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Response Familiarization, List Length and Method in Paired Associate Learning

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Response Familiarization, List Length and Method in Paired Associate Learning

Charles N. Cofer, Richard A. Olsen and Howard Walker

In a previous report of this series (Cofer & Olsen, 1965), anticipation and recall (or study-test) methods in paired associate learning were compared. One experiment reported replicated the finding that the recall method produced faster learning than anticipation when the response terms were two-digit numbers (Battig & Brackett, 1961). In the other two experiments CVC-CVC pairs were used. Except for one condition (moderate intra-pair similarity) the recall method was only marginally superior to the anticipation method, where there was any difference at all. Recall was superior to anticipation, however, in the moderate similarity intra-pair condition (one letter in common between S and R in each pair).

The superiority of recall in the case of two-digit response terms and the failure to find differences consistently when the responses were CVC's (for a review of similar findings in the literature see Cofer & Olsen, 1965, pp. 1-2) suggested that perhaps response integration is a necessary pre-condition for the superiority of the recall method. This assumes that 2-digit numbers are well-integrated, whereas CVC's (with less than 20% association value) are not. This assumption seems consistent with the discussion by Underwood & Schulz (1960) of response integration. Consequently, it would follow that if CVC's are given familiarization training, designed to integrate them, recall would be superior to anticipation for integrated R term CVC's as it is for 2-digit numbers. The first experiment reported here was designed to test this derivation.

Goss & Nodine (1965) have reported (in their Appendix) five experiments on the 2 methods in paired-associate learning. In two of them similarity was a main variable studied, and no differences attributable to methods were found. In the other 3 experiments meaningfulness was studied. Where the lists were homogeneous for meaningfulness, Goss & Nodine report no significant differences for methods. With mixed lists, however, recall was superior to anticipation.

Goss & Nodine used trigrams; the high meaningfulness items were 3-letter words, the low meaningfulness items were CVC's. They manipulated meaningfulness in both the S and the R terms, resulting in pairs designated as H-H, H-L, L-H, and L-L, with H and L referring to high and low meaningfulness, respectively. In their mixed-list experiment, one list was composed of 12 pairs, 3 each of the types just indicated. They also used 4-item mixed lists, in each of which one-item represented each of the arrangements for meaningfulness indicated above. (They also combined 4-item lists into a 12 item list in a part-whole learning procedure.) For all comparisons involving these mixed lists, recall was significantly superior to anticipation.

It can be contended that, in these mixed list experiments, list length rather than the non-homogeneous character of the lists with respect to meaningfulness, is the important factor. First we have the fact that the methods produced differences for 4-item lists. Second, it can be argued that in the 12-item mixed lists, the Ss could learn the list as though it were composed of several shorter lists. Thus, they could learn first the 3 H-H items, then, perhaps, the 3 L-H items, and so on. If this or something like it happens, then it may be that the factor making for superiority of recall is "functional list length", and the meaningfulness of the items in the longer list simply provides the basis on which the

Ss can segregate the items into small sub-lists, learning these sub-lists one after another.

The second experiment reported here was designed to answer the question whether recall would be superior to anticipation for short (i.e., 4-item) CVC-CVC lists. A re-analysis of the experiment (Cofer & Olsen, 1965, Exp. 1) which had produced a difference in favor of recall suggested that "functional list-length" was a real possibility. It was found that under recall the word-2 digit pairs fell into groups differentiated (across Ss) by rate of learning and that this grouping did not occur under anticipation. This grouping of items by difficulty does not, of course, prove that the Ss were learning the whole list by adopting a part-whole strategy (i.e., by learning sub-lists of the whole one at a time), but it is consistent with this notion.

Experiment 1

Materials. Eight of the ten CVC-CVC pairs used by Cofer & Olsen (1965, Table 1, Exp. 2) in their zero similarity condition were used.

Subjects. Forty male and forty female students in introductory psychology at the Pennsylvania State University volunteered as Ss. Point credits are given for participation in experiments. Ss were assigned to conditions in order of appearance at the laboratory, subject to the restriction that equal numbers of males and females be in each condition and that matching on the basis of response familiarization scores be accomplished.

Familiarization. Response familiarization was designed in accordance with the procedures outlined by Underwood & Schulz (1960, pp. 100-110), but deviated from their procedures in certain respects. We wished to achieve a fairly high level of response integration, and our procedure, we believe, accomplished this purpose.

Each response CVC was presented to each S on each familiarization trial for 6 sec. S spelled it aloud, then E did so, and finally S wrote it out and and spelled it aloud again. After one presentation of the entire list, S was given a 40 sec. written free recall test for the CVC's. Five different orders of presentation (on a Stowe memory drum) were used during the familiarization trials. Each trial consisted of the events just indicated (including free recall). Trials were continued until S had correctly recalled 7 of the 8 CVC's on any two free recall tests (a maximum of 15 trials was given). Matching was accomplished on the basis of the number of trials required to reach the criterion of 7 out of 8 correct responses on any two trials of familiarization training.

Learning. S was assigned either to anticipation or recall for P-A learning of the 8-item CVC-CVC list after the response CVC's had been familiarized. The first trial under both methods was a familiarization trial on which the pairs were presented and S spelled aloud both the S and R terms. In anticipation trials, S spelled first the stimulus, then attempted to spell the response term and when the pair appeared spelled both terms. S spelled the terms in a similar fashion for recall. There was a 4-sec. - 4-sec. rate with a 16 sec. inter-trial interval for anticipation. Learning was continued to one perfect trial or until 30 trials had been run. Five different orders of pairs and of stimuli were used. Between the presentation of the pairs and the stimulus series in recall there was a 16-sec. interval and between the presentation of the stimuli and the next presentation of the pairs there was a 4-sec. interval. There were 40 Ss (20 male, 20 female) under anticipation and 40 (20 male and 20 female) under recall. Materials were presented

by means of a Stowe memory drum.

Results

Table 1 shows the mean numbers of trials and errors to criterion for each sub-group (Ss not learning in 30 trials were given a trials score of 30). For females, the number of trials required under the two methods differs by .85 of a trial and for males by 3.45 trials. The difference for females is obviously not significant (and its direction is opposite to that expected) and the one for males produces a t of 1.41 which is not significant for either one- or a two-tailed test. For both sexes combined the methods difference for trials is only 1.30 trials.

A similar picture emerges for errors; the number of errors for the two sexes combined for the two methods is almost identical (78.03 and 79.10). For males the mean number of errors per trial is almost identical (4.0 and 4.3) and for females this is also true (4.00 and 4.35).

It may be concluded that, under the conditions of this experiment, response familiarization or integration does not result in a difference between anticipation and recall methods. This conclusion does not support the hypothesis that it is response integration which accounts for the superiority of recall for lists with 2-digit response terms.

Experiment 2

In this experiment two 4-item CVC-CVC lists were used under the two methods. The hypothesis, as outlined in the introduction, was that recall would be superior to anticipation with short lists.

Materials. Three 4-item lists were made up by randomly choosing sets of 4-items from the 8-item list used in Experiment 1. The lists were presented in 9 random orders under the two conditions.

Subjects. 30 Ss, comparable to those used in Experiment 1, were employed, 15 for each method. There were 15 male and 15 female Ss, split so that 8 males worked under anticipation, 7 under recall.

Procedure. Except for the elimination of response familiarization and for list length, the procedures in this experiment were identical to those in Experiment 1. Although 3 lists were used (with 5 Ss per list per method), results were combined for the lists, as the methods variable was the only one of interest here.

Results. The mean number of trials to criterion under anticipation was 10.93 and under recall was 13.73. This difference, which is in the direction opposite to that expected, yielded a t of 1.25, which, for 28 df is not significant at $p = .05$. Since the direction of the difference is opposite to that predicted, the hypothesis underlying this experiment may be said to be thoroughly rejected. The mean number of errors under anticipation was 23.47 and under recall was 34.20. These values yield per-trial error means of 2.14 for anticipation and 2.41 for recall and are in the direction opposite to prediction. On a two-tailed test, the difference in mean total errors is not significant, yielding a t of 1.74. (On a one-tailed test it would be significant at about $p = .05$, but it is in the wrong

direction.)

As studied here, then, reduction of list length does not produce an advantage for the recall method.

Discussion

The results reported here offer no support for the two factors advanced as perhaps being responsible for the advantage of the recall method, where it occurs. The two factors are response integration and list length. (It is noteworthy, however, that response familiarization is associated with the fact than an 8 item CVC-CVC list took 18.83 trials to learn for both methods combined, as compared to 12.33 trials for the 4-item list without familiarization, i.e., about 50% more trials were required though list length was doubled.)

The fact remains that sometimes recall does produce faster learning than anticipation. This has occurred when 2-digit responses and mixed lists in which meaningfulness varied (by using words and CVC's) were used. In addition, Battig, Brown & Nelson (1963, Exp. IV) found recall to be superior over 5 lists in which some of the items were words and some were not and some of the lists were mixed. From the report, it is not possible to tell whether the advantage was due to the word-non-word or mixed list factors. Battig and Wu (1965) have found an advantage for recall with response bigrams in a mixed-list experiment in which the 2 methods were mixed for a given list.

Our present opinion is that lists with 2-digit responses and list mixed for meaningfulness or for method show an advantage for recall. What the specific factor is and how it operates in favor of recall is not at all clear from available evidence.

Summary

Recall and anticipation methods for paired-associate learning were compared in two experiments. In one the effects of response familiarization or integration were studied, in the other, the effects of reducing list length. Neither response familiarization nor reduction in list length produced differences in learning rates under the two methods.

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Table 1

Mean Trials and Errors to Criterion in Experiment 1

	Anticipation		Recall	
	Trials	Errors	Trials	Errors
Males	20.30	82.90	16.85	72.15
Females	18.65	73.15	19.50	86.05
Both	19.48	78.03	18.18	79.10

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