

Contextual effects on learning and memory

LAWRENCE C. PERLMUTER

Veterans Administration Outpatient Clinic, Boston, Massachusetts 02108

and

RICHARD A. MONTY

*Behavioral Research Directorate, U.S. Army Human Engineering Laboratory
Aberdeen Proving Ground, Maryland 21005*

Subjects were given a page of words containing either two or four words per line. A single word (target) on each line was to be learned. Results showed that directing attention to background words by allowing subjects to choose the target word enhanced the incidental learning of those background items and learning of the target items as well. Possible reasons for these observations were discussed.

When one is required to remember a specific piece of information, such as a particular line of text on a printed page, in addition to learning the specific or "targeted" item, one simultaneously acquires and retains information about the context in which that target is embedded (e.g., Zechmeister & McKillip, 1972). It is fashionable to refer to such learning as "incidental," because it is not planned or purposeful. It has even been shown that learning of these contextual "cues" influences recognition and recall of the purposely learned target items. For example, successfully recalling the location on a page of the material to be remembered has been shown to be positively related to successful recall of the targeted items (Schulman, 1973).

The purpose of the present experiment was to determine if manipulating the amount of attention devoted to the context or background items would enhance not only the incidental learning of those items, but the learning of the targeted items as well. The amount of attention devoted to the background items was manipulated by allowing subjects, in some cases, to choose the target word they wished to learn on a line of words. The nonchosen words then served as the background or context on a subsequent target discrimination task. A

This research was supported in part by grants from the U.S. Army Human Engineering Laboratory Behavioral Research Directorate and the Veterans Administration. Thanks to Teresa Bennet and David Libon for assistance with data collection and to Janet England and Alan Feiner for assistance with data analyses. Victor Hoffman provided assistance with computer programs and analyses. His help is gratefully acknowledged. Robert A. Goodale of Boston State College graciously provided laboratory space and access to subjects. Special thanks go to Deborah Birkmire, Malekah Hakami, Robert Karsh, Wayne Shebilske, and Harvey A. Taub for constructive reviews of earlier versions of this manuscript. Address requests for reprints to Lawrence C. Perlmutter, Geriatric Research, Education and Clinical Center, V.A. Outpatient Clinic, 17 Court Street, Boston, Massachusetts 02108.

recognition task was also administered to permit examination of incidental learning of the background materials.

METHOD

Subjects

The subjects were 17 female students from an introductory psychology course at Simmons College. Each was paid \$4 for participation in the experiment.

Procedure

The experiment employed a within-subjects paradigm in which participants were presented lines of two or four five-letter words of high meaningfulness taken from a list generated by Locascio and Ley (1972). The subjects were told they would be required to remember one word from each line on a subsequent target discrimination task. Half of the target words (the words to be remembered) were chosen by the subjects (choice condition), and the remainder were selected randomly by the experimenter (force condition). In addition to performing the target discrimination task, the subjects were given an unanticipated recognition task.

The specific procedures were as follows. Upon arrival at the laboratory, small groups of subjects were shown a practice sheet containing five lines, each composed of two or four commonly used five-letter words. The first line consisted of two words, one of which was underlined, and subjects were instructed to draw a second line under the target word and then to study the word. The second line consisted of four words, one of which was underlined, and the same procedure was followed. The third line consisted of four words, none of which was underlined. Thus, on this choice line, subjects were instructed to choose the word they wished to remember and to underline and study it in the same manner as they had studied the targets in the previous lines. The fourth line presented a four-item force condition and the fifth, a two-item choice condition.

Following the choice/force phase, the subjects turned to Page 2 of their booklet for the target discrimination test, in which they saw four of the five lines of words they had just studied. The order of the lines and the order of the words within each line were rearranged randomly. None of the words was underlined. The first line consisted of two words, and subjects were instructed to underline the one word that had been underlined. They were encouraged to guess if they were uncertain. The same procedure was followed for Line 2. The third and fourth

lines each had four words on them, but two of the words on each line had been crossed out with a slash. This was done in order to eliminate differential guessing opportunities on the two- and four-item lines during the target discrimination trials. The subjects were told that one of the remaining two words had been underlined before and they were to remember or guess which one. This completed the practice session, and subjects were allowed to ask questions. At the start of the actual experiment, subjects were informed that the procedure would be similar to that of the practice trials but that a much larger set of words would be presented.

On the next page of the booklet, subjects were shown 24 lines (with 12 two- and 12 four-item lines interspersed) composed of a total of 72 high-meaningfulness words. They went through the choice/force procedure line by line, paced by the experimenter at the rate of 7 sec/line. On half of the lines, subjects chose the target words (choice condition), and on the remaining lines, target words were selected randomly by the experimenter (force condition). Within the choice condition, six lines consisted of two words and six lines consisted of four words. An identical division occurred within the force condition.

Following the choice/force phase, the subjects were given a 15-min break, during which the booklets were collected. Each booklet was turned to the test pages, and on each of the four-item lines, two (of the remaining three) nonchosen background words were crossed out by the experimenter. As in the practice trials, this was done so that on the test trials guessing probabilities would be equated on two- and four-item lines. The booklets with the appropriate items crossed out were returned to the subjects, and the first of two target discrimination trials was presented. That is, subjects turned to the first test page in their booklet, which displayed the 24 lines of items that had been presented during the choice/force phase. The order of the lines and the order of the words within the lines differed from the previous pages, and none of the words was underlined. Thus, during each of the two target discrimination trials, subjects recalled and underlined the one target item on each line that they had underlined during the choice/force phase. They were given 2 min to complete this task. Following this, subjects were instructed to turn back to the page on which they had made their selections and were given an additional 1 min of study. They then proceeded to the next test page, representing the second target discrimination trial, which was identical to the first except that items on a line and the lines themselves appeared in a different random order and only 1.5 min were allowed for completion of the test trial.

Following the target discrimination trials the subjects received an unanticipated recognition test that had not been included in the practice trials. Specifically, all 72 words that were utilized in the choice/force phase were randomly intermixed with an additional 72 words of equivalent meaningfulness, and the entire set of words was listed vertically, one item per line, on three booklet pages. To the right of the word list was a column labeled "old," a column labeled "new," and three confidence categories: "unconfident," "moderately confident," and "very confident." Subjects were instructed to read each word carefully, to check "old" if the word had appeared in the prior phase and "new" if the word had not appeared previously, and to indicate their confidence in the old-new decision. Subjects proceeded at their own rate, requiring about 15 min to complete this task.

RESULTS

Target Discrimination

The number of target words correctly underlined on the target discrimination task was subjected to an analysis of variance with conditions (choice vs. force) and numerosity (two vs. four items per line) as within-

subjects effects. Because of ceiling effects, Trial 2 was excluded from analysis. Only the main effect for conditions [$F(1,16) = 12.55$, $p < .01$, $MSe = 6.52$] reached significance, indicating that the percentage of choice items correctly recalled was greater than the percentage of force items (97% vs. 87%, respectively).

In summary, subject-selected target words were better discriminated than assigned target words. Further, discrimination of the target words was unaffected by numerosity (number of background items per line), an outcome Kausler and Kleim (1978) also found with college students with a similar task. Full interpretation of this outcome is dependent upon analysis of the recognition data in which target and background items are analyzed jointly.

Recognition Test

With respect to performance on the recognition task, the 72 old words (i.e., the words that had been presented during the choice/force phase) were treated as follows: A 6-point rating scale was established, whereby if the subject reported "old" and "very confident," "moderately confident," or "unconfident," a rating of 6, 5, or 4 was used, respectively. If they reported "new" and "unconfident," "moderately confident," or "very confident," a rating of 3, 2, or 1 was used, respectively. Thus, the best score, 6, was assigned if the subjects said "old" and "very confident," which was correct, and the worst score, 1, was assigned if they reported "new" and "very confident," as they were, of course, incorrect.

The rating scores were subjected to an analysis of variance with conditions (choice vs. force), numerosity (two vs. four items per line), and word type (target vs. background word) all as within-subjects effects. The main effect for numerosity reached significance [$F(1,16) = 60.80$, $p < .001$, $MSe = .27$], indicating that performance was better on the two-item lines than on the four-item lines (mean ratings, respectively, of 5.49 and 4.79). Similarly, the main effect for word type was significant [$F(1,16) = 103.79$, $p < .001$, $MSe = .62$], indicating that better recognition performance (higher ratings) was associated with the target words than with the background words (5.83 and 4.45, respectively). The Numerosity by Word Type interaction [$F(1,16) = 84.63$, $p < .001$, $MSe = .13$] also reached significance, indicating that target recognition was unaffected by numerosity, whereas recognition of background items decreased with an increase in numerosity, as shown in Figure 1.

Finally, the Conditions by Numerosity interaction also reached significance [$F(1,16) = 11.89$, $p < .01$, $MSe = .21$]. While the subjects achieved approximately the same recognition scores on the choice vs. force two-item lines (mean ratings = 5.41 and 5.58, respectively), with the four-item lines, recognition was relatively poorer in the force condition (mean ratings of 4.98 and 4.61 for choice and force, respectively). That

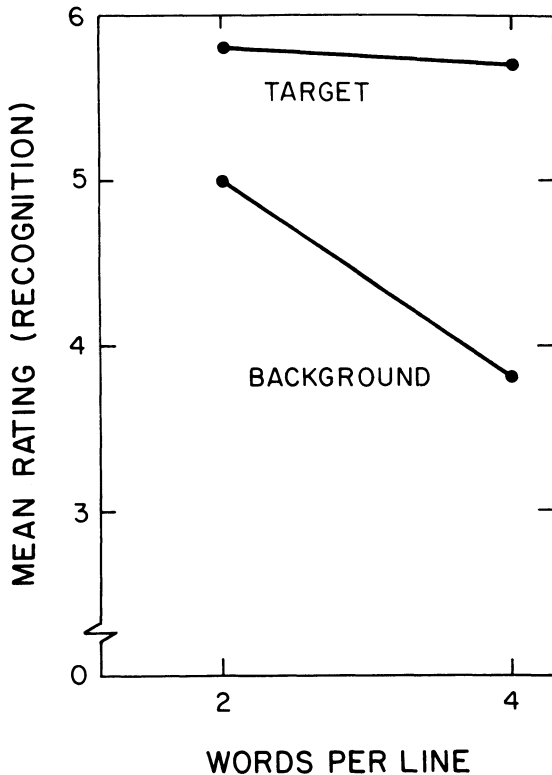


Figure 1. Mean rating on the recognition trial for target and background words as a function of the number of words per line.

is, the decline in recognition observed on longer lines was somewhat offset by the opportunity to choose. All other effects failed to reach significance at the .05 level of confidence.

These results, then, offer some support for the conclusion that choice benefited the learning of the target as well as the background items. However, these effects appear to be limited to the long lines.

DISCUSSION

In summary, target discrimination was enhanced by the opportunity to choose. Further, choice enhanced the recognition scores for both target and background items on the four-word lines. It appears, then, that directing attention to the background items by offering subjects a choice of materials to be learned not only enhances incidental learning of contextual material but also facilitates learning of the target items. These effects were reflected by both target discrimination and target recognition scores. From the point of view of the limited-capacity theorists (e.g., Posner & Klein, 1973), this result may be unexpected. From a limited-capacity perspective, it might be predicted that force targets would have been learned better than choice targets because attention to the force targets should not have been diluted by the need to examine background words. Similarly, background words should have been more poorly learned in the choice condition than in the force condi-

tion, since, presumably, choice targets received a greater amount of attention. In other words, the enhanced learning of items in one category (target or background) should have occurred at the expense of the learning of items in the other category.

One possible explanation for the enhanced learning of subject-selected targets is that subjects merely selected the items that were easiest to learn. Accordingly, by comparison with the choice targets, the assigned targets would have been relatively more difficult to learn. This explanation, however, fails to account for the superior recognition of background words on choice lines that were not selected because they were too difficult (according to this hypothesis) to learn. Thus, this idiosyncratic-choice explanation is at best incomplete.

Yet another explanation might attribute the superior learning of choice items to deeper levels of processing (Craig & Lockhart, 1972). To account for the superior learning of background items, this explanation would have to assume that background items on the choice lines were likewise more deeply processed than background items on the force lines. Although this explanation satisfactorily accounts for the improved learning of target-background items on choice relative to force lines, it lacks the explanatory power to account for results of some previous experiments in which the beneficial effects of choice were shown to generalize to the learning of nonchosen items and, indeed, to benefit performance on a nonchoice task (Monty, Rosenberger, & Perlmutter, 1973; Perlmutter, Scharff, Karsh, & Monty, 1980).

In summary, then, we are left with two possible explanations. Either the greater degree of attention devoted to both the target and background words brought about by the choice condition facilitated learning of both sets of words in the manner discussed by Schulman (1973) or offering the subject a choice led to a generalized state of motivation, as discussed elsewhere (Monty et al., 1973; Perlmutter & Monty, 1977; Perlmutter et al., 1980). Further experiments will more critically address these alternatives.

REFERENCES

- CRAIK, F. I., & LOCKHART, R. S. Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, 1972, 11, 671-684.
- KAUSLER, D. H., & KLEIM, D. M. Age differences in processing relevant versus irrelevant stimuli in multiple item recognition learning. *Journal of Gerontology*, 1978, 33, 87-93.
- LOCASCIO, D., & LEY, R. Scale-rated meaningfulness of 319 cvvc word paralogues previously assessed for associative reaction time. *Journal of Verbal Learning and Verbal Behavior*, 1972, 11, 243-250.
- MONTY, R. A., ROSENBERGER, M. A., & PERLMUTER, L. C. Amount and locus of choice as sources of motivation in paired-associate learning. *Journal of Experimental Psychology*, 1973, 97, 16-21.
- PERLMUTER, L. C., & MONTY, R. A. The importance of perceived control: Fact or fantasy? *American Scientist*, 1977, 65, 759-765.
- PERLMUTER, L. C., SCHARFF, K., KARSH, R., & MONTY, R. A. Perceived control: A generalized state of motivation. *Motivation and Emotion*, 1980, 4, 35-45.
- POSNER, M. I., & KLEIN, R. On the functions of consciousness. In S. Kornblum (Ed.), *Attention and performance IV*. New York: Academic Press, 1973.
- SCHULMAN, A. I. Recognition memory and the recall of spatial location. *Memory & Cognition*, 1973, 1, 256-260.
- ZECHMEISTER, E. B., & MCKILLIP, J. Recall of place on the page. *Journal of Educational Psychology*, 1972, 63, 446-453.

(Received for publication October 29, 1982.)