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Abstract

We hypothesized that subjective expectations were responsible for the release from proactive interference (PI) rather than the actual change in taxonomic subcategories. The experimental conditions included informing or not informing subjects of the change in taxonomic subcategory, crossed with whether the taxonomic subcategory was actually changed or remained unchanged. The interest in whether a release would be seen when the subjects were informed of a change, yet no change was actually administered, was most specific. Significantly higher recall was found for the condition in which subjects were informed of a change, but no actual change occured (I-NC) than in the control condition in which subjects were neither informed of a change nor did one occure (NI-NC). The overal results indicated that control condtions revealed lower recall than other conditions, $F(3, 129) = 2.96$. $p < .05$ on the critical trial. However, even when subjects were not told of a change, but a change occured (NI-C) a release from PI was observed, $M=.69$. A release from PI may be induced by the subject's self-awareness of the change in taxonomic subcategory.

Russ-Eft (1979) wrote that "proactive interference (PI) is a phenomenon characterized by a decreasing probability of recall with an increasing number of to-be-remembered items" (p. 422). However, since the late 1970's, little has been done to further understand this concept. Nevertheless, we were interested in the phenomenon because of the importance it plays in diverse applications in society. For example, it may be that if the phenomenon of PI is understood better, we will be able to utilize that knowledge when developing academic learning curricula, industrial training programs, and other procedural learning situations. It may be possible to make those learning experiences more fruitful by helping learners commit more information to long-term memory.

In the PI paradigm, subjects are presented with a list of three (sometimes more) items that are designated the to-be-remembered (TBR) items. After a distraction period subjects are prompted to recall these items. The original research varied the amount of time the distraction interval lasted (Brown, 1958; Peterson & Peterson, 1959). They found that the longer retention interval resulted in a greater memory decrement.

Brown (1958) postulated that memory loss after repeated trials was a result of decay. The decay theory states that information presented to the memory system starts to deteriorate immediately and automatically from short-term memory. He found a decrement in memory performance, as a function of time (Brown's finding was used to validate the decay theory). He presumed that because memory performance decreased as the retention interval increased, it must be the increased length of time that is responsible for poor memory performance.

However, Keppel and Underwood (1962) found that by maintaining a constant retention interval, there was still a decrement of memory from the first to the later trials when utilizing the same type of distractor task as Peterson and Peterson (Wickens, 1970). This finding led Keppel and Underwood to suggest that there was another process other than decay contributing to the loss of memory. They introduced a theory of memory loss being "attributable to PI [Proactive Interference] from previous items" (Baddeley, 1966, p. 302).

Wickens (1970) was interested in determining what mechanism might compensate for the effect of PI. He began an intensive study of the release from PI phenomenon. In Wickens' research, four trials were conducted in one category (e.g., fish). The study items were then changed to another category (e.g., tools) on the critical trial. He found that on this

on the critical trial. He found that on this crucial trial, when the category was changed, the subjects showed improved memory for the new category items. Thus, after having been given four consecutive trials of four words in each trial, the subjects have learned a total of 16 items from the same category (e.g., fish). If asked to recall the last group of four fish names, the subjects will have the previous 12 names of fish interfering with his or her memory. However, on the fourth trial, if the category was shifted to tools the subjects would have only four tools to remember, with no prior tools impeding upon the memory of those four. Thus, release from PI allows memory performance to improve.

Gardiner, Craik, and Birtwhistle (1972) referred to the 1970 study by Wickens in which summarized several prior studies which demonstrated that "rapid accumulation of PI depended upon similarity, across trials, of the TBR [to-be-remembered] items and further that performance could be restored almost to the original level if, on the next trial the TBR items were drawn from a different class" (p. 778). However, despite the general agreement as to the value of the release from PI effect when studying encoding, there is still no clear determination of the underlying causes.

Gardiner et al. (1972) summarized three basic hypotheses that could account for the release from PI. The first explanation is Wickens' (1970) attentional hypothesis which states that the subjects are alerted by the change in the TBR material on the critical trial and consequently gives more attention to the new material. The second possibility described by Gardiner et al., is Posner's storage hypothesis which suggests that "PI reflects spontaneous interaction during storage between the traces of current items and those of similar items stored from preceding trials. By this view the 'release' items are less vulnerable to intertrial interference" (p. 778-779). The third interpretation offered by Gardiner et al. was the retrieval hypothesis, attributed to Wickens. In this hypothesis, once "the TBR material is changed, the novel items supply a new, and thus more effective retrieval cue" (p. 779).

Wicken's research demonstrates that switching to a new category allows memory performance to increase to first trial levels. However, it is not clear from his work as to what defines a category. In fact, Gardiner et al. (1972) found no release when subjects were not informed about a subtle category shift (e.g. garden flowers to wild flowers). It may not be that categories, per se, are responsible for the release phenomenon. Rather, subject's subjective expectations may play a key role in the release phenomenon. As such, we suspected that subjective expectations alone may lead to the release from PI. To test this, we lead people to believe a category-shift had occurred when, in fact, no shift actually occurred (O'Neill, Sutcliffe & Tulving, 1976).

Our hypothesis was in partial agreement with each of the three hypotheses summarized by Gardiner et al. (1972). As with the attentional hypothesis, we too suspected that the subjects would be alerted by the change in category. This would allow the subjects to give more attention to the new material because the prior material is not going to be requested at recall. However, we suspected that the same effect would occur if the subjects thought that the category had changed even when the category remained constant. As to the storage hypothesis, we anticipated that the release items were less vulnerable to intertrial interference. However, it was our suggestion that this was a result of the subject's subjective expectation that information from the prior category would not be required at test, rather than the fact that it would not. As to Wickens' retrieval hypothesis, we proposed that it was the belief of category change that supplied the new, and thus more effective retrieval cue, rather than the change itself.

We suspected that the mechanism responsible for the release from PI was not the actual change in categories, but rather it was the subjective expectation that allows people to reorganize memory output, and thus permits release whether or not the category had actually changed.

Our purpose was to show that when the subjects *believed* there had been a change in the category from which the words were drawn, subjects would automatically purge the preceding, interfering material out of memory. Hence, subjects would experience a release from proactive interference. This clean memory register would then enable the memory system to encode and recall with efficiency equivalent to that experienced on the first trial. According to the subjective organization hypothesis, we suspected that the pattern of release would be as follows: I-C (Informed with change) = high release; NI-C (Not informed, but change) = low release; I-NC (Informed but not change) = high release; NI-NC (Not informed, no change) = low release.

It was the primary purpose of this experiment to demonstrate that an effect would be found in the subjective expectation of subjects. We thought the mechanism which controls release from PI is the subjective expectation of a category change on the critical trial, rather than the actual change.

Recognizing that the three hypotheses summarized by Gardiner et al. (1972) are not mutually exclusive of one another, our hypothesis does not distinguish between each of the three. Rather, our hypothesis offers an encompassing explanation of the higher processing involved in the proactive interference phenomenon, which the three hypotheses summarized by Gardiner et al. may be subordinate to.

Method

Overview

All subjects were tested in the Cognitive Psychology Lab at Florida International Univeristy. A personal computer was utilized to conduct all of the testing. A program designed specifically for testing the proactive interference phenomenon was employed to ensure consistent time intervals and random word selection for all of the subjects.

Subjects

The subjects were 143 Florida International University undergraduate students from various psychology classes. Participation in the experiment was offered as an extra credit project, or in some cases, as part of the class curriculum. Each subject was tested individually. There were young adult students in addition to older adult students. Age group was not analyzed.

Materials

We generated a list of word triads. These word groups were all taken from subcategories (e.g., indoor sports) of the larger classes (e.g., sports). Subjects were shown a triad of words on a computer screen. These words were grouped by subcategory. There were a total of 16 subcategories belonging to eight larger categories. Each word was presented for a two-second interval. After presentation of the words, the subjects engaged in an active distractor task of counting backwards, out loud, by threes, from a given three digit number. Immediately prior to encoding the final triad of words (this is also known as the *critical trial*) subjects were either given a blank screen if they were in the not informed condition, or a message identifying the subcategory to which the upcoming words belonged, such as "New Category= Saltwater Fish". The designation of the new category may have been an accurate depiction, or in some cases, intentional misinformation given by the experimenter such as "New Category = Fresh Water Fish", when in fact the category remained Salt Water Fish as in the previous trials.

Design

The study used a 4 X 2 between-subjects design with one factor being whether or not subjects were informed of a subcategory change and whether or not a change actually occurred. This variable was crossed with the presentation of either three or four trials prior to the critical trial.

Procedure

Upon entering the lab, each

subject was seated in front of the computer terminal. A list of instructions, which gave computer operating directions and task details, was read aloud by the examiner. The instructions were identical for all of the subjects. Once the experiment began, the subjects were presented with the first group of three words to remember. After presentation of the third word, subjects engaged in the distraction task. Upon completion of the distractor task, the subjects were asked to recall the target words by typing them on the computer. Order of recall was not important. The subjects were then presented with the next word triad. This continued until the final critical trial.

In the final trial, the critical manipulation occurred. Some subjects were informed of a sub-category shift and others were not. Subjects were randomly assigned to the informed or not informed conditions in addition to being randomly assigned to the change or no change conditions.

Informed Conditions

For those subjects who were informed of a sub-category change, a change may have occurred (I-C), or they may have been misinformed of a change when no change actually occurred (I-NC). For half of the informed subjects, this shift actually occurred.

Change vs. No Change Condition

The two separate conditions that involved change of the subcategory were the change and no change conditions. In the change condition, a subcategory different than that in the prior trials was actually introduced. The subjects may have been previously informed of the change (I-C), or not informed of any change (NI-C). However, in the no change condition, the subcategory remained the same as the prior trial even when informed that a change was about to occur (I-NC).

A control condition was also run in which subjects were not informed of any subcategory information on the critical trial, nor was there any change in the subcategory (NI-NC). These four conditions (I-C, I-NC, NI-C, NI-NC) were crossed with the possibility of receiving either three of four word triads prior to the critical trial. This yielded a total of eight experimental conditions. We then compared the amount of release as a function of a subcategory shift and subject's awareness of this shift.

Results

We found significantly higher recall for the condition in which subjects were informed of a change, but no actual change occurred (I-NC, $M = .63$) than in the control condition (NI-NC, $M = .49$), $t(143) = 1.8$, $p < .05$, one-tailed. Overall, we found that the control condition showed lower recall than the other conditions, $F(3,143) = 2.96$, $p < .05$ on the critical trial. However, even when subjects were not told of a change, but a change occurred, we observed a release from PI ($M = .69$). Thus, we did not replicate the Gardiner, et al. findings. Additionally, we found no difference between the presentation of three trials and four trials prior to the critical trial.

Discussion

The release from PI may be induced by the subject's awareness of the change in taxonomic subcategory. This awareness may occur either by having been made aware of a change in subcategory by the experimenter or by noticing it themselves. In each of the three conditions in which the subjects became aware of a change (or supposed change) the subjects were expecting different upcoming information and perhaps purged the prior interfering material from short-term memory.

What seems to be most interesting is that misinforming the subjects actually resulted in an increase in memory performance. It seems that this misinformation serves as a stimulus for the subject's memory system to unconsciously clear the memory store of all prior information. As such, the memory register is then ready to accept at full capacity/efficiency the

upcoming information which will not be impeded by the previous, now purged information. According to our results, it must be that the memory system looks for opportunities to clear its bank of prior information to enable processing of any upcoming information in the most efficient manner possible.

Further research in the applied field should be able to test this idea. For example, it may be that by presenting short segments of information in learning environments such as school, then changing to a new topic or to a different sub-topic within the same overall topic, students may be able to recall the information better. With clearer recall of the material, storage in long-term memory may be enhanced.

In summary, self-awareness alone, appears to be sufficient to induce a release. When subjects are made aware of a potential change, their recall performance improves even when they have been misled by the experimenter.

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