The role of dimensional preferences in discrimination learning¹

JOSEPH L. WOLFF

INSTITUTE OF HUMAN LEARNING, UNIVERSITY OF CALIFORNIA, BERKELEY

This study confirmed the hypothesis that S's preference for a stimulus dimension affects the ease with which he achieves a discrimination in which that dimension is relevant. The significance of this finding for the generally accepted explanation of Kendler & Kendler's (1959) study of discrimination reversal learning in kindergarteners was indicated.

Suchman & Trabasso (1966) found that pre-school children's preferences for color and form strongly affect the ease with which they learn to sort by these dimensions in a card sorting task. This study extends the investigation of this relationship to (a) 6-yr. old Ss, (b) non-planometric stimulus objects varying in height and brightness, and (c) a two-choice simultaneous discrimination task (DT). In addition, a simpler technique for assessing dimensional preferences than that used by Suchman and Trabasso was employed: Brian & Goodenough's (1929) test (BGT). It was predicted that brightness preferring Ss would find a brightness discrimination easier than a height discrimination, and the converse prediction was made for Ss preferring height.

Apparatus

Stimuli consisted of four opaque plastic cylinders, 3 in. in diameter, varying in height (6-1/4 in., T; 4-3/4 in., S) and brightness (black, B; white, W), i.e., TW, TB, SW, SB. Other apparatus used in DT included a gray turntable (with 12 in. high center screen) and a quantity of marbles. Black rubber grommets placed 4 in. apart on one half of the turntable held the marble rewards when these were baited under the discriminanda. In BGT a miniature gray wooden stage, complete with black curtain, was used to present the stimuli. The stage rested on a table 27 in. high.

Subjects

Ss were 47 lower to lower-middle class children attending two first grade classes in a Berkeley school. On the basis of the BGT results, 27 of these Ss were classified as height-dominant (HD), 17 were classified as brightness-dominant (BD), and 3 were classified as inconsistent (I). From this sample, 24 HD and 16 BD Ss were randomly selected to participate in DT. No I Ss were used.

Procedure

The BGT was administered 2-3 days before DT. To begin, S was made to stand facing the BGT stage so that the upper planes of the cylinder-stimuli were slightly below eye-level. The stimuli were then presented three at a time for six trials. On each trial

two cylinders, called the "response stimuli," were placed 8 in. apart on an imaginary line parallel with and 4-1/2 in. from the front edge of the stage. These cylinders differed in both height and brightness. The third cylinder, called the "reference stimulus," agreed in height with one of the response stimuli and in brightness with the other. It was placed behind the response stimuli, 5-1/2 in. from each. Each trial began with the reading of the following instructions: "See these two things up here (E simultaneously touches the two response stimuli), and see this thing back here (E touches reference stimulus); well, point to the thing up here which is just like the thing back here (E repeats motions)." Following S's response, E closed the curtain, recorded the choice, and arranged the stimuli for the next trial, without speaking or otherwise indicating confirmation of S's response.

A different combination of response and reference stimuli was presented on each trial in order to counterbalance specific position, size and brightness cues, and at the same time assess the consistency of S's responding. Although the same six combinations and sequence of combinations were used for all Ss, starting points within the sequence were determined randomly for each S.

An Ss was considered to have responded to brightness if the response stimulus he chose agreed with the reference stimulus in brightness; conversely, if agreement occurred on the height dimension, S was considered to have responded to height. Ss responding four times or more to either dimension were classified as HD or BD depending on the dimension eliciting the greater number of responses; Ss responding three times to each dimension were considered I.

The DT was administered in the same room as BGT. With three exceptions, procedure was that used by Kendler & Kendler (1959) in the original learning part of their task. The three exceptions are as follows: (a) no prizes were given as incentives; (b) cut-off was set at 50 trials; (c) positive cues within dimensions were randomly determined for each S rather than counterbalanced. The task began with a reading of the Kendler and Kendler instructions, following which the stimulus pairs (TW, SB) and (TB, SW) were presented one pair per trial in a pre-arranged sequence, and one of the four cues (i.e., B, W, T, or S) was 100%-reinforced by means of marble rewards. Although a non-correction procedure was employed, stimuli remained constant over trials whenever S made an error. All Ss worked to a criterion of 9 out of 10 consecutive correct

Table 1. Trials to Criterion

Dimension	Brightness-Dominant Ss			Height-Dominant Ss		
	Mean	Range	NF	Mean	Range	NF
Height	29.6	0-50	4	22.5	2-50	3
Brightness	16.1	5-24	0	44.8	14-50	10

Note—NF means Number Failing

responses or to a cut-off point of 50 trials. Prior to DT, Ss within each BGT category were randomly assigned in equal number to height or brightness as the originally relevant dimension.

Results and Discussion

Table 1 summarizes the learning data. Owing to the fact that variances were heterogeneous and no cell seemed normally distributed, parametric analysis of these data was judged unwarranted. Because scores seemed to fall into two roughly equal categories—50 and below 50—the number of Ss achieving criterion as a function of the dimension relevant was evaluated by the Fischer-Yates technique within each BGT category individually. From this analysis it was found that significantly more BD Ss achieved criterion on a brightness discrimination than on a size discrimination ($p = .038$, one-tailed), and that the opposite was true of HD Ss ($p = .006$, one-tailed).

These results indicate that the relationship between dimensional preferences and learning found by Suchman and Trabasso to hold for (a) 4-yr.-olds, (b) color and form, and (c) a card sorting task, holds in addition for (a) 6-yr.-olds, (b) size and brightness, and (c) a simple discrimination learning task involving non-planometric stimuli.

The present findings are also of interest in relation to those of Kendler & Kendler (1959). They found that the number of trials kindergarteners required to learn reversal shifts and the number they required to learn nonreversal shifts (following the present DT) were respectively positive and negative functions of the number of trials required to achieve the original discrimination (DT). This finding was construed as evidence that Ss who learn DT quickly employ verbal mediators which facilitate reversal and retard nonreversal shifting, while Ss who learn DT slowly (and hence, by the above relationship, learn nonreversal shifts quickly and reversal shifts slowly) do not mediate but rather learn according to simple S-R principles. But the present results, along with Kendler's (1964) and Wolff's (1965) findings that choice of optional reversal shift, as well as speed of shift learning, is often a function of di-

mensional prepotency, suggest a different interpretation: i.e., that the effect is due to dimensional preferences. Thus, according to the present findings, fast learners in DT are mainly those for whom the relevant dimension is preferred and slow learners are mainly those for whom it is unpreferred. But this implies (a) that most fast learners in DT are given a problem involving their preferred dimension during reversal shift (in which the relevant dimension remains the same) and a problem involving their unpreferred dimension during nonreversal shift (in which the relevant dimension is changed), and (b) that the converse is true of slow learning Ss. Hence, it might well be that speed of learning in DT is positively related to speed of reversal shifting and negatively related to speed of nonreversal shifting, because for Ss making reversal shifts, dimensional preferences have the same effect in both the DT and shift period, and for those making nonreversal shifts, dimensional preferences have opposite effects in the two periods.

The definitive test of this interpretation remains a problem for a future experiment.²

References

- Brian, C. R., & Goodenough, F. L. Relative potency of color and form perception at various ages. *J. exp. Psychol.*, 1929, 12, 197-213.
- Kendler, H. H., & Kendler, T. S. Reversal and nonreversal shifts in kindergarten children. *J. exp. Psychol.*, 1959, 58, 56-60.
- Kendler, T. S. Verbalization and optional reversal shifts among kindergarten children. *J. verbal Learn. verbal Behav.*, 1964, 3, 428-436.
- Suchman, R. G., & Trabasso, T. Stimulus preference and cue function in young children. *J. exp. child Psychol.*, 1966, 3, 188-198.
- Wolff, J. L. The effects of mediating ability, verbalization and pretraining on concept attainment in children. Unpublished Ph.D. thesis, Indiana University, 1965.

Notes

1. This study was performed while the writer was an NIMH Post-doctoral Fellow at the Institute of Human Learning, which is supported by grants from the National Science Foundation and the National Institutes of Health.
2. An attempt was made to test this interpretation in the study reported in this paper. Those Ss achieving criterion within 50 trials were immediately shifted. The remaining Ss were given special training the next day on the same discrimination they had originally received but with detailed instructions and the irrelevant dimension held constant. Following this they were returned to DT, and after they achieved criterion (all Ss were now successful) they were shifted.

Unfortunately, special training, which was not orthogonal to the three planned factors for the shift period, significantly affected shift-performance, thereby confounding the shift data and making them uninterpretable. For this reason the shift data were not reported.