The Memory Consequences of Study after Successful Recall

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Introduction

Our lab has been investigating data and models of spaced memory practice with the long-term goal of applying these models to optimizing the learning of material like vocabulary items. These continuous paired-associate experiments have utilized a recall-or-study trial procedure on both of 2 sessions. On first sessions (Session 1), items are randomized into conditions where they will receive a number practices at various spacing intervals. The memorial consequences of these conditions (distributed continuously across Session 1) are assessed during second sessions (Session 2) in which all of the items are retested several times to determine the effects of the practice by spacing conditions.

The procedure in these experiments was to introduce each paired-associate with an initial 5-second study presentation of the cue-response pair. Subsequent trials were then presented as tests of this knowledge. Because we wanted each trial to count as a single practice in the model, we provided a restudy presentation only when participants responded incorrectly. If the response was correct, we assumed that the correct response constituted a practice of the item. We felt that this recall-or-study procedure resulted in roughly equal practice for each trial.

However, a review of our work suggested that our assumption might not be so uncontroversial. Because of this we designed an experiment where we compared our procedure with a more typical test-and-study procedure where a study opportunity was always presented after a test.

Experiment

The basic procedures for the experiment are described above. The retention interval was 2 days. We looked at our results in terms of both session 1 and session 2 performance. On session 1, we compared recall performance for the two procedures for test trials 2 and 3 (where the effect should be strongest since it had not yet approached ceiling). The first test was excluded because the difference between conditions occurs depending on the success of this test. Means for test 2 and 3 performance were .684 and .639 for the test-and-study and recall-or-study procedures, respectively. This was significant $t = 2.372$, $p < .05$. However, a follow-up conditional analysis suggested that some portion of this effect was merely noise.

Not surprisingly, very little of this benefit persisted into Session 2 in which performance averages were .9 and .883 respectively, and the difference was not significant. Furthermore, session 2 first test results, which were farther from ceiling (*M*s = .760 and .746 respectively for test-and-study and recall-or-study conditions) also showed no significant difference.

Discussion

Subsequent to the experiment an ACT-R (Adaptive Character of Thought – Rational) (Anderson and Lebiere, 1998) model was created using modifications designed to capture the spacing effect described in Pavlik and Anderson (2003). This model captures the small differences in performance by proposing that study trials immediately following successful recall have little effect on long-term memory because the effect of these studies decays more quickly.

The data and model have implications for teaching material such as vocabulary items because they showed that in the typical paired-associate procedure the study trial after a correct recall is redundant and thus inefficient. Further, the data suggest that it is not crucial for models to consider the study after successful recall because its effect is so small. Finally, the model was shown to agree with arguments and data from Kimball and Metcalfe (2003) which proposed a theory of why delayed judgments of learning (JOLs) are more effective than immediate JOLs. The model agrees that this effect, which occurs only when there is no study after the JOL, is not due to enhanced metamemory.

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References

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