RETROGRADE AND ANTEROGRADE AMNESIC EFFECTS AS A FUNCTION OF RECALL CONDITIONS

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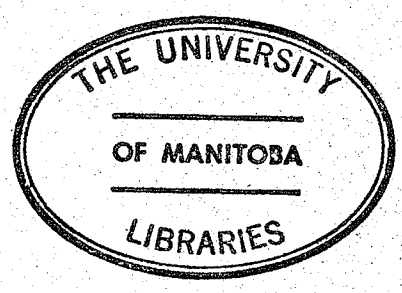

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ABSTRACT

Tulving (1969) found that a high-priority event, when presented in the middle of a free recall list, caused a retrograde amnesic effect. He and subsequent experimenters (Schulz, 1971; Schulz and Straub, 1972) hypothesized that induced retrograde amnesia results from a problem in consolidation, and Schulz (1971) and Schulz and Straub (1972) also hypothesized that consolidation explained the anterograde amnesia found in their studies. However, the results of Ellis et al. (1971) and Detterman and Ellis (1972) suggest that induced retrograde and anterograde amnesia result from different processes; retrograde amnesia results from a retrieval problem and anterograde amnesia from an encoding failure. The purpose of this study was to further investigate, by using a cueing paradigm, the processes involved in induced retrograde and anterograde amnesia.

A total of 160 male and female high school students were randomly assigned to one of four conditions in which the occurrence of low probability cues at input and output were manipulated. Each subject received 20 lists of 15 words with half the lists containing a high-priority event (the name of a famous person) at serial position 8.

The results indicate that while a cue presented at both input and output significantly improved recall it did not reduce the anterograde amnesic effect, thus supporting the hypothesis that induced anterograde amnesia appears to be best explained in terms of an encoding failure. A retrograde amnesic effect was not found in any of the four experimental conditions, making any conclusions tenuous.

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INTRODUCTION

Retrograde amnesia is defined as the inability to recall events that occurred during a period of time immediately prior to a critical event, while the events of an earlier or later period remain unimpaired. Until Tulving (1969), the only known ways of producing retrograde amnesia were by physiological methods. Such events as a blow to the head, anesthesia, and the intake of certain drugs have been known to cause retrograde amnesia (Hebb, 1970). Electroconvulsive shock has been found to be an effective method of producing retrograde amnesia in rats (Lewis, 1969). However, such methods are not amenable to experimental use with human subjects.

Tulving (1969) presented a new method of producing the retrograde amnesic effect in human subjects. His method involved the presentation of a list of words to a subject who was instructed to pay attention to a particular item that may or may not have appeared on that list. In his study Tulving presented his subjects with serial lists of common words and instructed them that some of these lists contained the name of a famous person. The subjects were further instructed that if the list they were given contained the name of a famous person they were to be sure to remember that name and to recall it first and then to recall the rest of the list in any order they pleased. If

the list did not contain the name of a famous person, the subjects were instructed to treat the list as a free recall task and to recall the words in any convenient order. Tulving's results showed that in the condition which contained the famous name, which he termed the high-priority event, the item which appeared just prior to this event was recalled significantly less than the word in the same position in the control condition, which was a standard free recall task. Tulving did not find a difference in recall between the items immediately following the high-priority event and their counterparts in the control lists. That is, no anterograde amnesia was found. He also found that the strength of the retrograde amnesic effect depended on the serial position of the high-priority event. The high-priority event appeared at one of three different serial positions in a list of fifteen words, those positions being 2, 8, or 14. The strongest retrograde amnesia occurred at serial position 14.

In the first experiment, Tulving used a constant presentation rate of one item per second. In a second experiment the presentation rate was varied, using either 0.5 second per item or 2 seconds per item. Tulving found that faster presentation rates (less than one second per item) increased the retrograde effect while slower rates (greater than one second per item) led to a decrease in the

retrograde effect. Thus, at a 2 second per item rate the retrograde effect disappeared in serial positions 2 and 8 and was only barely significant at position 14. Because retrograde effects were attenuated with longer presentation intervals, Tulving concluded that a disruption of a consolidation process which overlapped during the presentation of successive items was taking place. Briefly, the consolidation hypothesis states that after the presentation of an event a certain length of time is needed to encode that event into long-term memory if the event is to be remembered. Thus, according to this hypothesis, if there is a second event, such as a blow to the head, electroconvulsive shock, the intake of certain drugs or a high-priority event, which takes place immediately after the event to be remembered, the consolidation of that event is prevented and that event is not encoded into long-term memory (Hebb, cited in Sahakian, 1970). An important point of the consolidation hypothesis is that since the disruption stops the encoding process from taking place, the memory is permanently lost (Hilgard and Bower, 1966; Sahakian, 1970).

Saufley and Winograd (1970) investigated the effect that instructions to recall the high-priority event first had on the subjects in Tulving's experiments. Their study contained two experimental groups, with one group receiving the same instructions as Tulving's subjects, i.e., some

lists may contain the name of a famous person and if it does contain the name of a famous person be sure to recall it first. Their second experimental group received the lists as did the first group, but were given only standard free recall instructions. Saufley and Winograd found that the retrograde amnesic effect does not seem to be a function of the different types of instructions given to their two experimental conditions. The data for their instructed group, which can be considered a replication of Tulving, demonstrated the same retrograde amnesic effect that was found in Tulving's (1969) data, although the effect was not as strong as that shown by Tulving. For their non-instructed group the retrograde amnesic effect was still produced, but again the effect was not as strong as that reported by Tulving. As in Tulving's study Saufley and Winograd reported that their data did not demonstrate an anterograde amnesic effect.

In order to provide further tests of the amnesic effect in short-term memory Ellis, Detterman, Runcie, McCarver and Craig (1971) used amnesic events which were judged to be more powerful than those used by Tulving (1969) and Saufley and Winograd (1970). Instead of using 15 item word lists, Ellis et al. used 15 item picture lists. Also, instead of using famous name high-priority events, they used pictures of nudes as high-priority events. In Experiment I Ellis et

al. presented twenty lists to the subjects. Ten lists served as control lists and contained only line drawings of familiar objects (e.g., hat and football). The other ten lists contained a photograph of a nude at serial position 8. Each list was presented at a 1 item per second rate followed by a 1 minute free recall period. Ellis et al. found a retrograde effect as did Tulving, and Saufley and Winograd. However, they also found a very strong anterograde effect which was present for six positions following the high-priority event. This anterograde amnesia was not present in either the Tulving (1969) or Saufley and Winograde (1970) studies.

It seemed to Ellis et al. that the subjects rehearsed the material in Experiment I and that the high-priority event may have disrupted this rehearsal which affected memory for the immediately preceding and immediately following items. Ellis et al. felt that if the disruption of rehearsal was a factor in causing retrograde and anterograde amnesia, then reducing the amount of rehearsal by the subjects would also reduce the retrograde and anterograde effect. To test this hypothesis Ellis et al. attempted to minimize rehearsal by using a 30 item list and a yes-no recognition task. The design was a 2 x 2 factorial design which varied presentation time (.75 second per item versus 1.50 seconds per item) and the presence or absence of

the nude high-priority event at serial position 15 of a 30 item list. Ellis et al. did not test all 30 serial positions during a test trial; instead they used a probe technique to test 12 of the 30 serial positions. For lists containing a high-priority event, serial positions 3, 6, 9, 12, 13, 14, 16, 17, 18, 21, 24, and 27 were tested. For the control lists, the 12 serial positions to be tested were randomly selected for each list with the stipulation that each serial position be probed equally as often. The test list contained 24 items, 12 of which were from the original lists and 12 of which were new items. The subjects were to mark "yes" if the item had been seen before and "no" if it had not. The results obtained with this procedure did not demonstrate retrograde amnesia. What the authors did find was a strong anterograde effect which persisted in decreasing amounts over ten serial positions following the presentation of the high-priority event. The strong anterograde effect seemed to be enhanced by the faster rates of presentation.

The results in the Ellis et al. study are not consistent with Tulving's (1969) consolidation hypothesis. The fact that no retrograde effect is shown when using a recognition task points to the possibility of a retrieval problem instead of an encoding problem. A retrieval problem is the inability to retrieve stored information. In other

words, the needed information is encoded in memory, but for one reason or another the information is inaccessible. Retreival then is a problem of accessibility, not availability. On the other hand, encoding problems result from the inability to encode information into the memory store for future use, i.e., the process by which the information is integrated into the memory store is not initiated, whereas a consolidation problem occurs because the process has been prematurely terminated. If, on the other hand, the problem is one of retrieval, the item might be recalled under the proper conditions. In this case, seeing the item may act as a cue for the subject to correctly recognize it. Ellis et al. also point out that the recovery period, which persisted over ten serial positions, was dependent upon the number of items processed and not on time lapse. In order for the data to be consistent with a consolidation hypothesis, the amnesia should have been time dependent. In lieu of these findings Ellis et al. rejected a consolidation interpretation and leaned toward a rehearsal interpretation. According to a rehearsal interpretation a subject must rehearse an item in order for it to be encoded into long-term memory. If this rehearsal is interrupted or prevented, the transfer of information from the short-term store to the long-term store does not take place. In this case, the presentation of the

high-priority event preempts the rehearsal of prior information (retrograde amnesia), and the rehearsal of the high-priority event after presentation prevents new information from being admitted into short-term store which results in anterograde amnesia (Ellis et al., 1971).

Based on subjective reports and on the findings that overall recall in Experiment I was higher than in Experiment II, Ellis et al. felt that the subjects rehearsed the material in Experiment I, but were unable to do so in Experiment II. Therefore, since there was not any rehearsal of prior information for the high-priority event to interrupt in Experiment II, there was no resultant retrograde amnesia. The rehearsal of the high-priority event after its presentation, however, still prevented new information from being admitted into the short-term memory store, hence the anterograde effect in Experiment II.

Schulz (1971) specifically designed a study to investigate the possibility that the effects of the presentation of high-priority events might be attributable to a difficulty in retrieval rather than in storage or encoding. Each subject was presented a 15 item word list at either a 1 second per item rate or a .5 second per item rate followed by a free recall test and then a forced-choice recognition test. The forced-choice recognition test was comprised of 30 items; the 15 original list items, each

paired with a distractor item which was chosen from the same Thorndike-Lorge frequency range. From a consolidation point of view, one would expect that retrograde amnesia would be the same on a recognition test as on a free recall test because the initial encoding of the immediately preceding items is incomplete. Schulz, therefore, hypothesized that if retrograde amnesia was found to be the same on both tasks, then Tulving's consolidation interpretation would be supported. But, if the retrograde effects were due to a retrieval difficulty rather than an encoding difficulty, then the recognition performance might show no retrograde amnesia at all.

In the free recall task the data demonstrated significant retrograde effects at both the 1 second per item rate and the .5 second per item rate. No significant anterograde amnesia was found. These results are in confirmation of Tulving's (1969) original results (Schulz, Experiment I, 1971). For the recognition task Schulz found not only a significant retrograde effect but also a significant anterograde effect. The fact that retrograde amnesia was found in the recognition task tends to support Tulving's hypothesis for consolidation (Schulz, Experiment I, 1971).

In Experiment II, Schulz tested the possibility that the retrograde and anterograde effects found in Experiment I

might be merely a reflection of recall effects. Therefore, in this experiment, the free recall task was omitted. Two groups received the same 30 lists with 15 items in each list. Ten of the lists contained a high-priority event (famous name) at serial position 8, ten lists contained a high-priority event at serial position 14, and ten control lists contained no high-priority events. The only difference between the two groups of subjects was that one group was told that some of the lists contained the name of a famous person (a high-priority event) and that it was important to remember it and recognize it correctly on the test that followed. The other group was not given any instructions about the presentation of names of famous people. Each list was presented at a 1 second per item rate. Significant retrograde and anterograde amnesia occurred in both the instructed and non-instructed conditions. Although the retrograde effect seemed to be stronger than the anterograde effect, this difference did not reach a significiant level. These results seem to rule out the possibility that the retrograde and anterograde effects in Experiment I were merely a reflection of recall effects (Schulz, Experiment II, 1971).

Results from this experiment and from the Saufley and Winograd (1970) study on non-instructed subjects suggest that the intrinsic salience of the famous names may be an

important factor in determining that these items will be given a high-priority treatment. The non-instructed condition in both cases was essentially a von Restorff situation. The fact that the retrograde and anterograde effects were stronger when free recall was excluded suggested to Schulz that the free recall task may have facilitated the recognition of both immediately preceding items and immediately following items. Schulz felt that it might be possible that the immediately preceding and immediately following items could enjoy serial or associative organization with the high-priority event. In Experiment II, the high-priority events, and the immediately preceding and immediately following items were not recalled together. Therefore, any type of organization with the high-priority event, at the time of input, would not be as useful as it is in free recall where the high-priority event and the immediately preceding and following items are recalled together (Schulz, Experiment II, 1971). The encoding phase, as proposed by Tulving (1969), extends beyond the presentation time of an item and it is further proposed that a major portion of this encoding phase is devoted to the organizing of an item with other items in a given list. In the case of an immediately preceding item, the presentation of a high-priority event terminates the encoding phase of the immediately preceding item before the

immediately preceding item can be completely encoded into long-term memory, which results in the lower recall performance of the immediately preceding item. Presumably, the immediately following item is also affected because the processing of the high-priority event is carried over into the following item. Schulz argued that anterograde effects were not found when a free recall test was employed because of the high probability that the immediately following item would be organized with the high-priority event (Schulz, Experiment II, 1971). Since in a free recall task the subjects are allowed to recall the high-priority events, the immediately preceding items, and immediately following items together, such organization would be very beneficial. However, in Experiment II the immediately preceding item, high-priority event, and the immediately following item recognition pairs were not tested together and any organization would not be very beneficial to the subject. As a consequence the anterograde effect could be demonstrated in a recognition task, but not in a free recall task.

In Schulz's first two experiments the same 30 lists and the same recognition test pairings were used. In order to rule out any possibility that there might have been some characteristics specific to the materials used that could have been responsible for findings in Experiments I and II,