carefully and to check *American, Chinese,* or *neither,* depending on what each melody sounded like to them. It was explained that there was no right or wrong answer and what was right was how each melody sounded to them as they heard it. Subjects were also told that some of the melodies would be repeated and some would not and that it was not necessary for the answers for the same melody to be consistent because the opinions of what is American or Chinese might change as they listen to more of the melodies. This orienting task was used to made sure that the subjects were really attending to the stimulus material. The 32 melodies in each session were played by tape recorder, and there was a 5-s intertrial interval between consecutive melodies. The subjects did not have any problem keeping up with the tape recorder's 5-s pace.

After the acquisition phase, there was approximately a 5-min retention interval filled with conversation and the instructions for the preference test. The preference test consisted of six old and six new melodies. Subjects were instructed to check how much they liked each melody by choosing a phrase that best expressed their opinion, from *like most, like somewhat, no opinion, dislike somewhat,* and *dislike most.* After each melody, the experimenter stopped the tape recorder and allowed as much time as subjects wanted.

On Day 2, from 2 to 6 days after Day 1 (mean interval between Day 1 and Day 2 was 3.6, 3.9, and 3.5 for Korsakoffs, nonalcoholic controls, and alcoholics, respectively), subjects were given two new sets of melodies. For each set of melodies, the orienting task in the acquisition phase (*American, Chinese,* or *neither*) was exactly the same as the one on Day 1. However, after the 5-min retention interval, subjects were given a recognition test; subjects decided which melody out of each pair (one new and one old) sounded more familiar and also decided how sure they were of their answers by choosing from *very sure, quite sure,* and *guessing.*

It would be desirable to have preference ratings and recognition performance for the same melodies within-subjects. However, because it is not clear that repeated testing of the same item would have the same effects for Korsakoffs and controls, we adopted the alternative procedure of testing preference and recognition on comparable materials within-subjects, with specific items counterbalanced between test conditions across-subjects.

Results

Preference test. Table 1 shows mean preference ratings for melodies (averaged across the two sets) as a function of number of exposures for Korsakoff patients and control subjects. Scores from 1 to 5 were given to the scale of *dislike most, dislike somewhat, no opinion, like somewhat,* and *like most,* so that the higher the score the more preferred each melody was. For both Korsakoffs and controls, the ratings even after 10 exposures were well below ceiling. An analysis of variance (ANOVA) revealed a main effect of number of exposures, $F(3, 63) = 3.77$, $MS_e = .14$, $p < .01$. However, neither the Subject Group, nor the interaction of number of Exposures × Subject Group were significant. Subsequent analyses indicated that for both Korsakoffs and nonalcoholic controls, given some exposure, the number of exposures (1, 5, or 10) did not matter. A comparison of zero versus the 1, 5, and 10 exposures combined indicated that for both Korsakoffs and nonalcoholic controls preferences were greater after some exposures than after none, $F(1, 8) = 8.05$, $MS_e = .07$, $p < .02$ and $F(1, 8) = 5.04$, $MS_e = .08$, $p < .05$, respectively. In the alcoholic control group, although the mean preference after 10 exposures was greater than it was after fewer exposures, no comparisons were independently significant, probably because of the small number of subjects ($n = 6$) in this condition.

Table 1
Mean Preference Ratings for New and Repeated Melodies

	Number of exposures			
Group	(new) 0	1	5	10
Korsakoffs	3.74	4.06	4.06	4.19
Nonalcoholic controls	3.46	3.72	3.78	3.81
Alcoholic controls	3.39	3.29	3.42	3.71

Note. The higher the rating score, the more preferred the melody.

Table 2
Recognition Performance Reflecting Confidence Ratings

	Number of exposures		
Group	1	5	10
Korsakoffs	3.36	4.28	4.36
Nonalcoholic controls	3.94	4.81	5.39
Alcoholic controls	3.50	4.88	5.38

These results show that both Korsakoff patients and nonalcoholic control subjects liked previously heard melodies significantly more than new melodies. Most important, there was no group difference; the exposure effect shown by Korsakoff patients was equal to that shown by control subjects.

Recognition test. Table 2 shows recognition performance (averaged across the two sets) weighted according to subjects' confidence ratings. When subjects recognized an old melody, they got one of the scores, 4, 5, or 6, depending on their confidence ratings: 4 points for *guessing,* 5 points for *quite sure,* and 6 points for *very sure.* Similarly, when they falsely recognized a new melody, they got one of the scores 1, 2, or 3: 1 point for *very sure,* 2 points for *quite sure,* and 3 points for *guessing.* Thus, the higher the score, the

better the recognition. An ANOVA revealed main effects of number of exposures, $F(2, 42) = 28.61$, $MS_e = .45$, $p < .001$, and subject group, $F(2, 21) = 6.10$, $MS_e = .62$, $p < .01$. There was no interaction between number of exposures and subject group. Alcoholics and nonalcoholic controls did not differ, and Korsakoffs had poorer recognition than either nonalcoholic controls, $F(1, 16) = 8.81$, $MS_e = .78$, $p < .01$, or alcoholic controls, $F(1, 13) = 5.54$, $MS_e = .66$, $p < .04$.

Subsequent analyses of control subjects showed that their recognition performance was higher for 5-exposure melodies than for 1-exposure melodies, $F(1, 8) = 5.69$, $MS_e = .58$, $p < .04$, and $F(1, 5) = 15.78$, $MS_e = .36$, $p < .01$, for nonalcoholics and alcoholics, respectively, and higher for 10-exposure melodies than for 5-exposure melodies, $F(1, 8) = 14.00$, $MS_e = .11$, $p < .01$, and $F(1, 5) = 6.67$, $MS_e = .11$, $p < .05$, for nonalcoholics and alcoholics, respectively. Subsequent analyses of Korsakoff patients showed that their performance on 5-exposure melodies or 10-exposure melodies was higher than that on 1-exposure melodies, $F(1, 8) = 15.13$, $MS_e = .25$, $p < .01$, and $F(1, 8) = 7.68$, $MS_e = .59$, $p < .02$. The difference between 5 and 10 exposures was not significant for Korsakoffs.

Table 3 shows the probability of correctly recognizing old melodies in the recognition test. The results are similar to those based on the confidence ratings (shown in Table 2). An ANOVA revealed main effects of number of exposures, $F(2, 42) = 21.66$, $MS_e = .04$, $p < .001$, and subject group, $F(2, 21) = 7.80$, $MS_e = .05$, $p < .01$. Again, there was no interaction between number of exposures and subject group. The nonalcoholics and alcoholics did not differ, and recognition was lower in the Korsakoff group than it was in either nonalcoholic, $F(1, 16) = 12.29$, $MS_e = .06$, $p < .01$, or alcoholic controls, $F(1, 13) = 5.75$, $MS_e = .06$, $p < .03$.

Because there was some difference in the average WAIS scores for Korsakoffs and alcoholics, the recognition analyses were repeated, comparing four Korsakoffs and four alcoholics who were matched closely on age (means: K = 63, A = 62), VDQ (means: K = 106, A = 107), and PDQ (means: K = 97, A = 98). The pattern was as reported earlier, indicating the recognition deficit in the Korsakoff group cannot be attributed to the somewhat lower IQ of the group as a whole.

Table 3
Probability of Correctly Recognizing Old Melodies

Group	Number of exposures		
	1	5	10
Korsakoffs	.42	.75	.61
Nonalcoholic controls	.64	.89	.97
Alcoholic controls	.46	.92	.96

Overall, results from the recognition tests (Tables 2 and 3) show that Korsakoff patients' recognition memory for melodies was impaired in comparison with that of control subjects. Although Korsakoff patients showed improved recognition with more exposures (5 or 10 exposures vs. 1 exposure), they were still substantially below the controls.

Discussion

According to the MEM model, memory includes affect (e.g., feelings, impressions, preferences, attitudes, and so on) as well as perceptions and thoughts. Furthermore, affect is embedded in all three subsystems (sensory, perceptual, and reflection). Emotion may be associated with specific sensory and perceptual experiences or with reflections. Therefore, most affectively-toned experiences are combinations of reflective and nonreflective functions, though there is differential involvement of the reflective and the nonreflective subsystems depending on the situation.

We have suggested that amnesia results from a deficit mainly in the reflection system in the presence of relatively intact sensory and perceptual systems (Johnson, 1983). Therefore, we reasoned that in situations in which preferences are largely based on the perceptual qualities of objects, Korsakoff amnesics should be relatively unimpaired in the development of preferences because in such situations the absence of reflection should not be any particular disadvantage.

The results of Experiment 1 fit these expectations quite well. Alcoholic Korsakoff patients showed the same increase in preference for melodies as a consequence of prior

exposures as nonalcoholic control subjects did. Although Korsakoff patients' preference ratings were indistinguishable from those of control subjects, Korsakoff patients had significantly lower recognition scores in comparison with controls. Thus, we have a clear example of the acquisition of affective responses even though specific memory is disrupted. Furthermore, our results are consistent with other studies of the exposure effect, showing that even normal people sometimes develop preferences for exposed stimulus material (e.g., random shapes, random tones, or melodies) in the absence of conscious remembering (Kunst-Wilson & Zajonc, 1980; Moreland & Zajonc, 1977; Seamon et al., 1983; Wilson, 1975, 1979).

Experiment 2

In the second experiment, we used a situation that we thought would be more likely to draw on reflective functions. Subjects were shown pictures of two young men and were asked to give their impression of each by rating him on several characteristics, such as honesty and politeness. Then, subjects heard a few paragraphs describing events in the life of each person. One man was depicted as a "good guy" (he helped his father, he received a Navy commendation for saving someone from drowning, etc.), and the other was depicted as a "bad guy" (he stole things, broke his wife's arm in a fight, etc.). After a retention interval, the patients were shown each picture again and were asked about their impressions. Subjects were also asked which man they preferred, tested for recognition of the pictures, and for free and cued recall of the biographical information. We expected that Korsakoff patients would show little recall of the biographical information but would nevertheless prefer the good guy and change their ratings in the direction of the biographical information because the presentation of the picture during the preference and rating tasks should activate affective responses that became associated with the picture in the sensory and perceptual subsystems when the subject heard the biographical information. However, control subjects should be able to recover earlier reflections as well. Hence we expected controls to show greater changes in affect than amnesics in this situation.

Method

Subjects. The subjects were the same as those in Experiment 1.

Materials. Two color photographs of young men that were roughly comparable in attractiveness served as study pictures. For any given subject, one picture was named Bill and the other John. Pictures were counterbalanced so that half of the subjects received one picture as Bill, and the other half of the subjects received the same picture as John, and vice versa. Two other pictures were used as distractors on recognition tests. Each distractor item was matched with its corresponding target picture for hair color (one target was light and one darker).

Biographical information about Bill and John was created and tape recorded. This information is as follows:

Bill

In high school, Bill came to class late, and yelled at the teachers. Once he stole a car. Another time he robbed an old man who lived in the neighborhood. Bill joined the Army, but did not like being told what to do. He cut a man in a fight with a knife and was given a dishonorable discharge from the Army. Bill moved in with his mother and enrolled in the local college, but quickly flunked out. He argued a lot with his mother and once hit her during a fight. Bill got a job as a night watchman in a department store. The manager caught him stealing some clothing and a TV set and fired him. Bill married a woman who works at the department store. Bill and his wife fight often. Once she had to go to the emergency room at the hospital because he broke her arm.

John

John was captain of the high school football team. His grades were good, even though he worked nights helping out at his father's gas station. John joined the Navy and liked it quite a bit. Once, during a storm, one of the other sailors fell overboard and John saved him. John received a commendation for the rescue. After the Navy, John worked at a grocery store, shared an apartment with a friend from the Navy, and went to college. He took business courses and enjoyed them. John was recently promoted and now is in charge of several grocery stores. John married a woman who teaches at a local nursery school. John and his wife are waiting a few years to have children so they can travel some first.

Procedure. Each subject was tested individually. Subjects were told that they were participating in a study to find out what characteristics of people determine the impression they make. First, subjects were shown a picture of Bill and were asked to rate Bill on each of the following 20 characteristics: honest, polite, independent, generous, practical, cool-headed, out-going, tolerant, energetic, happy, intelligent, reliable, patient, brave, popular, cautious, optimistic, mature, competent, and skilled. For each characteristic, subjects indicated how they thought Bill compared with people in general. For example, the scale for honesty was *more honest than most of the people, more honest than many people, average, less honest than many people,* and *less honest than most of the people.* After subjects finished rating Bill, they were shown a picture of John and were asked to rate

Table 4
Percentages of Subjects Preferring the "Good Guy" and Recognizing Both Target Pictures

	Day 1				Day 2						Day 3		
	T_1		T_2		T_3			T_4			T_5		
	IR	Bio	IR	Bio	Pref[a]	IR	Bio	Recog[b]	Pref[a]	IR	Recog[b]	Pref[a]	IR
Preference													
Korsakoffs					78				89			78	
Nonalcoholic controls					100				100			100	
Alcoholic controls					100				100			—	
Forced-choice recognition													
Korsakoffs								100			100		
Nonalcoholic controls								100			100		
Alcoholic controls								100			—		

Note. The table also indicates when these tests took place in relation to the impression ratings task (see Figure 1) and presentation of the biographical information. IR = impression ratings; Bio = biographical information; Pref = preference test; Recog = recognition test; T = time.
[a] In the preference test, subjects chose one picture, Bill or John. [b] In the recognition test each target was presented with a distractor.

John on the same 20 characteristics. Then, subjects heard the taped information about Bill, and the taped information about John. While the information was being played, the appropriate picture was placed before the subject so that it was visible while subjects listened to the information about the person. About 2 hr later, during which subjects participated in Experiment 1, each subject went through exactly the same procedure, rating Bill and John on the 20 characteristics and hearing the taped information about Bill and John. The experimenter did not mention anything about the subjects' having done the same thing previously.

The second test session was scheduled from 2 to 6 days after the first (mean interval between Day 1 and Day 2 was 3.6, 3.9, and 3.5, for Korsakoffs, nonalcoholic controls, and alcoholic controls, respectively). At the beginning of the second day, subjects were shown the pictures of Bill and John and were asked "Who do you like better?" and "Who do you think is a nicer person?" Subjects were asked why they picked the picture they did. Then subjects rated Bill and John and listened to the tape again, following the same procedure as on the first day. About one and a half hours later, during which time subjects participated in Experiment 1, a recognition test was given. First, subjects were presented with the picture of Bill and the matched distractor and asked which person was more familiar. They were also asked why they thought that picture was more familiar. Subjects were also asked whether they had seen the pictures or not and were asked to tell whatever they knew about the persons in the pictures. Then the picture of John, along with its matched distractor, was presented, and the same procedure was followed. After these recognition tests, the subject was shown the pictures of Bill and John and asked whom he or she liked better and why. Then, subjects rated Bill and John on the 20 characteristics.

The third test session was scheduled from 10 to 29 days after the second (mean interval between Day 2 and Day 3 was 19.6 and 21.2 for Korsakoffs and nonalcoholic controls, respectively). Because alcoholic subjects did not differ from nonalcoholic controls over the first 2 days of testing, they did not go through the Day 3 procedures. On the third day, subjects received the same recognition test as on the second day. Then, they were shown the pictures of Bill and John and asked whom they liked better or who they thought was a nicer person. Subjects were also asked whether they remembered the names of the people in the pictures. Following this, subjects rated Bill and John on the 20 characteristics. Then, subjects were given a free-recall test followed by a probed-recall test on the biographical information they had heard about Bill and John.

Results

Preference tests. Table 4 summarizes the procedure for each of the 3 days and presents the data for the three preference tests where subjects were shown the pictures of John and Bill and asked to pick the nicer (or preferable) person. On Day 1, subjects heard the biographical information about each man twice. The first preference test came an average of 3.83 days later. Notably, 78% (seven out of nine) of the Korsakoff patients expressed a preference for John (the good guy). The second preference test was also on Day 2, approximately 2 hr after a third cycle through the impression ratings and biographical in-

formation. On this preference test, 89% (eight out of nine) of the Korsakoff patients preferred John. The final preference test was given on Day 3, approximately 20 days after the third and final exposure to the biographical information. Again, even after this substantial retention interval, 78% of the Korsakoff patients preferred John. One Korsakoff patient consistently chose Bill (the bad guy) on all three preference tests; another patient refused to choose either Bill or John (saying "how can I choose?") on the first and third tests, but chose John on the second test. As would be expected, on all three preference tests, 100% of the control subjects thought that John was nicer.

Recall of biographical information. Subjects were also asked why they preferred the man they did. On all three of the preference tests, all control subjects reported that they chose John because of the information they had heard about the two men.

On the first preference test, only one patient reported that he had heard some information about the two people. On the second preference test, four patients seemed to base their answers on information they remembered (e.g., "I've heard that the other person was a mean person." "You told me that this guy was more educated." "I remember this guy was a nicer person.") and two patients reported that they remembered having heard some information about the pictures but they could not remember what (e.g., "Something you told me about him, but I don't remember anything, and I feel that he is a nicer person.").

Responses on the third preference test (Day 3) looked more like responses on the first test. One patient seemed to have some memory for the previous information ("He wasn't too well adjusted in society."). The patient who had shown some memory on the first test was sure he had heard information and reported several details from the biographies correctly. He was the youngest patient (41-years-old) and seemed to be the least impaired of the patients, although he had been diagnosed as being in a stable Korsakoff stage. For the most part, Korsakoff patients made their choice on the basis of appearance (e.g., "He looks nice.").

At the end of Day 3, subjects also attempted to free recall as much of the biographical information as they could. Recall of idea units was scored leniently (e.g., a subject would receive credit for saying that "He committed some crimes" without specifying that Bill stole a car or robbed an old man). Even with a lenient criterion, the number of idea units recalled by Korsakoff patients was neglible (across all patients only seven ideas were recalled and four of these were from the one patient mentioned earlier). The nonalcoholic control subjects, on the other hand, recalled about 32% of the information about Bill and 39% of the information about John.

Free recall was followed immediately by probed recall. A series of questions were read, each designed to cue recall of specific ideas in the biographical information (e.g., the first three questions about Bill were: Do you remember how he did in high school? Did he steal anything? Did he go into the Army or Navy?, etc.). The probes produced a slight increase in Korsakoffs' recall (mean number of ideas recalled were 2.25 and 3.51 out of 22 for Bill and John, respectively). Even these low values probably overestimate what Korsakoff patients remembered, because it was possible to get some two-choice questions correct by chance. In contrast, mean cued recall in the control group was 10.50 and 12.00 for Bill and John, respectively.

Recognition tests. Table 4 shows where in the procedure the two recognition tests were administered and shows the results. Each forced-choice recognition test consisted of the two target pictures, each paired with a distractor (the distractors were the same for both recognition tests). The first test came after the subjects had seen the pictures on three occasions, most recently about 2 hr previously. The second test came after an average retention interval of 20 days. All subjects correctly recognized both target pictures on both tests.

Although it is not the major focus of the present study, the excellent recognition performance of the Korsakoff patients deserves comment. To be sure, there were only two pictures and the test was by the forced-choice method, thus this was an extremely easy recognition test. However, given the usual emphasis in the literature on the failure of amnesics to remember people, it is notable that these patients recognized two faces with 100% accuracy after a 20-day retention inter-

val. Similar high recognition of faces by Korsakoff patients on an immediate test was reported by Biber, Butters, Rosen, Gerstman, and Mattis (1981).

Impression ratings.[1] In analyzing the subjects' ratings of Bill and John on the 20 characteristics, the responses were *more than most of the people* (5), *more than many* (4), *average* (3), *less than many* (2), *less than most of the people* (1). Therefore, the higher the score, the more positively Bill or John was rated (mean ratings are shown in Figure 1). An analysis was first conducted that compared the alcoholic and nonalcoholic controls on the four occasions that impression ratings were taken in both subject groups. As is clear from Figure 1, alcoholic and nonalcoholic subjects did not differ, $F(1, 12) = .30$, $MS_e = .15$. Next, Korsakoff patients were compared with nonalcoholic controls over the five occasions (that is, including Day 3) that impression ratings were taken in both groups. An ANOVA revealed a 3-way interaction of Time × Bill/John × Korsakoff/Nonalcoholic control group, $F(4, 56) = 15.56$, $MS_e = .08$, $p < .001$. The same three-way interaction was obtained in an analysis based on the previously mentioned subset of Korsakoffs ($n = 4$) and alcoholics ($n = 4$) who were closely matched on age, VDQ and PDQ.

Subsequent analyses of nonalcoholic control subjects' data showed significant changes in ratings of Bill between Time 1 and Time 2, $F(1, 9) = 63.46$, $MS_e = .12$, $p < .001$, and for John between Time 1 and Time 2, $F(1, 9) = 22.97$, $MS_e = .07$, $p < .001$, and no significant changes after Time 2. Thus the major changes in ratings came after subjects had heard the biographical information for the first time and persisted over substantial intervals.

A separate ANOVA of Korsakoff patients' data showed a main effect for Bill versus John, $F(1, 7) = 5.31$, $MS_e = .62$, $p < .05$, and, more important, an interaction between time and Bill/John, $F(4, 28) = 2.88$, $MS_e = .09$, $p < .04$. Subsequent analyses indicated that ratings for John did not change significantly, whereas ratings for Bill did, Time 1 versus Time 5, $F(1, 7) = 5.73$, $MS_e = .17$, $p < .05$.

Direct versus indirect information. The autobiographical sketches bear directly on some of the rating scales (e.g., Bill's honesty) and only indirectly on others (e.g., Bill's optimism). It was of interest to determine whether the impressions formed of Bill and John were global (horns and halo, respectively) or more specifically tied to the semantic content of the information provided.

Direct and indirect characteristics were decided on the basis of ratings given by eight psychology graduate students. Table 5 shows impression ratings for the 10 most direct and 10 most indirect characteristics determined for Bill and John separately. In Table 5 the ratings are summed over all the available measures, excluding the first rating (Time 1), which occurred prior to the first presentation of the biographical information. In an analysis comparing Korsakoffs with nonalcoholic controls, there was a significant three-way interaction involving group, direct/indirectness, and Bill/John, $F(1, 14) = 7.27$, $MS_e = .15$, $p < .02$. The same 3-way interaction was significant when Korsakoffs were compared with alcoholic controls, $F(1, 12) = 5.36$, $MS_e = .10$, $p < .04$. The source of these 3-way interactions was clear from subsequent analyses of each group separately. Korsakoff patients showed no main effect of direct/indirectness and no interaction involving direct/indirectness of information. However, analysis of the nonalcoholic control group showed a significant Direct/Indirectness × Bill/John interaction, $F(1, 7) = 12.11$, $MS_e = .22$, $p < .01$. From Table 5, direct information led to higher ratings for John and lower ratings for Bill in comparison with indirect information. For the alcoholic control group, the interaction between direct/indirectness and Bill/John was also significant, $F(1, 5) = 18.92$, $MS_e = .06$, $p < .01$. From Table 5, direct information in comparison with indirect information led to lower ratings for Bill, but directness did not seem to affect ratings for John. Overall, direct information influenced ratings in the appropriate direction

[1] After one Korsakoff subject was tested, a change was made in the procedure used to collect the impression ratings. Hence the analyses for impression data are based on eight Korsakoffs, eight nonalcoholic controls (data from one subject were randomly discarded, with the restriction that counterbalancing of the assignment of pictures to biographical information matched the Korsakoff patients) and six alcoholic controls.

more than indirect information for the control groups, whereas this was not the case for Korsakoff patients. Korsakoff patients' ratings seem to reflect more general feelings or attitudes rather than the influence of specific detailed information.

Recognition and preference a year later. The present results demonstrate the clear development of affective reactions in Korsakoff patients. Furthermore, recognition and affect both appear to persist over substantial intervals for these amnesic patients. In fact, approximately a year after the present experiment, the Korsakoff patients were again tested for their recognition and preference for the pictures. The two target pictures were paired with the previously used distractors for two forced-choice recognition items. Whereas only 5 of the 9 subjects correctly selected the good guy over the corresponding distractor, all of the patients correctly selected the bad guy as more familiar than the distractor. When the two target pictures were paired and the subjects were asked to select the man they preferred, 6 of the 9 subjects chose the good guy. Thus, recognition was especially good for the bad guy, but subjects tended to prefer the good guy. Evidently, the

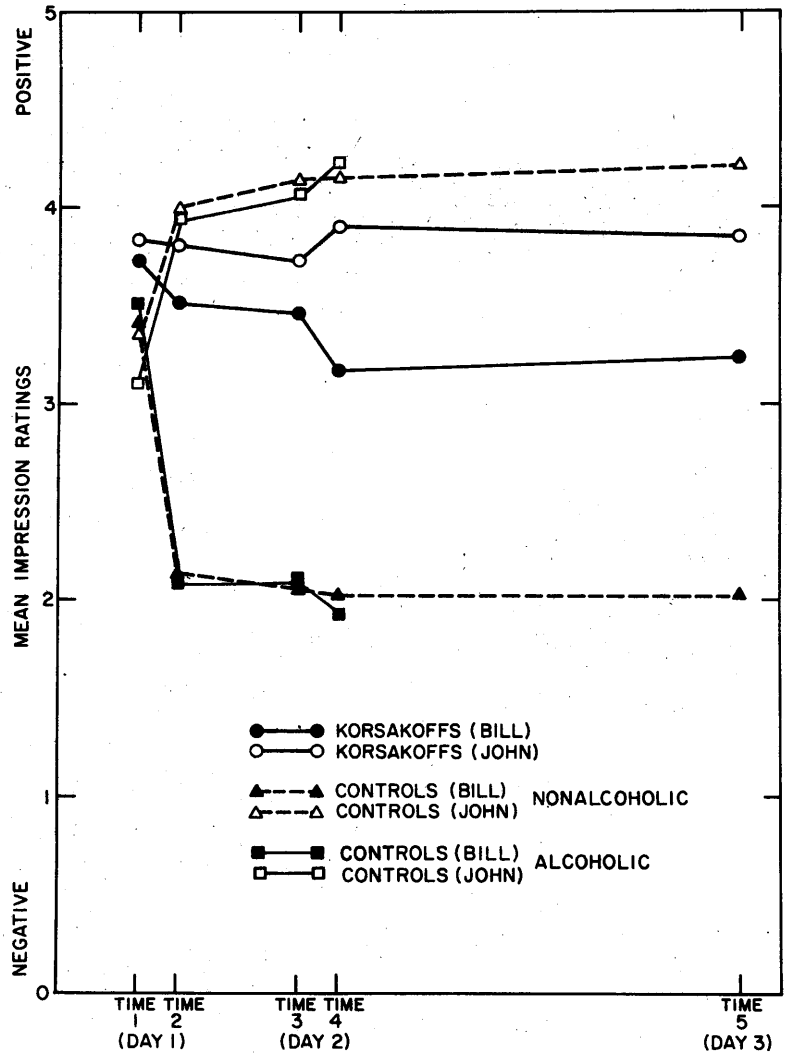

Figure 1. Mean impression ratings (Experiment 2).

preference judgments were based on something other than familiarity per se, even after a year retention interval. On the contrary, given that the Korsakoffs originally changed their opinion more about the bad guy than about the good guy (see Figure 1), it is tempting to conclude that the high recognition of the bad guy after a year reflects the role of affect in recognition rather than vice versa. Overall, our findings for Korsakoff patients are consistent with the idea, developed from studies of affect and memory in normal subjects, that affective reactions are not necessarily mediated by recall of relevant information (e.g., Fiske, 1982), nor necessarily mediated by recognition processes (Zajonc, 1980).

Discussion

The biographical information presented to Korsakoff patients had a strong impact on their judgments of which of two men was nicer. Even after 20 days, 7 out of 9 patients chose the good guy in preference to the bad guy. Furthermore, although initially the Korsakoff patients' impressions of the traits (e.g., honesty, optimism) of the two men did not differ, their ratings diverged after the subjects heard the biographical information.

According to the MEM model, affective responses are supported by all memory subsystems. Assuming that the reflection system is deficient in Korsakoff patients, the fact that their preferences and impressions of people change supports the idea that affect is stored in other systems as well. At the same time, the fact that the change in impression was much weaker in Korsakoffs than normals points to an important role for the reflection system in emotion. Evidently, the recall of specific details can influence affective ratings, as indicated by the more extreme ratings of the normal subjects.

Consistent with this, the ratings of control subjects were more influenced when the particular characteristics had been commented on directly in the biographical information than when the characteristics had not been commented on directly, suggesting that recall of specific information was to some extent mediating their impressions. In contrast, Korsakoffs' ratings were not influenced by whether the characteristics were directly or only indirectly implied in the biographical descriptions. This, along with the absence of recall of detail about the biographical information in the Korsakoff patients, supports the idea that their impression ratings and preferences of John over Bill were not mediated by recall of specific information.

Table 5
Impression Ratings of Bill and John on Characteristics Directly and Indirectly Mentioned in the Biographical Information

	Korsakoff patients[a]		Nonalcoholic controls[a]		Alcoholic controls[b]	
	Direct	Indirect	Direct	Indirect	Direct	Indirect
Bill	3.30	3.38	1.89	2.20	1.83	2.24
John	3.78	3.86	4.25	3.98	4.10	4.03

Note. The higher the score, the more favorable the rating. [a] Summed over 4 measures. [b] Summed over 3 measures.

General Discussion

In Experiment 2, Korsakoff patients developed less extreme impressions of people than did controls. On the other hand, in Experiment 1, the development of preferences for melodies in Korsakoff patients was the same as that in normal controls. What can account for the normal development of affect in the one case and the significant, but clearly disrupted development of affect in the other? Differences in the results of the two studies are interpretable within the MEM framework. The explanation we favor is that, in comparison with melodies, in developing preferences for people there is much more room for reflection functions to operate, especially when the subject is receiving specific details about the lives of the people. Some affective responses are presumably tied to whatever reflection activities subjects engaged in while hearing the autobiographical information (e.g., evaluating the severity of misdeeds, comparing the people to other people they have known, etc.), as well as to the perceptual features of the pictures. Later reinstatement of the perceptual cues from the pictures would serve to revive some affective components, but other aspects of the total affective

response would depend on reinstatement of the previous reflective activity. Normal subjects could cue themselves with recall of specific autobiographical details and would therefore have a more embellished affective response. Thus, we propose that the amnesics' inability to recall specific information about the men in the photographs was responsible for their weaker affective responses in comparison with controls, but that the affective components associated with sensory/perceptual features of the situation accounted for their nonetheless significant change in impressions based on experience. From the present data alone, we are unable to say whether Korsakoff patients were less likely to engage in reflection during initial processing of the biographical information or were less able to revive the products of reflective activity later, during the impression ratings. Reflective deficits very likely occur at both stages.

In summary, our two experiments indicate that Korsakoff patients retain the capacity to develop affective reactions. Furthermore, the findings are consistent with the idea that affect is stored in all three memory subsystems as suggested by the MEM model (Johnson, 1983). These findings also support the idea that the relative involvement of each of the three systems is different in different affective responses. Some affective responses, such as liking melodies or liking random shapes, depend mostly on sensory and perceptual systems. These affective responses are the kind of affective responses on which Zajonc (1980) based his arguments that affect does not depend on cognition. However, there are situations in which reflections play an important role in the development of affect and the retrieval of affective responses (Johnson, 1983). Some affectively-related responses are derived from reflective, self-generated experiences (e.g., getting angry in retrospect about a remark made during a previous conversation). Then, the regeneration of what we thought helps us remember our original feelings. In these cases, the recall of specific information on which our previous affective responses are based is important in the retrieval of our original emotion (Experiment 2). How much acquisition of affective responses we should expect from Korsakoff amnesics in any particular case depends on the relative involvement of various subsystems in supporting the affective responses in normal subjects.

The present results extend our knowledge of amnesia in that they demonstrate the clear development of affective reactions in Korsakoff patients. Furthermore, under some conditions, Korsakoffs' acquisition of affect seems to be normal (Experiment 1). Thus, affect should be added to the growing list of potentially spared memory capacities in amnesia and must be taken into account by theories of amnesia, especially those that attempt to characterize amnesia in terms of subsystems in memory. As they now stand, current theories such as the procedural/declarative distinction (Cohen & Squire, 1980) and the semantic/episodic distinction (Cermak, in press; Schachter & Tulving, 1982), do not directly speak to the issue of the acquisition of affect, and it is not obvious how to extend them so that they do. Our results fit more confortably with the suggestions of Jacoby (in press) and Moscovitch (in press). Both emphasize that spared memory should occur in situations where the test is indirect and does not require the subject to claim that he or she specifically remembers an episode. Asking subjects which melody they prefer or to rate pictures of people on various personality dimensions are indirect tests, and Korsakoffs do show effects of prior experience under these conditions. However, more is involved than the indirectness of the memory test. Under what circumstances should we expect amnesics to appear normal on an indirect test and under what conditions should we expect amnesics to show deficits on indirect tests? The MEM model suggests that on indirect tests supported by entries largely in the sensory and perceptual systems, amnesics will show relatively normal performance. On indirect tests supported by entries largely in the reflective system, amnesics should be at a disadvantage, in spite of the fact that the test is incidental.[2]

[2] The same type of argument can be made regarding "procedural" knowledge. If a test situation provides a good many perceptual cues for activating and maintaining ongoing procedures, amnesics should do relatively well. If the procedures for normal performance are not well supported by perceptual cues and require subjects to provide their own, a skill should be difficult and perhaps impossible for amnesics to learn.

These two experiments only scratch the surface of a complex issue, namely to what extent Korsakoff patients and other amnesics retain the affective components from experiences while the experiences themselves remain largely unavailable. Although the present experiments do not provide a strong test of the MEM model, the results are consistent with the MEM framework and indicate that it may be useful in generating hypotheses and interpreting findings about the disruption of memory functions.

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Received August 3, 1983
Revision received April 3, 1984 ■