

Experiment 2: Effects of Processing Depth on Implicit and Explicit Memory for Anagrams

Assignment

Include the following elements of a research paper in your laboratory paper for this experiment:

Title page

Method section (with appropriate subheadings – include a Design section as a subheading)

Results (describe results verbally, present the outcomes of statistical tests and describe the statistical conclusions reached, include **Figures and/or Tables** to present important results)

Discussion

References

Background Information for the Experiment

In recent years, researchers in memory have been interested in the relation between memory performance and our awareness that we are “remembering something.” Graf and Schacter (1985) suggested the term *implicit memory* to refer to memory for information that does not include awareness that we are *remembering*. This type of memory is revealed when performance on a task (such as the speed of solving a word puzzle) is improved when we have had some prior experience with materials used in the task. For example, we might have recently studied words that solve anagrams when we studied a list of words for a memory test. When solving the anagrams, we might not be aware that we are writing down words from the study list, but we might solve more anagrams for words that we studied than for words that we have not seen recently. In contrast, *explicit memory* refers to memory performance when we are aware that we are remembering. For example, we are aware that we are using our memory when we take a test and write down words from a list we studied.

Cognitive psychologists are interested in whether implicit memory and explicit memory represent different memory systems that are governed by different rules (e.g., Cohen & Squire, 1980). If there are multiple memory systems, the conditions that influence the quality of implicit memory will differ from the conditions that influence the quality of explicit memory. Thus, performance on an implicit memory test might be quite different from performance on an explicit task (such as free recall) for the same set of studied words. In our experiment, students might have forgotten many words from the list by the time they begin the free recall task and their memory for the words studied might be quite poor. However, they might still produce many of these same words as responses in the anagram task.

In addition, this experiment was designed to show that the manipulation of processing depth affects performance on an explicit memory task differently than it affects performance on an implicit memory task. Much research supports the beneficial effect of deeper, semantic processing on explicit tests such as free recall (e.g., Craik & Lockhart, 1972). However, Graf and Schacter (1985) suggest that implicit memory is not improved by deeper processing. This implies that words given deep processing will be remembered more often than words given shallow processing on a free recall test but that mere exposure to the words in any processing task (deep or shallow) will provide an equivalent benefit to performance on an implicit memory task such as anagram solution.

Details about the Method

- Participants were either students enrolled in the Memory & Cognition Laboratory or friends and family recruited by these students ($n = 9$)

- Refer to the data sheet to identify the number who studied each set of anagram solutions
- 40 anagrams for 6-letter words
- Anagrams had two (and only two) correct solutions (e.g., ACENST can be solved as either ASCENT or STANCE) Source of two-solution anagrams: Rawlinson, 1976
- 15 anagrams randomly selected for presentation in the deep processing study list
- 15 anagram randomly selected for presentation in the shallow processing study list
- 10 anagrams used as filler items for the anagram task (never studied)
- Solution “pairs” were randomly assigned to List A or List B
- Two versions of the processing task: one Power Point presentation presented the List A solution words; the other presented the List B solution words
- Each Power Point presentation presented two lists of words (one for each processing task)
- Shallow processing task: Does the word contain the letter B or P (yes/no response)
- Deep processing task: Rate the word on its *pleasantness*
- Describe counterbalancing of processing tasks across the 2 versions of the Power Point presentations
- Describe the filler task: Participants read a short story about a man and a woman who stop for gas and snacks on their way home from a holiday trip followed by answering questions about the story. The story contains many events that would be expected from a script for a stop for gasoline on an interstate. Many details from such a script are implied but not presented.
- Recall of story: Participants answered 15 questions about details related to the story. Half of the questions request details that were explicitly stated in the story. Half of the questions request details that could be inferred from the statements made in the story or are consistent with pre-existing knowledge (script knowledge) about stopping on a freeway.
- Implicit Memory Test (test for memory without awareness): 24 anagrams for the studied words (the last 12 from each list – first 3 were used as practice on the task) plus 10 filler anagrams (anagrams for non-studied words)
- Anagram task: solve the anagram with a real word (correctly spelled) that uses all the letters
- Anagrams were randomly intermixed in groups of three (filler anagrams; shallow processing list anagrams and deep processing list anagrams)
- Studied anagrams were presented in the same order that they were presented in during the study list
- Instructions were given for the processing tasks for the two lists of words, information about two filler tasks: reading a short story and answering some questions about it followed by a “word puzzle” task (actually, the implicit memory task).
- The recall test for memory for the words in the two lists was given after the anagram task was finished.
- Study words were presented in 60 point Times Roman Bold font in the center of the screen
- Words seen for 6 seconds.
- At the end of each list, a screen giving instructions for the next task (next rating task or the story task) was presented.
- Students pressed a key to advance to the next rating task or to the story.
- The story was presented on one screen in 26 point Times Roman font. The story remained on the screen until the space bar was pressed. (Instructions to press the space bar after finishing the story were printed in red at the bottom of the screen.)
- The next screen presented instructions to complete the set of questions about the story in the test booklet, followed by completion of the anagram task and then the memory test.
- Memory test: written free recall - write as many words that can be remembered from the study list in any order.
- Students worked at their own pace when reading the story, answering story-related questions, solving the anagrams, and completing the free recall test.

- Solution words for 24 of the anagrams in the anagram task had been seen recently in one of the rating task list (one shallow, one deep)
- The remaining 10 anagrams had not been seen recently (filler anagrams)
- One group studied one set of anagram solution words, the other group studied a different set of solution words.
- Measures
 - Number of anagrams solved with words from the “A” solution set (SolA in SPSS data file)
 - Number of anagrams solved with words from the “B” solution set (SolB in SPSS data file)
 - Number of filler anagrams solved (with either the A or B solution) (Fillers in SPSS data file)
 - Number of anagrams solved with words that had been seen in the shallow task (implicit_s in SPSS data file)
 - Number of anagrams solved with words that had been seen in the deep task (implicit_d in SPSS data file)
 - Number of studied words correctly recalled in the free recall task from the “shallow” list (explicit_s in SPSS data file)
 - Number of studied words correctly recalled in the free recall task from the “deep” list (explicit_d in SPSS data file)

Results

We will review data analysis during lab time. A copy of the SPSS output for this analysis is posted on my web site. Provide a verbal description of the findings, including at least one Figure (either a bar graph or a line graph that shows the data for the effects of the interaction of depth of processing and type of memory test on test performance). Present descriptive data for each of the hypotheses tested in this experiment. In addition, present the findings from each statistical analysis relevant to these hypothesis. Remember to state the conclusion drawn for each hypothesis. You will find it useful to organize this results section as a series of statistical analyses, each of which helps answer a specific question.

Discussion

Discuss the appropriate interpretation of these findings for questions about the nature of implicit and explicit memory and the effects of depth of processing. Connect these findings to the existing research literature on this topic. Discuss *important* limitations associated with this research. What conclusions can be drawn? Remember to support your conclusions with specific evidence based either on data generated in this research or on data reported in research that you cite.

References

- Cohen, N. J., & Squire, L. R. (1980). Preserved learning and pattern-analyzing skill in amnesia: dissociation of knowing how and knowing that. *Science*, *210*, 207-210.
- Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, *11*, 671-684.
- Graf, P., & Schacter, D. L. (1985). Implicit and explicit memory for new associations in normal and amnesic subjects. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *11*, 386-396.
- Rawlinson, G. E., (1976). Anagram frequency counts and anagram lists. *Quarterly Journal of Experimental Psychology*, *28*, 125-142.