Intralist similarity and facilitation of paired-associate learning by fixed order presentation¹

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It was demonstrated that when intralist similarity is high, paired-associate learning proceeds faster with fixed order presentation than with varied order. When intralist similarity is low, fixed order presentation does not facilitate learning.

An incidental finding in various studies of paired-associate learning has been that failure to rearrange the order of paired-associate items from trial to trial results in superior performance (McGeoch & McKinney, 1937; McGeoch & Underwood, 1943). This result was presumed to be a consequence of the utilization of serial cues. Newman & Saltz (1963), however, have obtained better paired-associate learning from fixed order, as compared with varied order presentation, even when the stimuli were rearranged on the test trial. This latter finding cannot be explained directly on the basis of serial cues, but suggests that fixed order presentation during learning contributes in some way to the association of individual stimulus-response pairs. Following Martin & Saltz' (1963) failure to replicate the Newman and Saltz results, Battig, Brown, & Nelson (1963) proceeded to conduct a series of five experiments in an attempt to identify variables that might be critical to the facilitative effect of fixed order presentation. Although they obtained the facilitative effect in several studies, unfortunately none of the variables they chose to manipulate showed any consistent interaction with the fixed-varied conditions. In a theoretical analysis, however, Battig et al suggest that stimulus-similarity or intralist similarity might be a relevant variable.

The primary differences between the Newman & Saltz (1962) and Martin & Saltz (1963) studies were in presentation time, i.e., inter-item interval, and in stimulus similarity. Newman and Saltz, who found a facilitative effect from fixed order presentation, used only four different consonants to construct a list of 10 CVC trigram stimuli, whereas Martin and Saltz, who obtained no effect, constructed their CVC stimuli from a set of 15 consonants.

The study reported here was done to ascertain whether intralist similarity does interact with constant serial order presentation in influencing paired-associate learning.

Method

The stimuli were two-letter words made from novel letters that had been created for a study on reading (Jeffrey & Samuels, 1966). They were highly dis-

criminable from each other, and sufficiently dissimilar to the Roman alphabet to make generalization from the latter unlikely. The responses to be learned, however, were familiar phonemes arbitrarily assigned one to a letter. A high similarity list was constructed by using only four of these novel letters to construct four two-letter words, whereas the low similarity list utilized eight different letters to construct four two-letter words. The responses for the high similarity list were $\bar{m}\bar{e}$, $\bar{m}\bar{a}$, $\bar{s}\bar{e}$, $\bar{s}\bar{a}$. Those for the low similarity list were $\bar{d}\bar{a}$, $\bar{b}\bar{e}$, $\bar{m}\bar{i}$, and $\bar{s}\bar{o}$.

The Ss were 48 children with a median age of 5 yr. 5 mo. They were divided into four groups, two of which received high similarity lists with either fixed or varied order presentation, and two of which received low similarity lists with fixed or varied order presentation. Each S was shown the four stimulus "words" in his list, told the word to be associated with each stimulus, and required to repeat the word. He was then told that on subsequent presentations he must try to say the correct word before E said the word. The stimulus cards were presented manually on 5 x 8 in. index cards with an approximate 4-sec. interval provided for S's response before the word was spoken by E. All Ss received 18 training trials prior to a test trial which followed without interruption. For the varied order groups, the order in which the four stimuli were presented was randomized from trial to trial. For the fixed order groups, the order was the same on each trial until the test trial when it was varied for the first time.

Results and Discussion

The mean number of correct responses on the test trial is shown in Table 1 for each group. There was practically no difference in test trial performance between the varied or fixed order of presentation for the low similarity list ($t < 1$, $df = 22$). On the high similarity list, however, the group receiving the list in

Table 1. Mean Number of Correct Responses on Test Trial for High and Low Similarity Lists Under Constant and Random Order of Presentation

Group	M	SD
High Similarity Constant	2.75	1.36
High Similarity Random	1.33	.89
Low Similarity Constant	3.25	.87
Low Similarity Random	3.42	1.00

fixed order performed significantly better on the test trial than the group which was given the list in varied order ($t=3.03$, $df=22$, $p<.01$).

These results clearly support the hypothesis that when intralist similarity is high, fixed order of presentation is superior to varied order, but when intralist similarity is low, the order of presentation seems unimportant. This experiment does not make clear, however, the basis for the interaction of intralist similarity and fixed order presentation. Battig et al found that learning time for a list presented in fixed order was not retarded by randomizing the position of each stimulus item following the first correct response to that item. They suggested that fixed order facilitated "an organizational state wherein mutual interference among individual pairs is overcome and the various pairs of the list become integrated into one or more larger, multiple pair units..." In two separate studies, Gagne (1950) and Rotberg & Woolman (1963) found that learning was faster when similar stimuli were kept together rather than distributed through the groups making up the total list, even though the order within the groups was not constant from trial to trial. To explain this effect, Rotberg and Woolman suggest that the grouping of similar stimuli made it easier for Ss to categorize the stimuli and responses. Thus, essentially the same explanation is given for the effect of grouping similar items as Battig et al gave for the effect of fixed order presentation. Although both explanations accentuate the categorization or organization of the pairs into groups, nevertheless the sort of process that is proposed is equally applicable to the discrimination between similar items. For example, in the Rotberg and Woolman study the three four-letter syllables in each group differed in only the last letter. In the present experiment the Ss given the high similarity list had to respond to both letters in each stimulus inasmuch as each letter was

common to two pairs of stimuli. It seems likely that both ignoring all but the last letter, as in the Rotberg and Woolman study, and taking both letters into account, as in the present study, would be facilitated by seeing the stimuli in the same order, or in relatively close proximity, on repeated trials if stimulus similarity were high. Once appropriate principles were discovered, the order in which stimuli were presented would matter little, as was indicated by Experiment V of Battig et al. The extent to which such a process might operate would, of course, depend considerably on properties of the stimuli other than intralist similarity per se.

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