The Effect of Cuing on Release From Proactive Interference in Korsakoff Amnesic Patients

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Korsakoff amnesic and alcoholic control patients were asked to recall successive lists of nine nouns of the same category. The expected progressive decrease in recall was reversed by a category shift on the fifth list for controls but not for amnesics. A context shift on the fifth list (changed color of words and background) led to improved performance by amnesics but not by controls. However, amnesics did show "release from proactive interference" at category shift if it was the second shift in a sequence (on trial nine) or if they were told to expect the shift. These findings relate amnesics' known vulnerability to proactive interference to an impaired use of available cues to segregate new from old material—unless the cues are made additionally salient. This difficulty could operate both during learning and at retrieval.

The amnesic syndrome, as manifested in patients with Korsakoff psychosis and related organic conditions, is characterized by a profound memory disorder particularly for events that occurred after the onset of the disease. In contrast, other cognitive functions remain relatively intact. (The major theoretical and experimental issues pertinent to the amnesic syndrome are documented in several recent reviews, e.g., Butters & Cermak, 1975; Kinsbourne & Wood, 1975; Rozin, 1976; Weiskrantz & Warrington, 1975). There is controversy concerning the precise nature of the dysfunction, but it is generally agreed that an exaggerated vulnerability to interference is a primary symptom.

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The difficulties Korsakoff patients have with interference are reflected by their tendency to emit responses corresponding to competing associations. Performance improves, however, when response competition is reduced, for example, by providing cues that effectively constrain the class of items or events from which the amnesic must choose a response (Cermak, Butters, & Gerrein, 1973; Warrington & Weiskrantz, 1970; Winocur & Kinsbourne, 1978; Winocur & Weiskrantz, 1976). These cues may be either some partial information about the stimuli to be recalled (Warrington & Weiskrantz, 1970), the taxonomic category from which the items were chosen (Cermak et al., 1973), or even extrinsic cues that help distinguish test situations from irrelevant ones (Winocur & Kinsbourne, 1978). The results of such cuing experiments suggest that amnesics require more salient discriminative information than is normally available to make the types of adjustments required in high interference situations.

A useful task for assessing the effects of interference is the release from proactive interference (PI) paradigm (Wickens, 1970). Four successive lists of words drawn from the same category (e.g., animals) are followed by a fifth list of words drawn from a different category (e.g., occupations). After each list the subject counts backward for a
fixed period and then attempts to recall words from that list. Normal subjects’ accuracy declines progressively from Lists 1–4 as PI builds up, but it recovers in List 5 with a release from PI. Two studies of amnesic patients using this task (Cermak, Butters, & Moreines, 1974; Kinsbourne & Wood, 1975) are consistent in showing that amnesics behave as do controls throughout Lists 1–4 but fail to show the expected improved learning immediately following a change in category in List 5.

The interpretation of this deficit offered by Winocur and Kinsbourne (1978), which may be generally applicable to the Korsakoff amnesics’ dysfunction, emphasizes an impaired use of cues that differentiate a new situation from similar experiences. Faced with pertinent changes, Korsakoff patients continue to respond in terms of previously formed associations that may no longer be appropriate. In the PI-release test, the variable cues on the release trial simply failed to alert amnesics to the need to adopt a modified strategy. It follows that amnesics should behave more flexibly on such a task if new items are rendered more discriminable from preceding items. The validity of this prediction is examined in the present research by using contextual cues to vary the relative distinctiveness of task components within a PI-release paradigm.

General Method

Subjects

Experimental subjects were drawn from populations of clinically diagnosed Korsakoff alcoholics (n = 13; 12 males, 1 female) who were institutionalized in the London, Ontario, or Boston, Massachusetts areas. All patients were severely amnesic, although there was no evidence of general dementia. The average age was 56 yr. (range = 48–62), the average Wechsler Adult Intelligence Scale (WAIS) IQ was 102 (range = 97–110), and the average score on the Wechsler Memory scale was 76 (range = 61–86).

Control subjects were drawn from a group of alcoholic patients undergoing treatment at the Alcohol and Drug Addiction Center, Peterborough, Ontario, Canada. There was no evidence of Korsakoff psychosis or severe memory problems in any of these patients. The average age was 48 yr. (range = 44–53), the mean IQ was 105 (range = 101–112), and the average Wechsler Memory scale score was 112 (range = 105–126). Socioeconomic levels of the control subjects were matched as closely as possible with those of the amnesic patients.

A minimum of five Korsakoff and five control subjects comprised the respective groups in each condition. There were no significant differences between Korsakoff or between control groups in terms of general intellectual or memory capacities. As is often the case, it was necessary to test some of the Korsakoff patients on more than one condition. Such testing was spaced over several weeks, and it was evident from patients’ comments, general behavior, and performance that there was no recall of previous sessions. In all conditions, it was possible to compare the performance of patients who had and had not been previously tested, and at no time was it possible to discern any differences. Each control subject was, of course, tested only once.

Procedure

The research employed a modified version of Wickens’ PI-release technique in which successive lists of nine familiar words were presented only once, with subjects instructed to recall each list immediately following presentation. In normal people, this technique produces results similar to Wickens’ (see Craik & Birtwistle, 1971) and has the advantage of eliminating the distraction task between list presentation and recall, which is often difficult to administer to amnesics. Lists for all test conditions were made up of words drawn from the following categories: sports, occupations, body parts, clothes. The items comprising each list were constant throughout, but their order within the lists was varied randomly between subjects. The selection of specific categories and sequential order was varied between subjects. No effects were found to be attributable to differences between categories.

Subjects were tested individually in small rooms in the institutions in which they resided. At the beginning of each session, the subject was told that lists of familiar words would be projected one at a time on a wall and that he/she was to read them aloud and try to remember them. At the end of each list, a blank slide would appear, which, along with the word repeat spoken by the experimenter, was the signal to recall as many words as possible from that list. Before testing, two sample words, unrelated to those in the lists, were presented as examples to ensure that the instructions had been understood.

A Kodak Carousel slide projector was used to project the stimuli on a wall approximately 5 ft. (1.5 m) from where the subject was seated. Each word was presented for 5 sec, during which the subject would read it aloud. No limit was placed on the amount of time required during recall; the next list was not begun until it was evident that no more words could be remembered. Subjects usually indicated that they had recalled all they could within 60 sec. At that point, the subject was asked if he/she could recall any other words and, if not, the trial was terminated. No additional prompting was provided.

Experiment 1

The first experiment compared the performance of Korsakoff and nonamnesic control groups on the Craik and Birtwistle
Figure 1. Performance on Korsakoff and control groups in the proactive interference release conditions of Experiment 1.

(1971) version of the PI-release test. In an experimental condition, a category shift occurred in List 5, and in a no-shift control condition, all five lists consisted of words in the same category.

Following category shift, further lists in the second category were presented, followed by a second shift to yet another (third) category. The purpose was to check on a finding by Kinsbourne and Wood (1975) that Korsakoff patients' initial failure to release from PI is followed by a delayed release if items from the new category are presented on subsequent trials. The result was interpreted by Kinsbourne and Wood as indicating that amnesics need more than the usually sufficient amount of information concerning a taxonomic shift before changing their behavior accordingly.

Method

Procedure

Words were printed in large black capital letters and projected against a white background. The first four lists consisted of words from one category (e.g., clothing), followed in the experimental condition by a category shift on Trials 5–8 in which all words belonged to a second category (e.g., sports), and then finally by List 9, which was made up of words from a third category (e.g., body parts). The categories and their sequences were varied between subjects, but no within-group differences were detected as a result on either the release or nonrelease trials. A control condition involved five lists of words belonging to the same category. This condition provided a nonshift baseline for List 5 recall. Subjects were asked for free recall of each list immediately after it was presented.

Results

The results of Experiment 1 are summarized in Figure 1. As can be seen in Figure 1A, Korsakoff and control groups in the no-shift condition showed progressive decline in the number of words correctly recalled over Lists 1–5. Analysis of variance applied to these data revealed that the effect of trials was the only statistically significant factor, \( F(4, 40) = 46.69, p < .001 \).

A different pattern emerged in the category-shift condition (Figure 1B) where a statistically significant Group \( \times \) Trials interaction was obtained, \( F(4, 52) = 5.18, p < .001 \). Subsequent analyses revealed significant group differences on Lists 5 and 7 (8 tests of independent means, \( ps < .05 \)). The relevant difference is on Trial 5, where controls showed substantial improvement in recall, whereas the Korsakoff group failed to release from PI. List 5 recall by the controls in the category-shift condition was as good as their earlier recall of List 1 and was significantly better than List 5 recall by the control group in the no-shift condition, \( t(8) = 3.37, p < .01 \). In contrast, List 5 recall by Korsakoff groups in the category-shift and no-shift conditions did not differ significantly, \( t(5) = 1.98, p > .05 \).
The most frequent errors made by all groups in this experiment were omissions whose numbers can be discerned from Figure 1. There were two types of commission errors—response intrusions, words that appeared in preceding lists, and semantic errors, semantically related words that did not appear in any list. In Experiment 1, response intrusions occurred more often than semantic errors, with Korsakoff patients committing larger numbers of both types than controls ($p < .05$; see Table 1). This was especially apparent in the no-shift condition, where Korsakoff patients made significantly more response intrusion errors than controls on all trials ($p < .05$).

It is interesting that virtually no response intrusion errors were made by either group on List 5 of the category shift condition. This was equally true for the control subjects, who displayed good recall of this list and the amnesics whose performance remained poor. On List 9, where the second category shift occurred, both groups showed comparable release, and so the similar error patterns that occurred were expected.

Focusing on Trials 6–9 of the category-shift condition, Figure 1B depicts the expected buildup of PI in the control group after the initial release on List 5, followed by a second release when the category is changed again in List 9. Amnesics showed essentially the same pattern, although their level of recall was lower than that of controls throughout Trials 5–8. They also displayed striking recovery at List 9 recall. A between-groups comparison of List 9 recall yielded no significant difference, $t(13) = 1.50, p > .05$, nor in fact was there a reliable difference between amnesics' recall on Trials 1 and 9 ($t < 1$). A response analysis revealed that there were no longer group dif-

Table 1

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<tr>
<th>Table 1</th>
<th>Mean Number of Response Intrusion and Semantic Errors for Korsakoff and Control Groups in All Conditions</th>
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<td>Response intrusion errors</td>
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<td>Trials</td>
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<td>No shift</td>
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<td>Korsakoff</td>
<td>8.6</td>
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<td>Control</td>
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<td>Category shift</td>
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<td>Korsakoff</td>
<td>9.5</td>
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<td>Control</td>
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<td>Context shift/category shift</td>
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<tr>
<td>Korsakoff</td>
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<td>Control</td>
<td>2.4</td>
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<td>Context shift</td>
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<td>Korsakoff</td>
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<td>Korsakoff</td>
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*Note. M designates the mean number of errors/subject over all trials. Scores for release trials (5, 9) and nonrelease trials (1–4, 2–4, 6–8) represent the mean number of errors/subject/trial.*
ferences in numbers of semantic errors after Trial 5 but that Korsakoff patients continued to make more response intrusion errors throughout Trials 6-8, \( t(13) = 1.86, p < .05, \) one-tailed.

Experiment 2

The results of Experiment 1 confirm the impairment of Korsakoff patients in a test of PI release (Cermak et al., 1974; Kinsbourne & Wood, 1975) using a modified version of the Wickens paradigm. There was, however, no evidence of a delayed release from PI by the Korsakoff group in the second category condition (Trials 5-8), although there was a significant release on the introduction of a third category on Trial 9. The discrepancy between these results and those of Kinsbourne and Wood (1975) will be discussed later.

The next experiment was conducted as part of our investigation into the value of differential contextual cuing in helping amnesics to cope with the deleterious effects of interference. Using the paradigm of Experiment 1, it was hypothesized that manipulations of context that rendered new category lists more discriminable from previous lists would facilitate release from PI in Korsakoff patients and result in improved recall of the new material.

Method

Procedure

The first condition of this experiment involved a context and category shift on Trial 5. In this condition, Lists 1-4 words were presented in black letters against a white background. List 5 consisted of words belonging to a new category and printed in red letters against a green background.

The second condition involved only a context shift. All lists consisted of words from the same category. Lists 1—4 were presented in black letters against a white background, whereas List 5 words were printed in red letters against a green background. This condition made it possible to assess the effects of contextual cuing alone without a category shift.

Results

As can be seen from Figure 2A, a context shift combined with a category shift resulted in a clear release pattern for both Korsakoff and control groups. Analysis of variance revealed neither a significant Group \( \times \) Trials interaction, \( F(4, 36) = 2.14, p > .05, \) nor a significant group effect \( (F < 1) \). Within-group analyses revealed highly significant improvements in List 5 recall over List 4 recall by both amnesic and control groups \( (p < .001) \). An analysis of error patterns (see Table 1) revealed that Korsakoff patients made more response intrusion and semantic errors than controls in the preshift trials of this condition \( (p < .05) \). However, there were no significant differences on either measure for List 5, where both groups showed good release.

The Korsakoff group appeared to respond to a shift in context even in the absence of a category change. As can be seen in Figure 2B, there was some recovery by the Korsakoff group on Trial 5 of the context shift condition, although the effect was not as dramatic as in the context shift, category shift condition. Nevertheless, the relative improvement in List 5 recall over List 4 recall by the Korsakoff group in the context shift condition was significantly greater than...
that of the control group, \( t(10) = 4.20, p < .001 \). Since recall by the control group did not change between Trials 4 and 5 \( (t < 1) \) in the context shift condition, the relative difference is likely due to an improvement by Korsakoff patients.

Once again, the tendency of Korsakoff patients to display more response intrusion and semantic errors that controls disappeared during the release test on Trial 5.

**Experiment 3**

Experiment 3 was an attempt to explain the behavioral pattern of Korsakoff amnesics in the category shift condition of experiment 1. The Korsakoff group did not display the delayed release from PI on Trials 6–8, as might be expected on the basis of Kinsbourne and Wood's (1975) results, but they did show excellent release on Trial 9 following a second category shift.

Two hypotheses seem capable of explaining this finding: (a) Korsakoff amnesics may simply have become more adept at the task as a result of the additional practice following Trial 5 or (b) based on their experience with the original category change on Trial 5, Korsakoff amnesics were more prepared to modify their strategies at the time of the second change. These alternatives were evaluated in the following experiment.

**Method**

**Subjects**

Eleven Korsakoff patients were tested. Eight had participated in either Experiment 1 or Experiment 2 several weeks earlier. There was no indication either through verbal reports or performance that they had recalled anything of their earlier experience.

**Procedure**

Different subjects were assigned to the following two conditions:

- **Practice control.** Nine recall trials were administered as in Experiment 1. The only difference was that Trials 5–8 were repetitions of Trials 1–4, with the same lists presented again in the same order. A category change occurred on Trial 9. If the results of the category shift condition in Experiment 1 can be attributed to the effects of additional practice, some release should be evident on Trial 9 of this condition.

- **Instructional set.** Subjects received only five trials with a category change occurring on Trial 5. The important variable was that before the beginning of testing, subjects were told that a category change would occur on Trial 5. It was reasoned that if the amnesics' Trial 9 release in Experiment 1 was due to their having expected a category shift, then pretest instructions that generate a similar expectancy should result in release even on a first occasion of category shift. Despite their dense amnesia, Korsakoff patients are known to retain some information without explicit awareness on their part, instructional set being one such example. Consequently, we conjectured that our procedure would have a chance of establishing the appropriate expectancy in our patients.

**Results**

Figure 3 presents the results. In the practice control condition, Korsakoff subjects displayed uniform PI over Trials 2–9. Clearly, subjects were not performing better on the task simply as a function of increased trials, and there was no sign of release from PI on Trial 9. In contrast, the subjects who had been told that there would be a shift in category displayed excellent release on Trial 5. A comparison of recall of Lists 4 and 5 indicated a highly significant difference, \( t(4) = 27.30, p < .001 \). A comparison of List 5 recall by amnesic groups in the two conditions also revealed a highly significant difference, \( t(9) = 3.38, p < .01 \).

An analysis of errors (Table 1) revealed the usual pattern of greater numbers of response intrusion than semantic errors. In the practice condition, where Korsakoff subjects failed to release on Trial 9, they nevertheless suppressed any tendency to make either type of error on this trial. This pattern was also observed throughout Trials 1–5 of the category shift condition in Experiment 1. In the instructional condition, where the Korsakoff group displayed good release, virtually all response intrusion and semantic errors similarly dropped out on the shift trial (Trial 5).

**General Discussion**

The results of Experiments 1 and 2 confirmed two important features of the amnesic syndrome in Korsakoff patients previously reported in the literature, namely, (a) failure to recover from the buildup of interference in a standard test of PI release and (b) responsiveness to the discriminative properties of salient contextual stimuli. In contrast, control groups consistently showed good PI release when taxonomic categories were changed but were not significantly
helped by more distinctive context. The latter result is in accord with other findings based on the Wickens paradigm. Reutener (1972) presented four lists of words belonging to the same category to normal subjects and found that changing the color of the test list did not produce improved recall. Similarly, MacLeod (1975) found that inserting a color cue prior to presenting the test list did not affect normals' recall performance regardless of whether a category shift also occurred.

Given amnesics' susceptibility to interference, it is interesting to note the absence of any dramatic difference in overall recall and in the buildup of PI between Korsakoff patients and control subjects. In fact, close examination of the data (see Figures 1 and 2) does suggest a tendency, albeit a non-significant one, for Kosakoff patients to perform more poorly than controls, especially on later lists. These results are consistent with those reported by Cermak et al. (1974) and suggest that buildup of PI might be a little more pronounced in the Korsakoff patients. That the differences are not as dramatic as might be expected may be accounted for in a number of ways. First, it is known that amnesics' immediate recall of relatively short lists, as measured by their digit span performance, is within the normal range (Milner, 1966). The number of items in our lists do not exceed this span by much and so the Korsakoff patients memory capacities would not be severely tried. Second, Craik and Birtwistle's procedure is such an extremely effective one for building up PI even in normal people that it may leave little room for the Korsakoff patients to exhibit their increased susceptibility to interference. Last, it has recently been shown that alcoholic subjects similar to those we used as controls do have demonstrable memory deficits, although they are not nearly as severe as the Korsakoff (Butters & Albert, in press). This too may have contributed further to the absence of expected differences between our two populations.

The lack of PI release by Korsakoff amnesics in a Wickens paradigm has been interpreted by Butters and Cermak (1975) as consistent with their notion of a basic encoding dysfunction, which affects particularly the processing of complex verbal information. Further support is derived from the fact that Korsakoff amnesics showed normal release when stimulus items are composed of letters or numerical material that are presumed to require less sophisticated verbal analysis (Cermak et al., 1974). The effectiveness of contextual cuing,
such as changes in target color and background, in eliciting normal release from PI in Korsakoff amnesics may also derive from their inability to encode items to a deep semantic level. Such contextual cues are most effective in normal people when the semantic value of the targets are low (Gardiner, Klee, Redman, & Ball, 1976). Thus there is considerable support for the argument that amnesics are deficient in processing complex information, but it may be too restrictive to attribute this exclusively to semantic processing. The present results show that under appropriate circumstances, Korsakoff amnesics are indeed capable of learning and remembering new verbal material notwithstanding substantial interference. Other evidence that amnesics can learn paired-associate lists of words (Winocur & Kinsbourne, 1978; Winocur & Weiskrantz, 1976) and yet be deficient on nonverbal tasks (Riege, 1977; Warrington & Baddeley, 1974), that require little semantic analysis further indicates that a semantic encoding hypothesis may be too narrow in defining the problem.

An alternative interpretation maintains that amnesics’ encoding capabilities are relatively intact but that they are deficient in retrieval. This view has been advocated by Weiskrantz and Warrington (1975), who, using partial cuing, demonstrated surprisingly good recall by amnesics of seemingly lost memories. One phenomenon that is commonly observed during retrieval in high interference situations is the profuse incidence of response intrusions based on related experiences. In the present research, Korsakoff amnesics, relative to controls, consistently emitted large numbers of semantically related incorrect words that had appeared in preceding lists or were from outside the task itself. This could be taken as reflecting a disinhibitory condition in Korsakoff patients leading to impaired response selection at retrieval. However, other evidence does not support this interpretation, which emphasizes response competition as the direct cause of amnesics’ performance deficits. For example, in Experiment 1, the failure of Korsakoff subjects to release from PI on the shift trial was not accompanied by a major intervention of prior list intrusions. Rather, the vast majority of errors were omissions. In other instances, most notably in prerelease trials of the various experimental conditions, Korsakoff patients emitted significantly more response intrusion and semantic errors, although there were no differences in the number of correctly recalled words. Using a negative transfer paradigm, Kinsbourne and Winocur (1980) explicitly demonstrated the independence of impaired memory and response intrusions by use of a contextual manipulation that reduced the incidence of intrusions without affecting memory performance.

Kinsbourne and Wood (1975) interpreted the Korsakoff amnesics’ failure at PI release in terms of a retrieval dysfunction. They argued that amnesics are impaired in dissociating similar contextual environments, which, in a PI-release paradigm, restricts their ability to relate encoded items on the release trial to the new category. As a result, Korsakoff amnesics, in attempting to recall the new items, remain under the influence of the more familiar cues based on the original category. Our results lend support to the notion that contextual cuing has special significance to amnesic patients. The present data, as well as those of another study (Winocur & Kinsbourne, 1978), suggest that amnesics are more dependent on contextual cues than are normal subjects, particularly in high interference situations in which such cues help in discriminating related and interfering events. In this regard, it is striking that Korsakoff amnesics, but not controls, responded to contextual cuing in the context shift condition of Experiment 2. In this condition, the amnesic group actually displayed greater release than the control group. Further, the amnesics’ failure with respect to context is not necessarily limited to retrieval. The benefits derived from contextual cuing in reducing the effects of interference may have permitted more efficient encoding and, consequently, better learning of the new list.

Kinsbourne and Wood (1975), using the Wickens paradigm, found a delayed release effect in Korsakoff amnesic patients who failed to release on the first shift trial. Increased exposure to the new class of items was seen as enhancing the amnesics’ awareness of the opportunity offered by the taxonomic shift to improve their recall. The failure of amnesic subjects to demonstrate
delayed release in the category shift condition of Experiment 1 appears inconsistent with Kinsbourne and Wood’s findings, but procedural differences may account for this. In the Craik and Birtwistle paradigm used in the present research, a cumulative contextual shift by providing a new category on consecutive postshift trials cannot be postulated, since the first postshift trial already offers as many as nine instances of the new category—a sufficiently salient change to make even amnesic patients aware of a category shift. (Indeed, their responses on the shift trial were in the new category.) Nevertheless, the amnesics performed no better on the postshift than on the preshift trials. This finding dissociates cue awareness for purposes of response (which was present) from cue awareness for purposes of use in generating mnemonic strategies (which was absent).

Two sets of results support this interpretation. Comparison of the Korsakoff patients’ release from PI on the context shift trial (Figure 2B) with those in which both context and category shifted (Figure 2A) shows the release to be much greater in the latter instance, suggesting that the information was available to them but required an additional cue to make it accessible to verbal report. Kinsbourne and Wood (1975) tested this idea more directly by providing Korsakoff patients with a category retrieval cue either prior to presentation or prior to recall. Only the latter was effective in enabling Korsakoff patients to show a normal release from PI.

Thus, it is postulated that in the category shift condition, the first release trial (Trial 5), was sufficiently distinctive for Korsakoffs to identify the presence of a new category but not adequate to enable them to alter their strategies and efficiently process the new information. A more explicit awareness of the category shift seems necessary if amnesics are to improve their performance. This was provided in Experiment 2 by contextual cues that dramatically contrasted the conditions associated with the preshift and postshift trials. In Experiment 3, the same effect was obtained by forewarning subjects that a change in category would occur on Trial 5. This instruction permitted Korsakoffs to incorporate the expectation of a shift into their initial strategies, and, consequently, they were better able to cope with the new information when it was finally presented. This interpretation is consistent with other data showing that Korsakoff amnesics are not necessarily impaired in developing hypotheses and maintaining sets as long as unexpected changes in experimental conditions do not occur (Oscar-Berman, 1973).

The successful release of Korsakoff patients on Trial 9 of the category shift condition (Experiment 1) may be seen as reflecting their ability to modify task strategies following appropriate experiences. Although surprised by the first category shift and unable to adjust their strategies accordingly, they were, as a result, prepared for such a shift when it occurred again. The initial category shift on Trial 5 appeared to serve the same purpose as the pretask instructions of Experiment 3.

One interpretation of the emerging pattern is that amnesics’ exaggerated need for contextual information may reflect an impaired preparedness to use task-related cues that normal subjects spontaneously use. Unable to take advantage of these cues, amnesics reach beyond the essential aspects of the task itself for additional discriminative stimuli to help in the formation of appropriate strategies. The additional cuing, contextual or other (see Winocur, in press), enables the amnesics to compensate for their basic difficulty in deriving information from normally available cues. The deficit would be expected to be greatest under conditions of high interference, where specific stimuli often ambiguously signal competing associations and where successful performance depends on finely grained discriminations.

The present hypothesis does not attribute the dysfunction selectively to the input or output stage. Depending on the nature of the task and the type of interference, this impairment could be manifest at either or both of these stages. In the present experiments, it could have taken effect at registration of the words in the list, or at retrieval, or both. There is in fact mounting evidence from our own work and that of others (Fuld, 1976; Huppert & Piercy, 1977; McDowell, 1979) that both acquisition and retrieval operations are affected in the amnesic syndrome of Korsakoff patients.
There is now ample evidence that amnesics experience difficulty using normally available contextual information (Huppert & Piercy, 1976; Winocur & Kinsbourne, 1978) and that they benefit from salient contextual cues in a way that controls do not (the present study; Winocur — Kinsbourne, 1978). However, it would be premature to presume that this is a qualitative deficit on the basis of these results. We have used tasks simple enough to fall within the learning capabilities of amnesic patients. In the Winocur and Kinsbourne study, these yielded near ceiling levels of performance by control subjects. This was not so in the present experiments. But there is reason to believe that normal subjects only use contextual information in this type of task when it is very difficult (Keppel, 1972) or when semantic cues are unavailable (Gardiner et al., 1976; Reutener, 1972). In the only available comparison of amnesics' and controls' ability to make contextual judgments (Squire, Nadel, & Slater, in press), performance of both groups was found to correlate positively with memory performance. Thus the use of contextual cues may be a feature of attempts made by both amnesic and normal people to remember virtually forgotten events.

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