The effect of verbalization of relevant and irrelevant dimensions on discrimination-shift learning

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This study explored both the effects of mixed verbalization on shift learning and the possible prepotent stimulus dimensions for 7-year-old children. Significant main effects were found for reversal and nonreversal shifts ($p < .05$) and discrimination variables ($p < .05$). Although no significant interaction was found, the data indicated that during transfer learning, verbalization of both dimensions facilitated the acquisition of a size discrimination to a greater extent than a brightness discrimination.

There are inclusive results among the studies investigating the effects of verbalization on shift learning, either during pretraining or during the learning task. One can find support that verbalization had no effect, interfered, or facilitated shift learning (Wolff, 1967).

It has been hypothesized that language makes stimuli more noticeable and, as a mediating response, serves to orient one toward a particular stimulus dimension. We have further hypothesized that if a verbal response was lengthened during initial learning to include the second dimension of a two-dimension discrimination task, this new verbalization would direct attention to both the criterial dimension being reinforced and to the irrelevant dimension. The overall effect would be facilitative during a nonreversal shift. In a recent study hypothesizing similar results, Milgram & Noce (1968) reported that mixed verbalization was more facilitative in discrimination learning than in reversal shift.

A second important consideration in shift learning involves the possibility of strong prepotent stimulus dimensions among Ss of various age groups. Smiley & Weir (1966) found that the rate of criterion attainment in discrimination and discrimination-shift learning was related to dimensional dominance. In addition, Wolff (1968) has investigated the role of dimensional preferences among young children and has found that, in a transfer discrimination task involving the dimensions of size and brightness, nursery-school children learn more easily when size is the relevant

dimension than when the relevant dimension is brightness.

The present paper attempted to further investigate both the relationship between verbalization and shift learning and the possible prepotent stimulus dimensions for 7-year-old children.

SUBJECTS

The Ss were 86 second-graders from the Bloomington Metropolitan Schools, Bloomington, Ind. Thirty-eight of the children were girls and 48 were boys. Two of the girls were eliminated from the experiment due to their failure to learn the initial discrimination. The Ss were randomly assigned to the various conditions without regard to sex or specific age considerations.

APPARATUS

The experimental apparatus consisted of a specially-constructed plywood box 20 in. wide, 20 in. high, and 10 in. deep. Two 3 x 3 in. one-way windows, 6 in. apart, were utilized for presenting the stimulus materials. A response button was located directly below each window.

A rotating rectangular box was mounted inside the apparatus for presenting stimulus pairs. Two square discriminanda made from construction paper were mounted on each of the four sides of this box. Each pair included all four possible stimulus attributes—small, large, black, and white. The four pairs were arranged so that each stimulus attribute appeared twice in each position—right or left—during a full rotation of the box. In each pair, the large stimulus was 2 in. square, and the small stimulus was 1 in. square.

Two 18-in. 60-W lumaline lamps were mounted inside the apparatus to provide instant visibility of the stimulus materials. A small buzzer could be connected to either of the response buttons through the E's manipulation of a knife switch. The buzzer provided positive feedback for the S. In addition, a small response light—visible only to the E—was utilized to detect incorrect responses by the S.

PROCEDURE

The 84 Ss were randomly assigned to 1 of 12 conditions. The two types of shifts were reversal (R) and nonreversal (R̄), and the three verbalization conditions were no verbalization (OV), one-dimension verbalization (1V), and two-dimension verbalization (2V). The two types of initial discrimination dimensions were size and brightness. The study was planned so that

the four possible stimulus dimensions—small, large, black, and white—were equally represented across verbalization and shift conditions in both the initial and final discrimination tasks.

The children were individually tested in a small private room. Each S was informed that he or she was about to play a game involving prizes at the end. Standard instructions were then given regarding the use of the apparatus, and each S was asked to complete two practice trials. Special emphasis was placed on the importance of making the buzzer sound in order to win. The E also informed each S about the four possible winning attributes and explained that the correct attribute might change during the game. The OV Ss received no further instructions.

In addition to the above directions, the Ss in the 1V conditions were asked to provide one verbal label—"small," "large," "black," or "white"—which described their stimulus choice on each trial. The 2V Ss were instructed to tell both the size and color of the stimulus object which they picked to win on each trial. The Ss in both the 1V and 2V conditions were asked to make their verbal responses before they pressed the button under the stimulus object which they had picked to win. These Ss were also given two practice trials in order to ensure that the verbal responses would be made in the desired manner.

It should be pointed out that all Ss were informed, as part of the instructions, of the stimulus dimension (size or color) that was relevant in the initial discrimination task. This procedure was carried out in order to facilitate learning of the initial discrimination. The Ss who had difficulty in learning the original discrimination were prompted by the E to focus their attention on the relevant stimulus attributes.

The beginning of each discrimination trial was indicated when the lamps were switched on to provide illumination for the pair of stimuli. For each S, the initial starting order of the stimulus pairs was determined on a random basis. For both the initial and the final discrimination tasks, the criterion was 9 out of 10 successive correct responses. The Ss who went beyond 72 trials in learning the final discrimination were considered to have learned the correct stimulus attribute at the end of 72 trials.

RESULTS AND DISCUSSION

Since the variances of scores varied widely between conditions, these scores were subjected to a log transformation prior to analysis. Trials to criterion in transfer learning are shown in Table 1.

As expected, Ss in the reversal-shift conditions required significantly fewer trials to criterion than those in the nonreversal conditions [$F(1,72) = 12.4, p < .05$]. The

Table 1
Means and Standard Deviations of Trials to Criterion Scores in Transfer Learning

Shift	Relevant Transfer Learning Dimension	Condition	Unconverted Mean	Mean	S.D.
Reversal	Size	0V	20.4	1.263	.222
	Brightness	0V	23.7	1.269	.295
	Size	1V	13.6	1.128	.066
	Brightness	1V	23.6	1.245	.332
	Size	2V	13.0	1.094	.135
	Brightness	2V	18.4	1.225	.201
Nonreversal	Size	0V	34.0	1.427	.332
	Brightness	0V	30.3	1.405	.272
	Size	1V	22.9	1.318	.203
	Brightness	1V	33.1	1.508	.115
	Size	2V	20.4	1.234	.251
	Brightness	2V	34.3	1.445	.300

data also indicated that Ss learned more easily when size was the relevant dimension than when the relevant dimension was brightness [$F(1,72) = 4.01$, $p < .05$]. Contrary to expectation, analysis of variance indicated no effect due to verbalization or to interaction.

One possible explanation of the above results concerns the influence of the instructions on subsequent discrimination performance. Since all Ss were given the entire universe of potentially relevant stimulus attributes—small, large, black, and white—in the initial instructions, it may be reasoned that this information tended to reduce the differential effects of the verbalization conditions. If mediation actually consists of covert verbalization, it may be hypothesized that once the mediating child is aware of the verbal labels for potentially relevant discriminations, the overt use of such labels will not necessarily provide additional support in the mediating process.

Failure to demonstrate verbal facilitation may have also been due to methodological problems caused by confounding the verbalization conditions with R and $\bar{R}$. In one case (1VR), verbalization was within a dimension that was to become relevant during transfer learning. Previous research has illustrated the facilitative effects of relevant verbalization. In the other condition (1VR), verbalization was in a dimension that was to become irrelevant which, according to previous research, should retard shift learning. Thus, it can be argued that the two conditions would cancel each other out.

In the present design, one might expect an interaction in the 1VR condition due to the training of irrelevant verbalization. This condition should have had the greatest number of trials to criterion among the three $\bar{R}$ conditions. However, 1VR did not differ from 0VR. The interaction probably would have occurred if it were not for the differential effects of size and brightness during the verbalization conditions. The data indicated that, during transfer learning,

one- and two-dimension verbalization facilitated the acquisition of a size discrimination to a greater extent than a brightness discrimination. This distinction appeared to have cancelled out any possible interfering effects of verbalization in 1VR.

As predicted, 2V required the fewest number of trials to criterion among the three verbalization conditions for both R and $\bar{R}$. As in 1V, when brightness was the critical dimension, the ease of shift did not differ from 0V, therefore preventing the occurrence of any interaction effect demonstrating the facilitative effects of 2V.

During discrimination learning for 1V, Ss appeared to begin by selecting a size discrimination during the initial trials. When size was the critical dimension, they appeared "unwilling" to surrender this label during $\bar{R}$ to brightness. But when brightness was the critical dimension during discrimination learning, Ss appeared to be more willing to use a size designation once they realized that their selections were no longer correct during shift learning.

Some evidence for this phenomenon is supported by Wolff's finding¹ that there is

an increase in preference for the size dimension at age 7. However, Wolff did not find a corresponding increase in the emission of size labels.

If size appeared high on these Ss' verbal hierarchy, it may be reasoned that size was more difficult to extinguish during $\bar{R}$, thus affecting the ease of shift from brightness to size as compared to the shift from size to brightness.

This same condition appeared to have influenced the effect of 2V. Although Ss verbalized both dimensions simultaneously, this condition did not serve to direct equal attention to both dimensions, and perhaps causing the similarity between 1V and 2V.

In future studies of this type, data concerning (a) number of trials required in discrimination learning, (b) frequency of Ss' verbalizing size and brightness during 1V, and (c) Ss' stimulus preferences should help explain any differential dimensional effects.

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NOTE

1. Wolff, J. L. The role of stimulus preferences in discrimination-reversal learning as a function of age. Unpublished manuscript, 1967.

Effect of the experimenter in human eyelid conditioning

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Two groups each of male and female Ss were run 60 trials in an eyelid-conditioning experiment, either by an E of the same or cross sex. It was predicted that the interaction between sex of E and sex of S would determine the conditioning level attained, rather than sex of S alone. The data

revealed a significant E effect, with the male E consistently eliciting higher conditioning levels than the female E.

Rosenthal (1966) has presented evidence that seemingly irrelevant factors can produce powerful effects in psychological experiments. Such a factor is sex of the E (Rosenthal, 1967), which suggests that previous findings of different task