

Instructions, ordering, and previous practice in free-recall learning¹

GORDON WOOD and DOROTHY CLARK, Michigan State University, East Lansing, Mich. 48823

Two experiments replicated and extended Tulving's (1966) finding that prior practice on part of a free-recall list can be detrimental to subsequent whole-list learning. Instructions concerning the nature of the lists influenced whole-list learning, but the influence of presentation order was unclear. The organization of the items acquired during part learning persisted during final list learning.

Tulving (1966) demonstrated that prior part-list learning can retard subsequent whole-list learning. Tulving had two groups of Ss each learn two lists, the second list being twice the length of the first. For the experimental Ss all the words of the first list were also in the second list; for the control Ss the first list words were not in the second list. The major finding was that the slope of the learning curve for List 2 learning was steeper for the control than for the experimental Ss. Tulving asserted that higher-order memory units formed during List 1 learning interfered with the List 2 learning of experimental Ss. The purpose of Experiment 1 was to determine if instructions concerning the List 1-List 2 relationship influence part-whole transfer. Since a S's behavior is determined by both learning and performance factors (Postman, 1968), it is possible that factors which influence performance (e.g., instructions) were responsible for Tulving's results.

EXPERIMENT 1

Method

All Ss learned a 15-word free-recall list and then transferred to a 30-word free-recall list. The experimental (E) Ss were either instructed (I) or uninstructed (U) about the relationship between the two lists. The I-E Ss were told that all the words in List 1 were in List 2 and that List 2 was twice as long as List 1. The I-C (control) Ss were told that none of the words in List 1 were in List 2 and List 2 was twice as long as List 1. All 45 words were of high frequency. The three presentation orders for List 2 were random except for the restriction that the List 1 words for experimental Ss were alternated with new items.

Each of the four groups of 16 Ss was presented with the same final list of 30 words for 10 alternating study and test trials. The words were presented at a rate of one word per second. Thirty seconds was given for each List 1 recall and 60 sec for each List 2 recall. A Stowe Memory Drum was used to present the words, and a tape recorder was used to record the oral recall.

Results and Discussion

The total mean number of words correctly recalled for List 1 was 113.19, 110.75, 116.88, and 107.88 for the I-E, U-E, I-C, and U-C conditions, respectively. The superiority of instructed over uninstructed conditions was not significant ($F = 3.52$, $df = 1/60$, $p < .10$). The E and C groups did not differ significantly ($F < 1$) suggesting the groups were of equal learning ability.

The mean number of words correctly recalled for each of the 10 trials of List 2 learning is presented in Fig. 1. The I groups were superior to the U groups ($F = 12.50$, $df = 1/60$, $p < .001$). The Conditions effect and the Instructions by Condition interaction were not significant ($F \leq 1.32$, $df = 1/60$, $p > .05$). The facilitation due to instructions did not seem to depend upon List 1 words being presented in List 2.

The slopes of the learning curves differed for the E and C groups as indicated by the significant linear component of the Trials by Condition interaction ($F = 61.40$, $df = 1/540$, $p < .001$). Yet the linear component of the Trials by Instructions by Conditions interaction was not significant ($F < 1$), suggesting that the negative transfer for experimental Ss late in

List 2 learning did not depend upon the Ss being uninstructed about the List 1-List 2 relationship. Although the Trials by Conditions interaction for the instructed groups ($F = 5.04$, $df = 9/540$, $p < .001$) and the Trials by Conditions interaction for the uninstructed groups ($F = 4.26$, $df = 9/540$, $p < .001$) were both significant, the negative transfer for experimental Ss was clearer for uninstructed than instructed Ss.

In short, the results of Experiment 1 replicated and extended Tulving's (1966) finding of a flatter learning curve for Ss given previous practice on one-half of the final list words. Tulving's finding does not appear to depend on Ss being uninstructed.

EXPERIMENT 2

Tulving (1965), after comparing the effect of presentation orders on free-recall learning, concluded that when material is presented in an order that keeps subjectively related subsets of words intact, the material can be learned more readily than when the subjectively related words are not presented consecutively. An attempt was made to extend Tulving's finding by demonstrating that the presentation order of a list determines, in large part, whether prior practice of items influences free-recall learning. In addition, the amount of prior practice was manipulated by presenting none, half, or all of the final list items prior to final list learning.

Method

A total of 72 Ss were randomly assigned to each of the four conditions so that 18 Ss were in each condition. Prior to learning the final list (List 3), Ss practiced two lists of 15 words each, with five trials on each list. The All-Separate group and the All-Mixed group were given all of the items from List 3 in Lists 1 and 2. The Part-Mixed group was given List 3 items for List 2 but not for List 1. The Control group received irrelevant items for both Lists 1 and 2. The order of the final list for the All-Separate group consisted of all the items from one list followed by all the items from the other list. The ordering for the All-Mixed and Part-Mixed groups consisted of an alternation of List 1 and List 2 items and an alternation of List 2 items and new items, respectively. The manipulation of presentation order was accomplished by the construction of Lists 1 and 2. All Ss received the

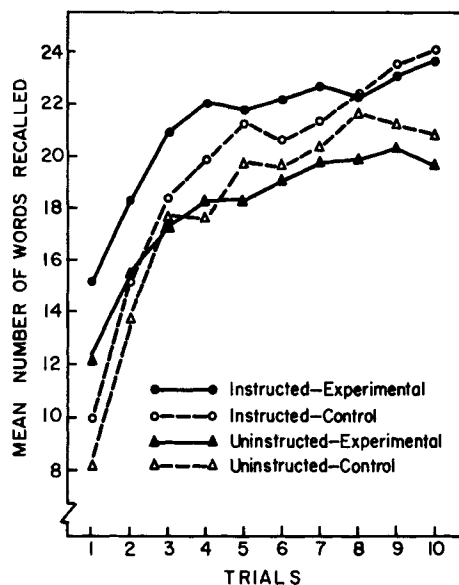


Fig. 1. The mean number of words correctly recalled for the 10 trials on List 2 for the four conditions of Experiment 1.

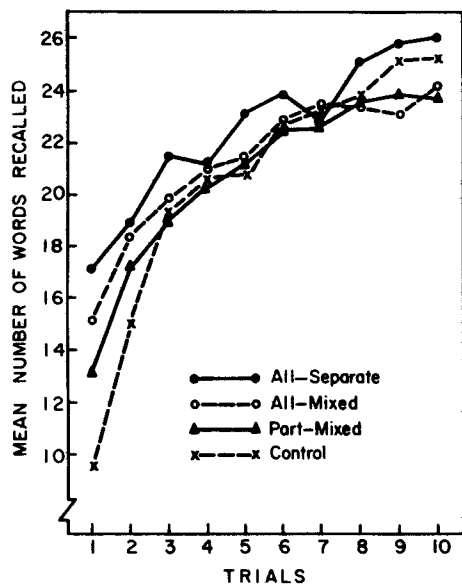


Fig. 2. The mean number of words correctly recalled for the 10 trials on List 3 for the four conditions of Experiment 2.

same presentation orders of List 3; each S received three different orders of his three lists. Except for the restrictions imposed by the design, the presentation orders were random. The words were taken from Deese's (1959) zero interitem associative strength lists.

Subjects were run in groups. Lists 1 and 2 were presented in booklets with a new page for each of the five trials. Ss had 1 sec per word to read each list and 45 sec for written recall. At the end of each presentation, Ss closed their study booklets and wrote the items they could recall in their answer booklets. The final list was presented by a slide projector for 10 alternating study and test trials. The words were presented at the rate of one word every 2 sec with 90 sec for written recall.

Results and Discussion

Performance on Lists 1 and 2 was analyzed to determine whether the groups differed prior to List 3 learning. Each S's score consisted of the number of words correctly recalled on Trial 5 of both lists. The means for the four groups, which ranged from 22.78 to 24.17, were not significantly different ($F < 1$).

The mean number of words correctly recalled for List 3 is presented in Fig. 2. There was no difference as a function of Conditions ($F = 1.66$, $df = 3/68$, $p > .05$), but the slopes of the curves differed for the four conditions ($F = 71.05$, $df = 3/612$, $p < .001$). The Part-Mixed and Control groups were essentially identical to the conditions in Tulving's (1966) study except that a group presentation procedure was used in the present study. A separate comparison of these groups revealed that the slopes of the curves differed when all 10 trials were considered ($F = 156.00$, $df = 1/612$, $p < .001$), but not when Trials 4-10 were considered ($F = 3.58$, $df = 1/612$, $p < .10$). It appears that the difference in slopes was largely a result of the initial positive

transfer for the experimental Ss. However, the fact that the positive transfer for experimental Ss was not maintained can be viewed as support for Tulving's notion that higher-order memory units formed during List 2 learning interfered with List 3 learning.

A comparison of the All-Mixed group and the Control group was made to determine if the negative transfer resulting from prior practice with final list items would be obtained when all the items were practiced prior to final list learning. An analysis of the number correct for Trials 4-10 revealed that the slopes of the curves differed ($F = 9.60$, $df = 1/612$, $p < .01$). This finding is rather strong support for the view that prior experience with items is not necessarily helpful. An examination of Fig. 2 yields weak evidence to support the view that presentation order influenced performance. A comparison of the All-Separate and All-Mixed groups with the Control group revealed that negative transfer late in List 3 learning was obtained only when the List 1 and List 2 items were not presented consecutively for List 3.

Bousfield & Bousfield's (1966) measure of stimulus category repetition (SCR) was employed to compare organization of recall on Trial 10 with previously learned organization from Lists 1 and 2. The Part-Mixed group had previous practice on odd or even final list items. Each previously learned list was viewed as a category to determine whether words presented together during List 1 and 2 learning would be recalled together on Trial 10 of List 3 learning. The difference between the obtained and expected value of SCR was computed for each S.

The mean SCR scores (obtained minus expected) based on odd and even List 3 categories were .97, 1.33, and -2.39 for the All-Mixed, Part-Mixed, and Control groups, respectively. An orthogonal comparison between the average of the mixed groups and the Control group was significant ($F = 23.44$, $df = 1/51$, $p < .001$), indicating that the mixed groups maintained, at least in part, their prior organization of Lists 1 and 2 throughout final list learning. This result supports Tulving's contention that Ss may be unwilling or unable to abandon their previously learned organization.

REFERENCES

- BOUSFIELD, A. K., & BOUSFIELD, W. A. Measurement of clustering and of sequential constancies in repeated free recall. *Psychological Reports*, 1966, 19, 935-942.
- DEESE, J. Influence of inter-item associative strength upon immediate free recall. *Psychological Reports*, 1959, 5, 305-312.
- POSTMAN, L. Association and performance in the analysis of verbal learning. In T. R. Dixon and D. L. Horton (Eds.), *Verbal behavior and general behavior theory*. Englewood Cliffs, N. J.: Prentice-Hall, 1968. Pp. 551-571.
- TULVING, E. The effect of order of presentation on learning of unrelated words. *Psychonomic Science*, 1965, 3, 337-338.
- TULVING, E. Subjective organization and effects of repetition in multi-trial free-recall learning. *Journal of Verbal Learning & Verbal Behavior*, 1966, 5, 193-197.

NOTE

1. This investigation was supported in part by Public Health Service Research Grant MH 14063. This manuscript is based in part on a thesis submitted by Dorothy Clark to Michigan State University in partial fulfillment for the degree of Master of Arts, November 21, 1967.

(Continued from page 186)

REFERENCES

- CARTERETTE, E. C., & COLE, M. Comparison of the receiver-operating characteristics for messages received by ear and by eye. *Journal of the Acoustical Society of America*, 1962, 34, 172-178.
- GREEN, D. M., & SWETS, J. A. *Signal-detection theory and psychophysics*. New York: Wiley, 1966.
- POORTINGA, Y. H. The comparability of scores obtained in different cultures. Paper read at the Annual Congress of the South African Psychological Association, 1967.

NOTES

1. The author's stay at the Institute has been made possible by an Advanced Research Fellowship from the Anglo-American Corporation of

South Africa.

2. The range of means for the auditory experiment varied between approximately 42 dB and 48 dB. The visual scale was not calibrated in terms of common standards.

3. The results of the first group under conditions of no monetary reward were very similar to those given in Fig. 1.

4. Most of the scores obtained by one of these Ss during the training also fell close to the diagonal.

5. In order to confirm this, a number of other risk-taking tests were administered to all Ss. The intercorrelations between these and the signal detection experiments were mostly in the expected direction. They do, however, require confirmation with larger samples.