Order of emission in continued association as a predictor of individual free recall [1]

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A different list of 30 experimental word pairs was presented once to each of 20 Ss. Immediately following list presentation, the first member of each pair was presented to S who attempted to recall missing words. Word pairs for each S were taken from previously gathered continued association data. One third of the pairs consisted of word association stimuli paired with S's own first associates to those stimuli, one third consisted of stimuli paired with associates from the middle of S's hierarchy and one third consisted of stimuli paired with last words given by S in the continued association task. Recall data indicated that first associates were recalled more than middle or last associates.

Several studies have shown that average rank order of emission in continued association yield word association hierarchies roughly similar to hierarchies obtained to the same stimuli through the use of normative frequencies in single word association (Cofer, 1958; Garskof, 1965; Rosen & Russell, 1957). Garskof & Houston (1963) suggested that order of emission in the continued association of a single S reflects the relative strengths of that S's associations to a stimulus word. The degree of pre-experimental association between a stimulus and a free association response as measured by normative frequencies has been shown to determine amount of facilitation in a variety of verbal behavior tasks (e.g., Jenkins, Mink, & Russell, 1958; Postman, 1962). The present experiment was designed to test the following proposition: if hierarchy position measures association strength for an individual then relative position of associations ought to predict amount of facilitation in free recall.

Design

Approximately one year prior to the recall experiment, a large group of Rutgers University female undergraduates gave continued associations to a set of common words in accord with a procedure outlined in Garskof & Houston (1963). Twenty of these students, chosen at random, served in the present experiment.

A different list of word pairs was developed for each S based on that S's continued associations such that one third of the pairs consisted of stimuli and S's first associates to these words, one third of the pairs consisted of other stimuli paired with S's own middle associates to those words, and the remaining pairs were made up of stimuli and S's last associates to those words.

The list of word pairs was presented once to each S. S was then immediately presented with a list containing only stimulus words and was instructed to recall the missing member of each word pair.

It was necessary to consider the possibility that obtained data, while possibly conforming to the experimental prediction, might simply reflect greater word association strength of earlier associates rather than greater *retention* of earlier associates. A word association control task was devised to test this possibility. After the recall test each S was presented with 10 additional stimuli from the original normative continued association data, and was asked to associate once to each of these words. These associates were compared with the continued association data and the recall scores to determine whether as many of the original first, middle, and last associates would be given in free association as appeared in the recall data.

Differences in pre-experimental associative strength may be compensated for by differential rehearsal. To examine this possibility, half of the Ss were run under incidental learning instructions and half under intentional instructions. If differential rehearsal occurs, smaller differences in recall ought to obtain between levels of associative strength under intentional instructions than under incidental instructions.

Materials

Individual presentation sheets listing 36 word pairs were prepared for each S. The first three and the last three pairs were buffer items. The 30 experimental pairs contained 30 stimulus words from the prior continued association selected to minimize intralist similarity in meaning. Sets of ten stimulus words were, for a given S, paired with either the first, middle, or last associations given previously by that S to those words. All of the responses chosen were from either the A or the AA categories in the Thorndike-Lorge (1944) count. Equivalent numbers of A and AA words were used in each association strength condition. A different random order of pairs was presented to each S.

A second list was prepared for each S containing only the words which had served as stimuli in the continued association task listed in a different random order from the first list.

A third sheet was prepared which was used with all Ss to gather the contemporary word association data. This sheet listed 10 other words from the original large set of stimuli. Each word was followed by a blank space.

Procedure

Ten Ss were randomly assigned to intentional and incidental learning conditions. Each S was tested separately. In the intentional group, S was told that

Table 1. Mean Recall and Association Scores

	First		Middle		Last	
	Recall	Asso.	Recall	Asso.	Recall	Asso.
Incidental						
Mean	6.7	3.8	3.7	0.8	3.4	0.3
SD	1.64	2.48	2.00	1.03	1.78	0.48
Intentional						
Mean	6.7	3.9	5.2	0.9	5.1	0.5
SD	1.95	1.45	2.70	0.88	2.28	0.71

he would have 2 sec. to study each pair of words and that after studying the entire list, he would be tested for recall of the second member of each pair. A blank sheet of paper was placed on top of the experimental list. There was a small window in the sheet just large enough to expose one pair of words at a time. E, timed by a stop-watch, gave S a spoken signal to move the sheet to expose the next pair of words every 2 sec.

In the incidental group, S was instructed to circle the word in each pair which in his opinion was more frequently used by Rutgers University students. The study was described as an investigation of common word usage. The identical procedure regarding timing and the use of the windowed sheet was employed with this group.

The same procedure for the testing of recall was used for both groups. Immediately after the presentation of the paired associates list, S was given the sheet containing only the stimulus words. S was told to write all of the words she could remember which had just been paired with words on the previous sheet. The blank sheet with the window was also used in the test, and S had 3 sec. for each response. After the recall test, each S was given the sheet of 10 new stimulus words and told to write down the first word that came to her mind as she read each stimulus.

Results and Discussion

For each S, the number of first, middle, and last associates that were accurately recalled were counted. The six buffer items are not included in the analysis of results. The word association data were compared to each S's previously collected continued association data. Each response was categorized according to its position in the original continued association hierarchy of that particular stimulus, first if it had been in the first third of the hierarchy, middle if it had been in the middle third, and last if it had been in the last third.

Table 1 presents the mean number of correctly recalled items for each level of hierarchy position for each learning group. It also indicates the mean number of associates given in the present association task which were also found in the original first, middle, and last thirds of the Ss' continued association hierarchies. It can be seen that more items were recalled in every level of hierarchy position for both learning methods than were given as word associates. T tests (df = 9) were used to test the significance of these differences. For the incidental learning group the ts were 4.95, 3.86, and 5.47 for the first, middle, and last hierarchy position. The ts for the same levels in the intentional learning groups were 6.00, 4.45, and 6.41. All of these values reached the .01 level of significance. That is, in all conditions, significantly more associates were correctly recalled after presentation than were given as associates with no intervening presentation. These results are interpreted to mean that a significant degree of learning did take place.

An anlysis of variance was performed on the recall data. The effect of hierarchy position was significant ($F = 18.172$, $df = 1/18$, $p < .01$).

The effect of learning condition was nonsignificant ($F = 1.899$, $df = 1/18$). The interaction was also nonsignificant ($F = 2.177$, $df = 1/18$).

The simple effects of hierarchy position were tested with the Lindquist (1953) procedure.

In both learning conditions, the comparisons between the first and middle positions and between first and last were significant ($p < .05$) while the comparisons between middle and last positions were both nonsignificant.

These analyses indicate that hierarchy position is related to the recallability but that the obtained differences were the result of differences between items from the first positions and the other two levels. This finding may indicate that a simple rank function is not adequate to represent differential associative strengths within a continued association hierarchy.

Although the effect of method of learning was nonsignificant, inspection of Table 1 reveals that the mean recall scores were the same for the first positions in both learning groups, but recall was considerably better for the middle and last associates in the intentional group. Thus it may be that intentional learning instructions were most beneficial where pre-experimental association strength was low.

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Note

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