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ABSTRACT

The verbal discrimination learning of elementary school children was assessed in two experiments. In both experiments, Ss were given either regular discrimination learning instructions (control), instructions to pronounce the correct pair member aloud three times during study trials (vocalization), or instructions to generate a visual image of the correct pair member during study trials (imagery). Experiment 1 employed a mixed list of homonym, synonym, and unrelated noun pairs, while Experiment 2 employed homogeneous lists of homonym and synonym pairs. The results of the two experiments provided partial support for the proposition that a particular rehearsal strategy would be facilitative only when it provided a discriminative cue which was relevant to the materials on hand. (Author)

IMAGERY AND VOCALIZATION STRATEGIES IN CHILDREN'S VERBAL DISCRIMINATION LEARNING

WISCONSIN RESEARCH AND DEVELOPMENT

CENTER FOR COGNITIVE LEARNING

Technical Report No. 221

IMAGERY AND VOCALIZATION STRATEGIES IN CHILDREN'S VERBAL DISCRIMINATION LEARNING

by
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Report from the
Operations and Processes of Learning Component of
Program 1: Variables and Processes of Learning and Instruction

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Statement of Focus

The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Technical Report is from the Project on Variables and Processes in Cognitive Learning in Program 1, Conditions and Processes of Learning. General objectives of the Program are to generate knowledge and develop general taxonomies, models, or theories of cognitive learning, and to utilize the knowledge in the development of curriculum materials and procedures. Contributing to these Program objectives, this project has these objectives: to ascertain the important variables in cognitive learning and to apply relevant knowledge to the development of instructional materials and to the programming of instruction for individual students; to clarify the basic processes and abilities involved in concept learning; and to develop a system of individually guided motivation for use in the elementary school.

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Abstract

The verbal discrimination learning of elementary school children was assessed in two experiments. In both experiments, Ss were given either regular discrimination learning instructions (control), instructions to pronounce the correct pair member aloud three times during study trials (vocalization), or instructions to generate a visual image of the correct pair member during study trials (imagery). Experiment 1 employed a mixed list of homonym, synonym, and unrelated noun pairs, while Experiment 2 employed homogeneous lists of homonym and synonym pairs. The results of the two experiments provided partial support for the proposition that a particular rehearsal strategy would be facilitative only when it provided a discriminative cue which was relevant to the materials on hand.

I
Introduction

The purpose of this study was to explore conditions under which imagery and vocalization strategies are effective in children's verbal discrimination learning. A verbal discrimination task requires that the subject discover which word in each of several pairs of words is "correct" according to the experimenter's predetermination. Recently, Rowe and Paivio (1971) found that adult Ss instructed to form an image of the correct item in each pair performed better than Ss instructed to say the correct word aloud. Both imagery and vocalization instructions facilitated performance relative to a control group receiving no special strategy instructions.

The reasons for the facilitative effects of both the imagery and vocalization strategies are not precisely known. In the case of imagery, Rowe and Paivio speculated that if Ss form an image of the correct word in each pair, the task becomes one of recalling which of the two words has been imaged. The image thus provides a discriminative cue for choosing the correct item.

In the case of vocalization, facilitative effects of spoken rehearsal have been found in numerous experiments (e.g., Carmean & Weir, 1967; Wilder, 1971). One reasonable hypothesis concerning this effect is that spoken rehearsal provides auditory and articulatory cues specific to the correct item and thus aids discrimination.

Given the above hypotheses of how imagery and vocalization strategies produce their effects in verbal discrimination learning, it should be possible to devise conditions under which the relative effectiveness of each strategy can be either enhanced or reduced. For example, if the imagery strategy provides a distinctive image to the correct word, then the facilitative effect of imagery should diminish when synonym pairs are used. Since the words in a synonym pair presumably elicit similar images, Ss should have difficulty distinguishing which of the two words was initially imaged. Subjects employing a vocalization strategy, however, should have no special difficulty with synonym pairs since the correct word within a pair would still provide distinctive cues when spoken aloud.

On the other hand, when the words in a pair are homonyms, the auditory and articulatory cues provided by vocalization are common to both items and should not aid the S in discriminating them. However, a distinctive image can be generated to the correct item in homonym pairs; imagery, therefore, should be the better strategy with this pair type.

To test the above predictions, a list containing homonym, synonym, and unrelated pairs was constructed. Compared to a control condition with no strategy instructions, imagery instructions were expected to facilitate performance more than vocalization instructions on homonym pairs, while the opposite was expected on synonym pairs. With unrelated pairs, previous research (Rowe & Paivio, 1971) has shown imagery to be better than vocalization (and both better than no instructions) with adults. Since the present study utilized fourth graders as Ss, no firm imagery vs. vocalization predictions were made, although based on recent learning research with children, facilitation (relative to no instructions) was expected for each (Levin, in press).

II
Experiment I

Method

Subjects

Eighty-four fourth-grade children from a suburban elementary school in Wisconsin participated in the experiment. A randomized-block schedule for six conditions (combinations of three instructional conditions and two list versions) was drawn up, and Ss were assigned to conditions in the order of their appearance at the testing room.

Materials

The verbal discrimination list consisted of three types of word pairs which were randomly distributed throughout the list. There were six homonym pairs (e.g., FLOWER-FLOUR), six synonym pairs (RUG-CARPET), and six unrelated pairs (BED-FENCE) for a total of 18 pairs. The words in all pairs were of medium to high Thorndike-Lorge (1944) frequency (the average frequency was 77 occurrences per million), and the three sets of pairs were roughly equivalent in mean frequency.[1] It was not possible to obtain normative I, or imagery (Paivio, Yuille, & Madigan, 1968), values for all of the words. However, all words were concrete nouns and, in the judgment of the authors, readily elicited images. The fourth-grade teachers of the Ss judged all of the words to be within the reading vocabulary of their students. For one version of the list a randomly selected member of each pair was designated as correct; in the other version the other member of each pair was correct.

Procedure

The Ss were tested individually using a memory drum. A study-test procedure was employed, with the pairs being presented at a 4-sec. rate. The words were placed side by side, and on study trials the correct word in each pair was underlined. Following Rowe and Paivio's (1971) procedure, subjects in the vocalization condition were told to pronounce the underlined word three times. Subjects given imagery instructions were told to form an image of the underlined word. Control Ss were not given any special strategy instructions. On test trials the underlining was absent and S pointed to the member of each pair that he thought was correct. Subjects were required to make a choice for every pair. Two study-test trials on a practice list of four unrelated words preceded the five trials on the experimental list. The practice trials insured that Ss understood both the nature of the task and the strategy instructions. A different random order of the experimental list was used on each study and each test trial. The spatial position of correct and incorrect items within pairs was counterbalanced such that: (a) for each pair, the correct and incorrect word appeared equally often in the right and left positions across presentations; and (b) on each presentation of the list, correct and incorrect items occurred equally often in the left and right positions.

Results and Discussion

Although the present experiment might be conceptualized as a repeated measures factorial design consisting of the two primary factors, Instructions (between subjects) and Pair Type (within subjects), a preferred conceptualiza-

[1] As will be noted later, comparisons among pair types initially were not of interest and therefore precise pair-type equivalences (in terms of frequency, number of letters, and the like) were not deemed crucial.

tion was to regard the three pair types (unrelated words, synonyms, and homonyms) as dependent variables, and to "nest" Instructions within Pair Types. As a result, the previously stated predictions were evaluated via variable by variable univariate analyses utilizing Tukey pairwise comparisons, each performed with a simultaneous Type I error probability of .05. As has already been noted, learning was measured over five test trials. However, preliminary inspection of the data revealed that the task was easier than anticipated. Consequently, a more parsimonious description of the results is presented exclusively in terms of Trial 1 performance.[2]

Figure 1 shows the mean number of pairs correctly discriminated on the first test trial,

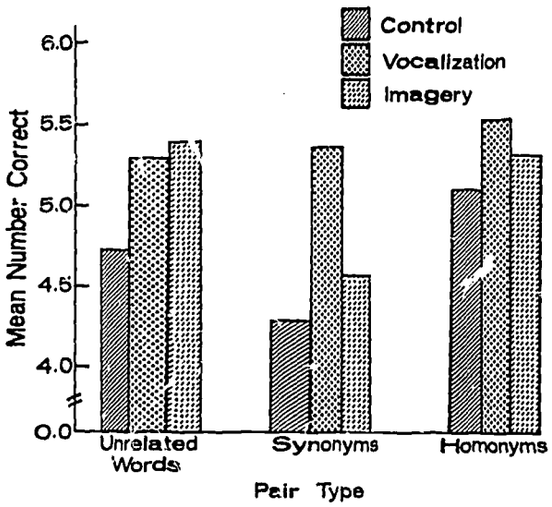

Fig. 1. Mean number of pairs correctly discriminated as a function of instructions and pair types (Experiment 1).

as a function of instructions, for each of the three pair types. Statistically, differences among instructions were detected for unrelated pairs ($F = 4.18$, $df = 2/78$, $p < .05$) and synonym pairs ($F = 6.68$, $df = 2/78$, $p < .01$), but not for homonym pairs ($F = 1.49$, $df = 2/78$, $p > .10$).

The pattern of significant differences for unrelated and synonym pairs essentially supports the predictions. For unrelated pairs, imagery and vocalization instructions did not differ significantly; at the same time, imagery instructions were significantly better than regular instructions while vocalization instructions were not. As may be seen in Table 1, the present results for unrelated pairs compare favorably with Rowe and Paivio's (1971) data (based on adults and a homogeneous list of unrelated noun pairs), although in their study each pair of differences was statistically significant when scores were corrected for guessing and a less conservative post hoc comparison procedure was employed.

Figure 1 suggests, and post hoc comparisons confirm, that for synonym pairs quite a different instructions profile was produced. As was predicted, vocalization instructions resulted in better performance than either imagery or regular instructions, the latter two not differing significantly. The cue distinctiveness hypothesis affords a viable account of this finding. That is, when synonym pairs constitute the learning materials, acoustic discriminability is still preserved for a vocalization strategy. On the other hand, the image/meaning similarity of synonyms decreases the effectiveness of an imagery strategy.

That no significant differences among instructional conditions were found within homonym pairs is puzzling, and defies a cue distinctiveness interpretation. It should be remembered that precisely the opposite of the synonym pair result was anticipated for these pairs: imagery instructions were expected to be facilitative (since imagery distinctiveness was preserved), while vocalization instructions were not (since acoustic distinctiveness was eliminated). Though not assessed statistically, performance on homonym pairs was uniformly high for all instructional conditions, and in fact, was descriptively higher than for the two other pair types (see Figure 1). This finding was unexpected, and contradicts some recent data showing that homonym pairs are more difficult to learn than unrelated word pairs (Kausler & Olson, 1969).

Although the expected outcomes were

[2]Since parametric assumptions appeared questionable upon an inspection of the data, each of the three univariate analyses comparing instructions was performed using Kruskal-Wallis analyses of ranks, followed by Nemenyi post hoc comparisons (Kirk, 1968). In all cases the statistical decisions correspond to those reported for the parametric techniques.

Table 1
Comparison of the Rowe and Paivio (1971) Results with the Present Data, in Terms of Percentage Correct for Unrelated Pairs, as a Function of Three Types of Instructions

	Control	Vocalization	Imagery
Rowe and Paivio	73	83	87
Present Data (Unrelated Pairs)	79	88	90

Note: The percentages are based on different numbers of items in the two studies, which also utilized different list types, numbers of trials and age populations. The Rowe and Paivio data differ from those in their published study in that the percentages reported here have not been corrected for guessing (Rowe, personal communication).

obtained for unrelated and synonym pairs, the homonym pair data prevent unqualified support of the predictions. It is worth noting that the single significant effect attributable to the List Version factor (all other F's were less than 1.00) occurred within homonym pairs, and consisted of an interaction of this factor with Instructions ($F = 4.61$, $df = 2/78$, $p < .05$). Examination of the separate list versions was uninformative with regard to the predicted differences among instructions. However, inspection of the constituent items revealed that three of the six homonym pairs (viz., FLOWER-FLOUR; ANT-AUNT; and PAIR-PEAR) were such that inappropriate labeling (whether intentional or not) of the second pair member (i.e., "FLEUR"; "ONT"; and "PEER") may well have taken place. An inappropriate labeling would, of course, decrease the acoustic similarity of the words and at the same time transform one of the words in each pair into an unfamiliar (and therefore distinctive) stimulus. That some of the subjects may have perceived the preceding pairs in this manner was independently ascertained (by an experimenter who took no part in data analysis) for children given vocalization instructions: first trial mispronunciations were recorded as having occurred seven times for these three items.

Too, the mixed-list nature of the present task may have contributed to the strange homonym result. A recently completed unpublished study by Robert Norton at the University of Wisconsin supports this interpretation, since the same homonym-over-unrelated pair superiority was discovered in a mixed list, although this finding was not statistically significant.

In view of the above considerations, a second experiment was designed to replicate the three instructional conditions of Experiment 1 with revised materials and homogeneous lists of homonyms and synonyms.

III
Experiment II

Method

Materials

Two pilot studies were run to select the word pairs for the homonym and synonym lists. For the first pilot study, a pool of 37 synonym and 25 homonym pairs was formed. Ten fourth-grade Ss were shown one member from each pair (62 words in all) and were asked to pronounce and define each word. Another ten fourth graders were shown the other members of each pair. Inspection of the data revealed that while enough synonyms were sufficiently familiar to fourth-grade Ss to form a verbal-discrimination list of reasonable length, this was not true for homonyms at this grade level. Consequently, a second pilot study was run with ten sixth-grade Ss, using only the words from the homonym pairs. Again, Ss were required to pronounce and define each word. Twenty of the homonym pairs were found to be suitable for this grade level (i.e., at least eight out of ten Ss correctly pronounced and defined both members of the pair). However, a decision to use only noun-noun pairs reduced the homonym list to 12 pairs. The synonym list also consisted of 12 noun-noun pairs selected from those used in the first pilot study. The criterion of selection (that at least eight out of ten Ss pronounce and define each word correctly) was the same as for the homonym pairs. For one version of each list a randomly selected member of each pair was designated as correct; in the other version the other member of each pair was correct.

Subjects

The Ss were 120 sixth-grade children from a suburban Wisconsin community quite similar to those in which the first experiment and pilot studies were run. Equal numbers of males and females were randomly assigned to the six conditions formed by the factorial combination of Instructions (imagery, vocalization, and control) and Pair Type (homonym and synonym).[3]

Procedure

The procedure was exactly the same as in the first experiment except that Ss were given two study-test trials instead of five.

Results and Discussion

The mean number of correct responses over the two test trials, as a function of Instructions and Pair Type, may be found in Figure 2. Simple main effects of Instructions (within pair types) were computed after removing the main effects of List and Sex.

Analysis of variance revealed no effect associated with Pair Type ($F = 1.22$, $df = 1/112$, $p > .10$). A significant effect of Instructions was detected within homonym pairs ($F = 3.89$, $df = 2/112$, $p < .05$), but not within synonym pairs ($F < 1$). Tukey post hoc comparisons within the homonym pairs indicated that imagery instructions were superior to vocalization instructions, as predicted.

Although there was a significant main effect of Trials ($F = 6.36$, $df = 1/112$, $p < .05$), it did not interact with either of the experimental factors.

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[3] "Sex" was included as a stratifying variable here since the Experiment 2 pilot studies suggested that girls were more fluent than boys with the present materials.

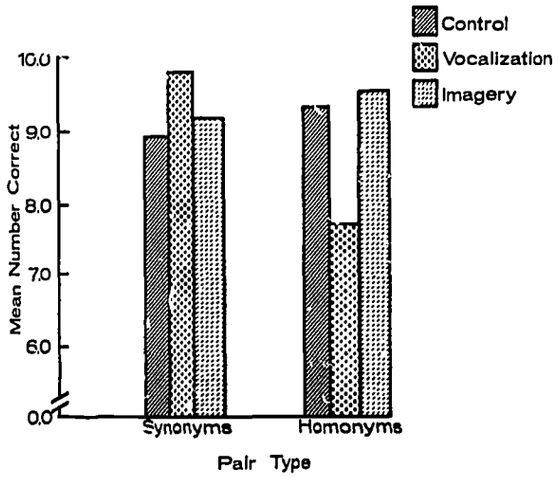

Fig. 2. Mean number of pairs correctly discriminated as a function of instructions and pair types (Experiment 2).

Although total confirmation of the initial predictions cannot be claimed, the results of the two experiments jointly considered provide complementary supporting evidence. Thus, while the inferiority of vocalization, relative to imagery, instructions for homonym pairs was clearly demonstrated in the homogeneous list of Experiment 2, at the same time the previously detected (in the mixed list of Experiment 1) superiority of vocalization instructions for synonym pairs was obscured. A possible explanation of the homonym results was offered earlier.

Despite the nonsignificant effect of instructions for synonym pairs in Experiment 2, a look at Figure 2 affords a descriptive corroboration of the pattern in Experiment 1. The relative decrease in the effect may be attributed to the possibility that Ss are more likely to abandon an ineffectual strategy (e.g., imagery for synonyms) with a homogeneous list than they are with a mixed list (where periodic reinforcement accrues with the imagery strategy, i.e., on the nonsynonym pairs). Vocalization Ss do not have this option, however, because of the overt nature of their response. This interpretation must be considered tentative, as the necessary supporting data are lacking at present.

The present findings add to the rapidly accumulating literature which documents the importance of subject-generated (experimenter-induced) mediational strategies in children's learning (cf. Levin, in press; Paivio, A., 1971). While most of the research to date has focused on verbal and imagery processes in associative and serial learning tasks, these conclusions may now be extended to an even more fundamental type of learning, i.e., discrimination learning (Gagné, 1970). At the same time, when facilitation and interference are selectively produced within the same experimental paradigm (cf. Brooks, 1968), as was attempted here, valuable support for the psychological reality of frequently unobservable phenomena (e.g., covert imagery or vocalization) may be the result.

References

Brooks, L. R. Spatial and verbal components of the act of recall. Canadian Journal of Experimental Psychology, 1968, 22, 349-368.

Carmean, S. L., & Weir, M. W. Effects of verbalizations on discrimination learning and retention. Journal of Verbal Learning and Verbal Behavior, 1967, 6, 545-550.

Gagné, R. M. The Conditions of Learning. New York: Holt & Co., 1970.

Kausler, D. H., & Olson, R. D. Homonyms as items in verbal discrimination learning and transfer. Journal of Experimental Psychology, 1969, 82, 136-142.

Kirk, R. E. Experimental Design: Procedures for the Behavioral Sciences. Belmont, California: Brooks/Cole, 1968.

Levin, J. R. When is a picture worth a thousand words? In Issues in imagery and learning: Four papers. Wisconsin Research and Development Center for Cognitive Learning, Theoretical Paper No. 36, in press.

Paivio, A., Imagery and Verbal Processes. New York: Holt & Co., 1971.

Paivio, A., Yuille, J. C., & Madigan, S. Concreteness, imagery, and meaningfulness values for 925 nouns. Journal of Experimental Psychology Monograph Supplement, 1968, 76 (1, Part 2).

Rowe, E. J., & Paivio, A. Imagery and repetition instructions in verbal discrimination and incidental paired-associate learning. Journal of Verbal Learning and Verbal Behavior, 1971, 10, 668-672.

Thorndike, E. L., & Lorge, I. The Teacher's Word Book of 30,000 Words. New York: Bureau of Publications, Teachers College, 1944.

Wilder, L. Spoken rehearsal and verbal discrimination learning. Speech Monographs, 1971, 38, 113-120.

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