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Fluency versus Conscious Recollection in the Word Completion Performance of Amnesic Patients

LAIRD S. CERMAK, MIEKE VERFAELLIE, AND MARIE SWEENEY

Memory Disorders Research Center, Boston University School of Medicine, Department of Veterans Affairs Medical Center, Boston, Massachusetts

AND

LARRY L. JACOBY

McMaster University

To examine the relative contribution of fluency and recollection to the word completion performance of amnesics, we administered a task in which patients were told specifically *not* to utilize previously presented words during stem completion (an Exclusion condition). This condition was contrasted with a standard word completion task in which patients were encouraged simply to complete the stem with the first word that came to mind (an Inclusion condition). Since the exclusion condition necessitated controlled respecification of the initial presentation, it was hypothesized that amnesics would be less able than controls to exclude study list items. Consistent with this hypothesis, the results indicated that the amnesics' performance, unlike that of the alcoholic controls, did not significantly differ as a function of task condition. To examine whether amnesics' conscious recollection could be enhanced, Experiment 2 presented the study list five times. The amnesics now were able to exclude a significant number of items from the study list; however, they still did so considerably less frequently than alcoholic controls. For the alcoholic controls, increasing the number of study trials had little additional effect on their exclusion performance, but it significantly enhanced their inclusion performance. Taken together, these findings suggest that for control subjects, word completion performance is likely mediated by a combination of

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fluency and recollection, while for amnesic patients, performance is almost exclusively based on the fluency with which an item comes to mind.

The finding that amnesic patients perform as well as controls on a "primed" word completion task, despite an inability to recognize that the words appeared previously, is now a well-accepted outcome (Graf, Squire, & Mandler, 1984; Graf, Shimamura, & Squire, 1985). This result receives frequent citation from memory theorists who propose that two separate systems exist in normal memory and that in amnesia, one of these systems is damaged while the other remains intact (Cohen, 1984; Cermak, Talbot, Chandler, & Wolbarst, 1985). The two most familiar dichotomies for which this evidence is marshalled are the Procedural/Declarative (Cohen & Squire, 1980) and the Episodic/Semantic (Tulving, 1972) distinction.

The Procedural/Declarative theory states that increased performance on indirect memory tasks is due to a reinstatement of encoding procedures and operations. Whenever a task reengages prior processing operations, performance will be facilitated, even though the amnesic patient may not have any record of those operations. The Episodic/Semantic theory, on the other hand, states that facilitation reflects the activation of preexisting knowledge. When a stimulus already in memory is presented for study, its lexical and/or semantic representation is temporarily activated. This activation sensitizes the patient to that particular stimulus which then becomes more readily reactivated, even when only partially exposed. The patient does not remember the specific episode that produced such activation but responds to the product of that sensitization.

Both of these theories attempt to explain the process by which repetition priming occurs in automatic, rather passive terms. However, results from a recent unpublished word completion study at our Center suggest that processes under control of the subject might also have a role in repetition-priming effects. This study involved the presentation of a list of high-or low-frequency words, followed by a stem completion task. When low-frequency words were used, amnesics and controls showed equivalent priming. In contrast, when high-frequency words were used, the stem completion performance of the amnesics far *exceeded* that of the alcoholic controls, even though their preexperimentally determined baseline completion rate was similar. These findings are difficult to interpret as the result of automatic, passive processes. Instead, they suggest that the control subjects utilized their memory for words presented on the study list differently than did the amnesics. Their recognition memory for the studied words was superior to that of the amnesics, but they were less drawn to these stimuli during the completion test. Conscious strategies allowed them to select from among a number of possible stem completions. Amnesics, in contrast, seemed more influenced by the automatic effects of

processing and consequently responded more often than control subjects with items from the high-frequency study list.

This difference in target word utilization by amnesics and controls highlights the fact that not only performance on direct tests, but also performance on indirect tests, may be mediated by a combination of automatic and controlled processes (Dunn and Kirsner, 1989; Jacoby, 1988). For instance, judgements of subjective familiarity may reflect automatic influences of memory, whereas the ability to attribute this familiarity to its correct source may reflect consciously controlled processes. Possibly, during word completion, amnesic patients rely solely on an automatically generated sense of familiarity, without knowledge of its source. Normals, on the other hand, can in most circumstances attribute this familiarity to its source and choose whether to respond to it or not. In the case of high-frequency words, familiarity is high but normal individuals may realize why and may choose to select another word to complete the stem. Amnesics, on the other hand, may be unable to do so, hence their higher stem completion performance.

To more directly examine the role of automatic and controlled processes in word completion performance, the present study used a word completion task in which correct performance required the use of consciously controlled processes. In this task, patients are told explicitly *not* to use the words that were just presented on the study list as stem completions. Their performance in this condition is then compared with performance on a standard word completion task in which correct responding may reflect automatic influences as well as conscious control. Exclusion of words which are familiar because of their previous exposure requires the ability to oppose a familiarity-based judgement on the basis of conscious recollection (Jacoby, 1991). If, as hypothesized, amnesics are unable to do so, then their responses should be more strongly bound to fluency, irrespective of the task instructions.

EXPERIMENT 1

Method

Subjects. Two groups of male subjects participated in this experiment. The first group consisted of nine amnesic patients. Six of these patients were alcoholic Korsakoff patients who were residing in various chronic care facilities in the Boston metropolitan area. All had histories of chronic alcoholism, were unable to recall day-to-day events, and had extensive retrograde amnesia. The other three amnesics included two anoxic patients and one postencephalitic, all living at home and all displaying the same clinically amnesic profiles as the Korsakoff patients. The mean age of the entire amnesic group was 62 years, with an average of 14 years of education. The average WAIS-R VIQ score for this group was 104, WMS-R Attention score was 105, General Memory score was 74, and Delayed Memory score was 56.

The control group consisted of eight chronic alcoholics living in private homes or local public halfway houses. None of these men evidenced any signs of neurological or psychiatric

illness. All had abstained from alcohol for at least 1 month prior to participation in the experiment. Their average age was 60 years, with an average of 13 years of education. This group's mean WAIS-R VIQ score was 110, WMS-R Attention score was 110, General Memory score was 115, and Delayed Memory score was 115.

Task. Patients were initially required to generate sentences for a list of 20 target words. Following this exposure, they were given a word stem completion task to perform. In a first condition (Inclusion), the patients were told, as is the standard procedure, to complete each stem with the first word that came to mind. In a second condition (Exclusion), they were told to complete the stems with any word *except* those that had been on the target list. Immediately after the word stem completion task, the patients were asked to circle, from among word pairs, those words that had appeared on the original list.

Materials. Eighty target words of at least four letters in length were selected from Webster (1986) such that the first three letters of each word (the stem) were common to at least 10 other words and no target words shared the same stem. These 80 targets were divided into four lists of 20 words each such that each list was matched for frequency (Francis & Kucera, 1982), with the means varying between 74 and 89. The words were printed in large capital letters on 3 × 5 index cards and arranged such that the order of presentation did not reflect the order of the target stems on the answer sheet. The word completion task consisted of 20 word stems including 10 target stems and 10 filler stems. Three practice items were inserted at the beginning of each stem list. A second sheet of 10 word pairs including the remaining 10 target words and 10 new filler words was used for the recognition task.

Each patient participated in both Inclusion and Exclusion conditions, so received two of the word lists. However, the four lists were counterbalanced between patients in such a manner that the target words from the two lists that a patient did not see served as fillers for the stem completion and recognition task. In this manner a baseline stem completion score could be determined across patients.

Procedure. Each patient was tested in two sessions separated by at least 1 week. In the first session (the Inclusion task), the patient was presented with the target list of 20 words, one at a time, and instructed to make up a sentence utilizing each word. Immediately following the presentation of the target list, the patient was given the word stem completion sheet and told to complete the stems with the first word that comes to mind.

In the second session (the Exclusion task), the patient was presented with another target list of 20 words which he was asked to utilize in sentences. Immediately afterward, he was instructed to complete the stems on the word stem answer sheet with the first word that came to mind, as long as that word was *not* from the target list.

After each word completion task (Inclusion or Exclusion), a forced-choice recognition task was administered in which patients were required to circle the word that came from the target list in each of 10 word pairs.

Results

Word completion. For each patient, we computed the percentage of study list words (targets) they gave as completions for the stems and the percentage of nonpresented list words (fillers) they correctly completed by chance. These data, which are presented in Table 1, were analyzed by means of an ANOVA with Group (Amnesic, Alcoholic) as the between-subjects variable and Instructional Set (Inclusion, Exclusion) and Item Type (Target, Filler) as the within-subjects variables. Results of this analysis revealed a significant main effect of Instructional Set ($F(1, 15) = 11.62$, $p < .01$), indicating that across groups, more list items were given as completions in the inclusion condition than in the exclusion

TABLE 1
PERCENTAGE OF STUDY LIST WORDS (TARGETS) AND NONPRESENTED LIST WORDS (FILLERS) COMPLETED TO A LIST ITEM IN EXPERIMENT 1

	Target	Filler	Priming score
Amnesics			
Inclusion	39.9	15.2	24.7
Exclusion	26.2	8.7	17.5
Alcoholics			
Inclusion	21.4	17.8	3.6
Exclusion	3.9	13.5	−9.6

condition. In addition, there was a significant main effect of Item Type ($F(1, 15) = 7.58$, $p < .01$) which indicated that targets were given as completions more frequently than fillers. However, this latter effect was modified by a significant Group × Item Type interaction ($F(1, 15) = 13.43$, $p < .01$), indicating that the percentage of correctly completed targets exceeded the percentage of correctly completed fillers only for the amnesics ($F(1, 15) = 10.94$, $p < .01$), but not for the alcoholic controls. This was not due to a difference between groups in the correct completion of fillers, but rather reflected a difference in the completion of targets ($F(1, 15) = 8.67$, $p < .01$).

Since the instructional set affected not only the percentage of targets given as completions, but also the percentage of fillers, a priming score was computed for each patient by subtracting the percentage of completed fillers from the percentage of completed targets. The effect of Instructional Set was then examined using an ANOVA with Group as the between-subjects variable and Instructional Set as the within-subjects variable. This analysis revealed a significant difference between groups ($F(1, 15) = 13.46$, $p < .01$), suggesting that amnesics utilized the primed target stem more frequently than did controls, regardless of Instructional Set. No other effects were significant.

Planned comparisons of the effect of Instructional Set within each group revealed a significant effect for the alcoholic controls ($t_7 = 2.01$, $p < .01$), but not for the amnesics ($t_8 = .65$, ns), suggesting that only the alcoholic controls were able to modify their response according to the instructional set.

Recognition. Recognition memory scores for the amnesics and alcoholic controls as a function of Instructional Set are provided in Table 2. These data were analyzed by means of an ANOVA with Group as the between-subjects factor and Instructional Set as the within-subjects factor. A significant Group effect emerged with amnesics recognizing far fewer list words than controls across all conditions ($F(1, 15) = 62.84$, $p < .001$).

TABLE 2
PERCENTAGE OF STUDY LIST WORDS RECOGNIZED IN THE INCLUSION AND EXCLUSION CONDITION OF EXPERIMENT 1

	Inclusion	Exclusion
Amnesics	69.0	70.3
Alcoholics	95.0	98.8

There was no significant effect of Instructional Set nor was there a Group × Instructional Set interaction.

Discussion

The amnesic patients used more study list items to complete word stems than did the controls in *both* the inclusion and exclusion conditions. As discussed previously, performance in the inclusion condition might reflect either the automatic effects of fluency or the consciously controlled recollection of the study items. It is unlikely that the amnesics' superior inclusion performance is mediated by superior conscious retention of the studied items, since as expected, amnesics recognized significantly fewer list items that did the controls. In addition, while they were able to withhold some responses in the exclusion condition, they did so much less than the alcoholic controls and their level of responding with target words remained significantly above chance level. This implies a defect in the amnesics' ability to consciously recollect that the target item had been on the list. Consequently, the amnesics' performance in the inclusion condition more likely reflects the automatic effects of memory rather than conscious control. Amnesics may be more responsive than controls to the fluency generated by prior presentation, because they are less capable of determining its source. That is, while controls can consciously choose to use a stem completion other than the one that is familiar, amnesics are unable to do so.

Although the amnesics' priming score was much less affected by the instructional set than was the score of the controls, the fact that they completed fewer stems in the exclusion condition than in the inclusion condition suggests that they may have some limited ability to consciously retrieve list items. Experiment 2 was designed to examine whether this ability could be enhanced by presenting the study list for several trials rather than just one. If, under these conditions, amnesics can engage more fully in consciously controlled processes, then their exclusion score should be reduced and be closer to chance level, just as it was for the controls. Alternatively, if the effect of extra trials is only to enhance the fluency associated with the study list items, then both the inclusion and

TABLE 3
PERCENTAGE OF STUDY LIST WORDS (TARGETS) AND NONPRESENTED LIST WORDS (FILLERS) COMPLETED TO A LIST ITEM IN EXPERIMENT 2

	Target	Filler	Priming score
Amnesics			
Inclusion	42.8	14.6	28.2
Exclusion	23.5	13.2	10.3
Alcoholics			
Inclusion	36.4	6.0	30.4
Exclusion	2.2	12.4	−10.2

exclusion responses of the amnesics might increase and further exceed those of the alcoholic controls.

EXPERIMENT 2

Method

Subjects. Two groups of male subjects participated in this experiment. The first group consisted of 10 amnesic patients (7 Korsakoff, 2 anoxic, 1 postencephalitic). All but one Korsakoff patient had also participated in Experiment 1, but at least 3 months had passed between testings. The second group consisted of 9 alcoholics selected from the same pool of control subjects as in Experiment 1 but none of whom had actually participated in that experiment. This new group had a mean age of 54.9 years with an average of 13 years of education. Their mean WAIS-R VIQ score was 111, with a WMS-R Attention score of 108, General Memory score of 112, and Delayed Memory score of 114.

Materials and procedure. The materials and procedure were identical to those used in Experiment 1, except that the entire study list was presented five times and patients were asked to generate a sentence on each presentation. In addition, we ensured that the amnesic patients were presented with the two target lists which they had not been exposed to in Experiment 1.

Results

Word completion. Table 3 presents for each group the percentage of study list words (targets) given as stem completions as well as the percentage of nonpresented list words (fillers) that were correctly completed by chance. An ANOVA with Group as the between-subjects factor and Instructional Set and Item Type as the within-subjects factors revealed a significant main effect of Group ($F(1, 17) = 5.16$, $p < .05$), indicating that overall, the amnesics gave list items as completions more frequently than did the alcoholic controls. As in Experiment 1, the main effect of Instructional Set ($F(1, 17) = 24.81$, $p < .01$) and Item Type ($F(1, 17) = 25.44$, $p < .01$) were significant. However, these were modified by a significant Instructional Set × Item Type interaction ($F(1, 17) = 23.45$, $p < .01$). Tests of simple main effects revealed that instructions had a significant effect on the number of targets completed ($F(1, 17) = 34.12$,

TABLE 4
PERCENTAGE OF STUDY LIST WORDS RECOGNIZED IN THE INCLUSION AND EXCLUSION CONDITION OF EXPERIMENT 2

	Inclusion	Exclusion
Amnesics	75.4	72.0
Alcoholics	100.0	100.0

$p < .01$), but not on the number of fillers completed by chance. The interaction between Group, Instructional Set, and Item Type was marginally significant ($F(1, 17) = 3.54$, $p < .08$), largely because amnesics completed more targets than did the alcoholic controls in the exclusion condition ($F(1, 31) = 7.48$, $p < .01$). In this condition, amnesics completed targets with list items more frequently than they completed fillers ($F(1, 9) = 18.1$, $p < .01$). A trend in the opposite direction occurred for the alcoholics ($F(1, 8) = 4.09$, $p < .08$).

As in Experiment 1, a priming score was again calculated for each subject by subtracting the number of fillers completed with list items from the number of target items. A 2 × 2 analysis of variance performed on this data did not produce a significant Group difference. There was a significant effect of Instructional Set ($F(1, 17) = 23.79$, $p < .01$), indicating that both groups showed less priming in the exclusion condition than in the inclusion condition. The Group × Instructional Set interaction was also marginally significant ($F(1, 17) = 3.53$, $p < .08$). Planned comparisons indicated that while both groups showed equivalent priming in the inclusion condition, the priming score of the amnesics remained higher than that of the alcoholic controls in the exclusion condition ($t_{17} = 3.01$, $p < .01$). For each group separately, however, the effect of Instructional Set was significant (amnesics: $t_9 = 2.17$, $p < .05$; alcoholics: $t_8 = 4.68$, $p < .01$).

Recognition. Recognition memory scores for the amnesics and alcoholic controls as a function of Instructional Set are provided in Table 4. An ANOVA with Group as the between-subjects factor and Instructional Set as the within-subjects factor revealed a significant Group effect ($F(1, 17) = 25.7$, $p < .01$). Thus, even after five presentations, the amnesics still recognized far fewer list words than did controls across all conditions. There was no significant effect of Instructional Set nor a Group × Instructional Set interaction.

Discussion

Increasing the number of presentation trials significantly altered the pattern of performance of the two subject groups. In the inclusion condition, the amnesics and alcoholics now demonstrated equivalent priming.

This was due primarily to the fact that priming increased dramatically for the alcoholic controls following five presentations, whereas it increased only marginally for the amnesics. While previously, the controls demonstrated no significant difference in their completion of fillers and targets, they now showed a substantial priming effect. In the exclusion condition, the amnesics' priming score far exceeded that of the alcoholic controls, as it had in Experiment 1, but now the amnesics showed a significant effect of Instructional Set. Increasing the number of presentations allowed the amnesic patients some conscious control over their performance. However, even after five study trials, this ability was not sufficient to reduce the completion of targets to the controls' level, or even to the level obtained for fillers. Alcoholics, on the other hand, produced far fewer targets than fillers, just as they had in Experiment 1. Thus, the amnesics were still much more likely than the alcoholic controls to respond to the fluency with which a previously presented item came to mind, suggesting that their ability to consciously retrieve list items remained significantly impaired. This inability undoubtedly underlies their impaired performance on the recognition memory test as well.

The finding that in the inclusion condition, five presentations increased the use of list items as completions for the alcoholic controls is consistent with recent findings by Chen and Squire (1990), who also found that stem completion priming increased for normals when list items were presented four times instead of once or twice. The fact that repetitions had a much smaller effect on the performance of the amnesics implies that for them, the maximum effect of fluency occurs following just one presentation. Chen and Squire (1990) found that a similar asymptote effect eventually occurred in their normal subjects, since additional presentations up to 16 or 32 did not further increase their priming score.

In summary, the present findings suggest that increasing the number of presentations has quite different effects on the performance of amnesics and alcoholics. For the amnesic patients, increasing the number of presentation trials has little effect on their use of fluency in a standard word completion task and produces only moderate gains in the use of conscious control in an exclusion condition. In contrast, alcoholic controls are more likely to use a fluency heuristic following five presentations, but they maintain almost complete conscious control over their performance when the task requires them to do so.

CONCLUSIONS

In Experiment 1, the amnesics' performance on a standard word completion task in which automatic influences (fluency) and conscious control (recollection) produced effects in the same direction did not significantly differ from their performance on an exclusion task in which automatic influences and conscious control were opposed to one another. The pres-

entation of multiple study trials in Experiment 2 did produce differential performance in these two conditions, but the amnesics' ability to oppose automatic influences remained significantly impaired. Thus, it can be concluded that the effects of consciously controlled processes to the amnesics' memory performance are, if anything, minimal.

This notion that amnesics are deficient in their conscious use of memories is hardly novel. Warrington and Weiskrantz (1982) suggested that amnesics have a selective impairment in a mediational memory system in which information is actively and consciously manipulated. In the same vein, Moscovitch (1989) has stressed that amnesics' confabulations might reflect an inability to consciously evaluate the source of automatically available information. The use of an oppositional procedure in the present experiments, however, allows a direct examination of this claim because it provides a means for separating the effects of conscious control from those of familiarity. Furthermore, while Warrington and Weiskrantz (1982) and Moscovitch (1989) postulated a distinction between automatic and controlled processes as an explanation for impaired retrieval from explicit memory, the present findings extend this distinction to a task generally seen as being a measure of implicit memory.

In this context, it is important to emphasize again that the amnesics' performance on the standard word completion task was similar to that of the alcoholic controls in Experiment 2, but exceeded that of the controls in Experiment 1. These findings would be very difficult to account for if one assumed that performance on this implicit task is mediated by a single underlying process. Instead, these results suggest that for normals, word completion performance is likely mediated by a combination of automatic and controlled processes, while for amnesics, it is almost exclusively determined by automatic influences of memory. Therefore, even though amnesics' implicit memory has frequently been reported to be normal on the basis of their performance on word completion studies (Shimamura, 1986), the processes underlying this performance may be distinctly different for amnesic patients and control subjects.

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