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The effects of practice upon rehearsal in short-term memory*

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Ss were allowed to pace their acquisition of nine items in a memory task, and the distribution of their rehearsal was measured. Peak rehearsal pauses changed positions across the first five trials but occurred at the same positions across the last five. Thus, Ss used the first trials to test various acquisition strategies and select among them the one that enabled them to maximize their recall.

Contemporary theories of memory and explanations of experimental findings are relying increasingly on the postulation of cognitive processes rather than associative concepts (Norman, 1970). Consider Restle's (1970) explanation of his transfer-of-training findings. He pretrained two groups of Ss in a continuous paired-associates task, one group having relatively long presentation-to-test intervals (Group 1) and the other experiencing shorter intervals (Group 2). Both groups were then tested on the same task with variable intervals. Restle found that the group trained with longer memory intervals showed greater accuracy on the test trials over all intervals. He suggested that Ss' information-processing strategies were a function of the demands of the task on which they were trained and that once a cognitive structure was learned in training, it would be transferred to the test trials. Group 2 Ss could perform adequately in their training trials by merely storing a few recency items in a short-term rehearsal buffer. However, Group 1 Ss had to employ a more permanent long-term code in training, which, when transferred to the test trials, presumably accounted for their superior performance at all intervals. Restle extrapolated from these findings the hypothesis that the phenomenon of improvement over trials in a memory task, commonly known as learning-to-learn or practice effects, might reflect the fact that it takes several trials for Ss to select the most efficient strategy for the task at hand rather than the refinement across trials of any one strategy.

The present experiment was designed to test Restle's hypothesis that Ss use the first few trials of a short-term memory task to select an appropriate acquisition strategy. The experiment uses a multiple-list, single-trial, single-probe serial memory task in which the Ss themselves determine the rate at which the lists' items are presented. Previous investigations using this task have provided Ss with from 5 to 10 "practice" trials to familiarize themselves with the task (Belmont & Butterfield, 1969). Analyses of the Ss' interitem pauses have revealed that during the postpractice trials, Ss typically pause to rehearse near the middle of the lists but do not pause appreciably toward the end of the lists. The explanation for the use of this strategy is that recall of the probe from the early and middle portions of the lists requires that these items be transferred to a relatively permanent secondary memory store by means of rehearsal, which is accomplished during pauses near or just past the middle of the lists, whereas the terminal list items can be recalled accurately simply by committing them to an echo box or primary memory store.

If Ss adopt this sort of strategy gradually, then an examination of data from the first few trials, which are usually administered just to familiarize Ss with the task, should reveal evolving patterns of hesitations which gradually change to a stable pattern of pausing most just past the middle of the lists.

SUBJECTS

The Ss were 11 undergraduate students who volunteered their services for $2.00.

*The research reported here was supported by USPHS Grants HD-00183 and HD-04760. Reprint requests should be sent to the first author at 3933 Eaton Street, Kansas City, Kans. 66103.

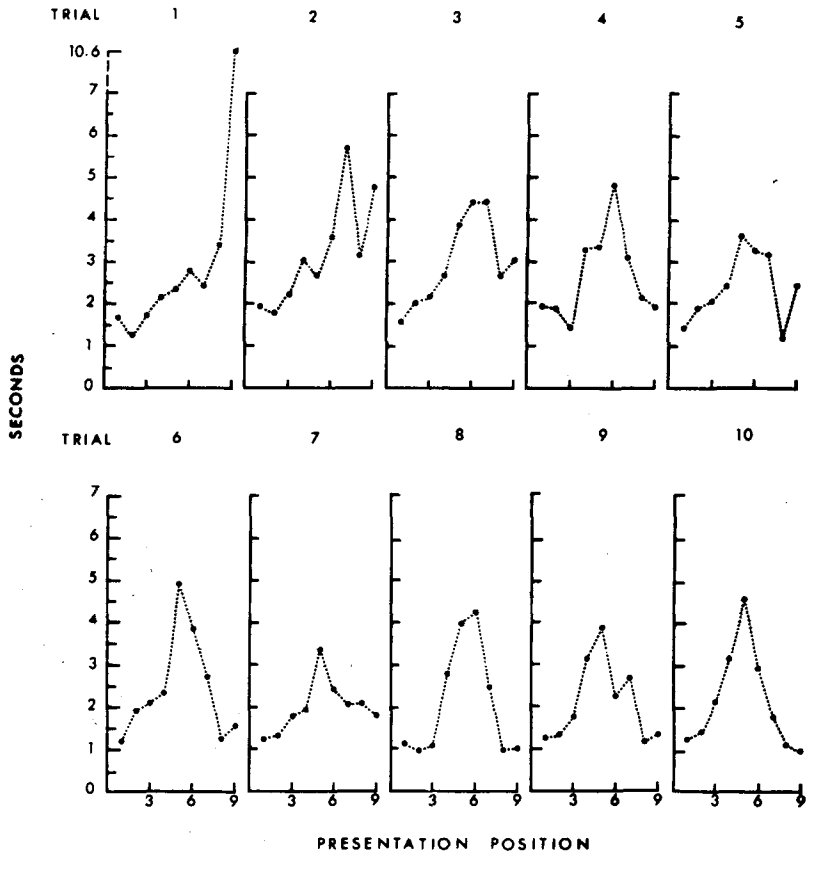

Fig. 1. Mean pauses following each presentation position for each of 10 trials.

APPARATUS

The S was faced with a 24 x 8 in. panel, along the lower half of which were mounted, 2.5 in. from center to center, nine Industrial Electronics in-line projectors, each capable of displaying the 12 letters A, C, E, H, K, L, N, P, S, U, X, and Z. The letters were projected through switch-loaded transparent Lucite keys. A 10th (test) projector was mounted above the middle of this stimulus array. Relay circuitry associated with a static card reader determined the letter to be presented in each projector and the sequence of projectors. A pushbutton switch permitted S to expose the letter sequence at any rate, with the restrictions that all letters were of 0.5-sec duration and were preceded by a 0.3-sec lag following S's push-to-see response. A printing counter recorded the time to the nearest .05 sec from each letter offset to S's next push-to-see response. Each list was tested with a single probe which appeared in the upper projector. The S's response following the appearance of the probe was to press the projector screen where the probe letter had appeared in the list. The position of the correct response varied randomly across trials.

PROCEDURE

All Ss were given 10 trials, with a different arrangement of letters on each trial. For each trial, the randomly generated list of nine letters appeared one at a time from left to right across the face of the apparatus. The Ss themselves determined when each letter appeared by pressing a button, and dependent measures were the interletter pauses created by Ss as they paced themselves through the 10 lists.

RESULTS

Figure 1 shows the mean pause following each position (letter) for each of the 10 trials of the experiment. It shows that there was a marked change in where the Ss paused to rehearse over the first five trials and much less change over the last five trials. In order to evaluate these data, a 2 by 5 by 9 Half (first vs second five trials) by Trials by Positions analysis of variance was performed. All of the main effects and every interaction except Trials by Half were significant ($p < .05$). In order to clarify the Half by Trials by Positions interaction [$F(32,320) = 2.61$, $p < .01$], Trials by Positions analyses were performed separately for the first and second halves of the experiment. The analysis for the first half revealed significant effects for positions [$F(8,80) = 4.01$, $p < .01$] and Trials by Position [$F(32,320) = 3.50$, $p < .01$]. The analysis of the second half showed only a significant main effect for positions [$F(8,80) = 2.72$, $p < .05$].

DISCUSSION

The findings indicate that Ss used the first few trials to select an acquisition strategy that was well suited to the memory demands of the probe task. They began by employing rehearsal to transfer all nine of the list's letters to a relatively long-term memory store. Gradually, they employed less and less rehearsal of the terminal letters of the list until, by the sixth trial, they were transferring only the first five or six letters to a long-term store and allowing the last three or four letters to remain unrehearsed in an immediate memory store. The adoption of this dual active-passive strategy is entirely consistent with the theoretical models proposed by Norman & Rumelhart (1970), Wickelgren (1970), and Shiffrin (1970). It also confirms the hypothesis of Restle (1970) that Ss use the first few trials of a memory experiment to test a variety of strategies in order to select the most effective one for the demands of the particular task.

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