

THE EFFECT OF ALPHABETICAL SUBJECTIVE ORGANIZATION ON MEMORIZING UNRELATED WORDS¹

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THIS PAPER REPORTS an experimental demonstration of the effect of subjective organization on memorizing unrelated words. Subjective organization refers to subjects' tendency to recall in an invariant order verbal items presented in varying orders from trial to trial. It has been discussed and a method for its measurement has been described elsewhere (Tulving, 1962).

There is some evidence (Tulving, 1961; Tulving, 1962) that subjective organization and frequency of correct responses are positively correlated: subjects who achieve high scores on subjective organization recall more words than subjects with low organization scores, and increasing recall over trials is accompanied by increasing organization: While it seems plausible enough to assume that such a correlation between the two response variables results from the effect of organization on performance, alternative interpretations are not excluded. One could argue, for instance, that organization and performance are two parallel, but independent manifestations of "intelligence." Thus, more intelligent subjects might not only organize their recall more systematically than subjects of lower intelligence, but also recall more words. Nor do other experiments, in which recall is shown to be a function of organization inherent in the material (for example, Bousfield, 1953; Miller & Selfridge, 1950), provide unequivocal evidence as to the nature of the relation between the two variables. When learning materials differ in degree of organization, they may also differ in other variables relevant to ease of learning.

A more direct approach to the problem involves experimental manipulation of subjective organization independently of changes in learning materials or conditions of practice. If under these conditions changes in organization lead to changes in performance, the latter variable can be said to be dependent on the former. The experiment reported in this paper used this general approach.

The design of the experiment was simple. Two groups of subjects learned identical material under identical conditions of presentation and recall, but under different sets of instructions. One group was told to recall as many words as possible, the other group was given instructions to organize their recall alphabetically.

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METHOD

Subjects

Ninety-nine second-year pre-medical students enrolled in an introductory psychology course served as Ss. The experiment was conducted as a part of the regular classroom procedure.

Materials

A list of 22 English nouns, covering a wide range of frequency of occurrence values, constituted the learning material for both groups. The words, listed alphabetically, were: answer, buyer, cherub, despot, ether, fasces, gorget, hermit, journal, letter, mantel, natron, orphan, person, question, rennin, satin, tempest, umbra, vulture, windrow, and xylem. As can be seen, all words were five- to seven-letter disyllables, and no two words had the same initial letter.

Procedure

Prior to the experiment, each S received a set of 12 recording slips with 22 consecutively numbered lines, and a folded sheet. The latter contained additional instructions. The Ss were told not to look at these sheets.

The instructions given to all Ss before the first trial informed them that their task was to memorize a list of 22 nouns which would be projected one by one on the screen in front of the classroom. After all 22 words had been shown, they were to record as many of the words as possible on the first recording slip. Then, when time was called by E, they were to draw a line under the last word they had recorded, place the slip, face down, under the pile of other slips, and be ready for the next trial. The Ss were also informed that there were no restrictions on the order in which they recalled the words, their main task was to recall as many words on each trial as possible.

Words were projected with a Kodak Cavalcade 520 projector, at the rate of approximately 1.5 sec. per word. The Ss had 90 sec. after each trial to record their recall. The order of words in the stimulus list was changed after each trial in a non-systematic manner. A total of 11 trials was given.

Differential Instructions

All Ss worked under identical instructions for the first three trials. After the Ss had finished recording their recall following the third trial, E asked them to look at the folded instruction sheets. For one-half of the total group, hereafter called the Standard (S) Group, the instructions were: "This is just to inform you that you have been assigned to the experimental group 'S.' You should simply continue as before, trying to do your very best on each recall trial and put down as many words from the list as you can."

For the other half of the Ss, hereafter referred to as the Alphabetical (A) Group, the instruction sheets contained the following: "Try to organize your recalled words alphabetically. When you look at the words on the screen, note their first letters, and make an attempt to associate the word with the letter. When you write the words down, go through the letters of the alphabet one at a time and try to remember the word that goes with each letter."

Thirty sec. were given Ss to read these additional instructions.

RESULTS

In this experiment we were interested in comparing the performance of two groups of subjects distinguished in terms of the organization of

recall. The differential instructions given to the groups were designed to produce clear-cut differences in organization. For some reason, seven subjects in the A Group did not follow instructions and did not organize their recall alphabetically. In the light of the primary objective of the experiment it was decided to exclude their data from the analysis. For the same reason the data of two subjects in the S Group, who had organized their recall alphabetically, were also omitted from consideration. To equalize and round off the numbers in the two groups, the recall records of 40 subjects in each were randomly selected for analysis from among the remaining subjects.

Figure 1 shows the learning curves for the two groups. On the abscissa are 11 trials, on the ordinate the mean number of words correctly recalled.

For the first three trials, when both groups worked under identical standard instructions, the curves are very similar. Thus there seem to be

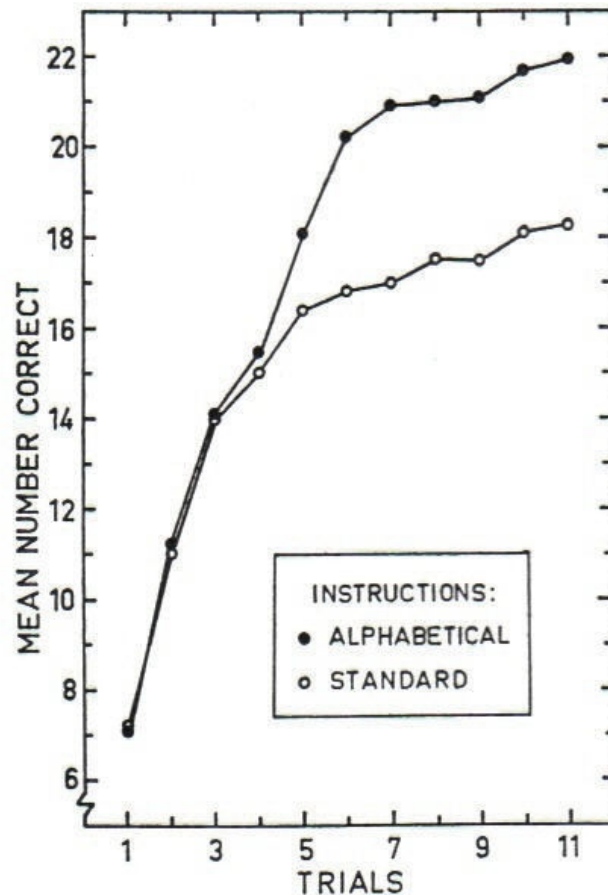


FIGURE 1. Mean number of words recalled as a function of trials. Each curve is based on an independent group of 40 subjects. Immediately preceding Trial 4, different instructions were given to the two groups.

no systematic differences between the two groups as to their learning "ability." On Trial 4, immediately after the differential instructions were given, there still is no obvious difference in performance. Beginning with Trial 5, however, the two curves draw rapidly apart. The slopes of the curves are quite different between Trials 4 and 6. It seems reasonable to assume that the upper limit imposed on performance by the length of the list attenuates the score of the A Group on later trials. With longer lists, the advantage of the Alphabetical Group over the Standard Group may well be greater than it was in this experiment.

The mean performance of the A Group on Trial 6 exceeds the mean performance of the S Group on Trial 11. A median test comparing these two sets of scores yielded a chi-square of 14.46 which is highly significant. Thus, 30 seconds spent on reading special instructions, combined with practice on three additional trials following Trial 3, seem to have had a greater facilitating effect on performance than eight additional trials in the absence of special organizing instructions. It should also be mentioned that on Trial 11 the perfect score of 22 correct was achieved by 37 subjects in the A Group, but only 5 subjects in the S Group.

An analysis of the erroneous responses reflected a similar difference in favour of the A Group. Table I shows the total frequencies of two kinds

TABLE I
TOTAL FREQUENCIES OF TWO KINDS OF ERRORS IN THE RECALL DATA OF TWO GROUPS FOR BLOCKS OF TRIALS PRECEDING AND FOLLOWING DIFFERENTIAL INSTRUCTIONS

	Trials 1 to 3 (Before instructions)		Trials 4 to 11 (After instructions)	
	A Group	S Group	A Group	S Group
Repetitions	14	9	0	55
Intrusions and misspellings	60	72	41	103

of errors: (1) repetitions of list words within a trial, and (2) misspellings and extra-list intrusions. These data are shown separately for the blocks of the first three and the last eight trials.

It is difficult to evaluate the data in Table I statistically, since the frequencies are combined for subjects and trials. The frequencies of errors are too small to justify a more detailed breakdown. These error data, however, do suggest that alphabetical organization completely eliminates repetitions and considerably reduces the probability of other errors.

No attempt was made in this experiment to examine the sequential organization in the recall records of the S Group. It is well known that the order of immediate free recall is related to the probability of recall of individual items (Bousfield, Cohen, & Silva, 1956), to the organization

inherent in the material (Bousfield, 1953; Deese & Kaufman, 1957; Rothkopf & Coke, 1961), and to the instructions as to the order of recall (Deese, 1957). Previous research at Toronto has also sufficiently demonstrated that subjects tend to subjectively organize recall of experimentally unorganized materials even in the absence of any specific instructions to do so (Arbuckle, 1961; Marshall, 1961; Tulving, 1961, 1962). Organization of recall, therefore, undoubtedly occurred in the S Group of this experiment, but in view of the previously reported findings it need not be elaborated in the present context. The experimentally produced difference between the two groups clearly was not that between alphabetical organization and no organization, but rather between alphabetical organization and other, apparently less effective, forms of organization. This fact, however, does not change the main conclusion drawn from the experiment: performance is a function of subjective organization.

DISCUSSION

Previous experiments (Tulving, 1961; Tulving, 1962) have shown that repeated presentations and attempts at free recall have at least two readily observable consequences. First, the frequency of correct responses increases systematically over trials—subjects “learn” the material. Second, the tendency to recall items in the same order from trial to trial also increases—subjects “organize” the material. When repetition is held constant, a positive correlation between learning and organization is found. A plausible explanation of these concomitant effects is that changes in performance are dependent upon changes in organization. The main purpose of this experiment was to test an implication of this explanation and thereby clarify the relation between the two variables.

The findings of the experiment leave little doubt that subjective organization is an important determinant of performance in free recall learning. The superiority of performance of subjects who organized their recall alphabetically over that of those who used different, apparently less powerful methods of organizing was both large and obvious. In the light of this finding it is entirely reasonable to assume that correlations between performance and subjective organization, under conditions where methods of organizing are not under the experimenter's control, reflect nothing more nor less than the same functional relation demonstrated in this experiment.

The experiment and its findings have several implications for theory and research in the field of verbal learning and memory. On the theoretical side, the results of the experiment add further support to Miller's conceptual analysis of remembering (Miller, 1956a; Miller, 1956b; Miller, Galanter, & Pribram, 1960) which holds that improvement in recall under conditions of practice, and for sequentially structured materials (for

example, Miller & Selfridge, 1950), is a consequence of organization of initially unrelated items into larger units of information. In view of the present results as well as the results from previous studies (Tulving, 1962; Tulving & Patkau, 1962) Miller's unitization hypothesis can be regarded as a very promising beginning of a comprehensive theory of memory.

Implications of the present experiment for research have to do with the problem of individual differences and the problem of the effect of repetition on recall. Consider again the two learning curves shown in Figure 1. Remember that all subjects learned identical material under identical conditions of practice. Now suppose that differences in organization between the two groups are not known, as would in fact be the case in most experiments in verbal learning. Under these conditions most researchers would probably interpret the differences between the two groups of subjects in terms of their learning "ability": there are "fast" learners and "slow" learners. The tendency may also be strong to attempt to understand these between subject differences in terms of their psychometric correlates (Noble, 1961). As we do in fact know about the underlying differences in organization in this experiment, these remarks are admittedly irrelevant. But they are possibly quite relevant to other experiments in which subjective organization has been neither manipulated nor measured. It is quite reasonable to assume that in those experiments, too, a certain proportion of between subject variability, perhaps a large proportion, is attributable to variability in methods of organization. It follows that if we wish to add to our understanding of "individual differences" in learning "ability," a good place to begin looking for the source of these differences is the learner's own behaviour in the learning situation and his subjective strategies of remembering.

As to the effects of repetition on recall, the two learning curves in Figure 1 are again instructive. It is obvious that the curves reflect much more than the effects of repetition or practice, even if we limit the question about these effects entirely to the given material under the given conditions of learning. One could say, for instance, that the learning curve of the S Group reflects not only the effects of repetition, but also the effects of the subjects' ignorance of effective methods of organizing the material. Because of such an intimate relation between repetition and organization, the specification of the effects of repetition on recall necessarily involves the specification of the methods of organization that the subject uses. That is, because of the interaction between repetition and methods of organization, there may be no such thing as a "pure" effect of repetition. The limiting case of such a hypothesized interaction is the situation in which no subjective organization of any kind is possible. Under these conditions, repetition would have no effect on recall. It is

very probable, of course, that with normal adult human beings as subjects, subjective organization cannot ever be completely prevented. But other implications of the hypothesized relation between repetition and organization do pose new and interesting problems for research.

SUMMARY

A demonstration experiment has been reported on the effect of alphabetical subjective organization on memorizing words. Two groups of Ss learned an identical list of 22 nouns on 11 trials. After the first three trials one group was instructed to organize recall alphabetically, while the other group proceeded under standard instructions to recall as many words as possible. A considerable difference in the rate of learning favouring the alphabetical organization group was discussed in terms of the role of subjective organization in memorizing. The experimental findings have implications for the problem of individual differences in learning and the problem of the effect of repetition on recall.

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