Stimulus control in the albino rat as a function of extradimensional discrimination training*

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Two groups of rats were given a generalization test along the floor tilt dimension following either single stimulus training in the presence of white noise or discrimination training between the presence and absence of white noise. For both groups, training took place with the floor in the flat (horizontal) position. The generalization test revealed strong control by the flat floor for the discrimination Ss and weak or no control by the flat floor following single stimulus training. The results are discussed as supporting the general attention view of Thomas and his associates.

In a recent study, Thomas, Freeman, Svinicki, Burr, & Lyons (1970) described a series of experiments which demonstrated that discrimination training heightens attention (defined by the slope of a generalization gradient) to stimulus change and thus produces a general rather than a selective effect. That is, the birds learn to attend in general, rather than attending to specific stimuli or dimensions. Experiment 5 of the series produced the most dramatic evidence in favor of the general attention view. This work involved two groups of pigeons and extradimension discrimination training, i.e., the dimension along which generalization was tested was irrelevant during discrimination training. Group 1 (TD) was given discrimination training between a flat floor (S+) and a floor tilted 10 deg (S–). A second group received single stimulus training to the flat floor. For both groups, the key was illuminated by a green light throughout training. The test for attention involved a generalization test along the wavelength dimension, which was constant and irrelevant during training.

In this situation, predictions based on a selective attention theory of the type advocated by Sutherland (1964), Mackintosh (1965), and Trabasso & Bower (1968) are clear: wavelength generalization gradients following single stimulus training should be steeper than following TD training. The predictions based on the general attention view are the opposite (cf. Thomas et al, 1970, for an articulation of the predictions based on the two positions). The results of the experiment clearly favor the general attention view, i.e., the wavelength gradient was reliably steeper following TD training than following single stimulus training.

The purpose of the present study was to provide further information concerning the general attention view by investigating the possibility that extradimensional discrimination training heightens stimulus control vis à vis single stimulus training, but, instead of the pigeon, the albino rat was the experimental S.

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METHOD

The Ss were 12 experimentally naive albino rats 100 days old at the start of the experiment. The rats were maintained at 80% of their free-feeding weight throughout the experiment. The apparatus consisted of four rat operant conditioning chambers modified so that the floor could be tilted 25 deg, in 5-deg steps, on either side of horizontal. White noise was provided by a Grason-Stadler noise generator. Each chamber contained a very dim light mounted on the front panel 5 in. above the response bar.

Upon arrival at the laboratory, all rats were individually caged and allowed free access to food and water until a stable weight level was obtained, at which time each S was reduced to 80% of its free-feeding weight and training was begun.

On Day 1, all Ss were magazine and barpress trained and allowed to obtain 50 continuous reinforcements (CRF) for barpressing. Reinforcement consisted of Noyes rat pellets (45-mg). On Days 2 and 3, each rat received an additional 50 CRF for barpressing. For the next six training sessions, the reinforcement schedule was changed to a variable interval ¼ min (VI ¼ min) and each session lasted 15 min. On Days 10-12, the reinforcement schedule was changed to a VI ½-min schedule; the training session remained 15 min.

Following this preliminary training, half the Ss received single stimulus training with the white noise on and VI 1-min reinforcement schedule in effect. The stimulus-on periods were for 50 sec, and each was separated from the next by a 10-sec blackout. The stimulus-on periods were signaled by the onset of the dim bulb mounted on the front panel of the chamber. There were 30 such 50-sec periods in each daily session. Training continued in this manner for 20 days.

The remaining six rats were given discrimination training between the white noise on (S+ VI 1-min reinforcement) and the absence of white noise (S– extinction). Each S in the discrimination group received 15 50-sec S+ periods alternated with 15 50-sec S– periods in a quasirandom sequence. Stimulus-on periods were separated by the 10-sec blackouts. Training continued in this manner until a criterion of seven responses to S+ for each response to S– for 3 consecutive days was attained. It required an average of 20 training days to reach criterion and, as with the single stimulus group, the floor remained in the flat position throughout all training sessions.

Following the single stimulus training and criterion performance for the discrimination Ss, all rats were given a generalization test to the floor tilt dimension. The test stimuli included the S+ and five floor positions, in 5-deg steps, on either side of S+; these stimuli were randomized within a series, and four different random series were presented to each S. All testing was conducted in extinction and stimulus-on periods were for 50 sec, with the 10-sec blackout separating each.

RESULTS

Figure 1 presents the mean percent of total responses to each of the floor positions for the single stimulus control group and the group tested following discrimination training. An analysis of variance

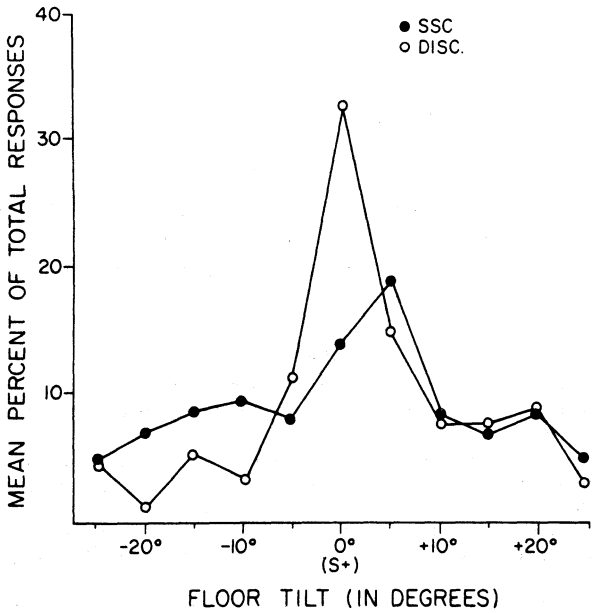

Fig. 1. Mean percent of total responses to each of the test floor positions for both groups.

performed on these relative gradients reveals that both are reliable: $F(10,50) = 5.81$, $p < .01$ for the single stimulus control group; $F(10,50) = 11.07$, $p < .01$ for the discrimination group. A t test between the percent of total responses to S+ for both groups reveals that the discrimination group gradient is reliably steeper at the flat floor position than is that for the control group [$t(10) = 3.34$, $p < .01$]. Note that while the gradient for the control group is reliable, the peak of the gradient fails to occur at the flat floor positions, but occurs at a floor position rotated 5 deg clockwise from horizontal. In fact, five of the six rats in the control group showed a strong preference for this test stimulus value. However, the control exerted by the horizontal floor position is clear for the Ss in the discrimination group, with all six rats in this group demonstrating a clear preference for the flat floor.

Figure 2 depicts the absolute gradients, i.e., the mean responses to each of the test stimuli for both groups. An analysis of variance performed on these data indicates that both are reliable: $F(10,50) = 3.81$, $p < .01$ for the single stimulus control group; $F(10,50) = 13.44$, $p < .01$ for the discrimination group. These absolute gradients are reported so that direct comparisons between the shape of the relative and absolute gradients may be made.

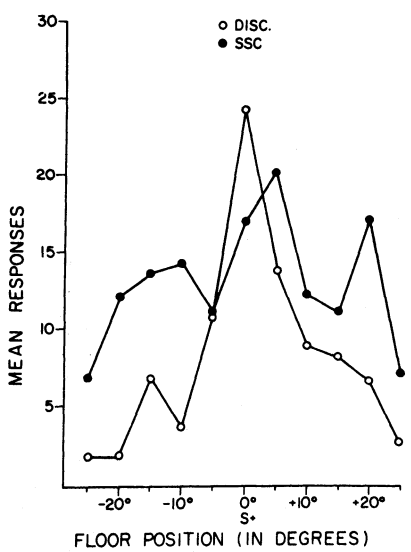

Fig. 2. Mean responses to each of the test floor positions for both groups.

DISCUSSION

The results of this study suggest that discrimination training along one dimension increases stimulus control by a dimension (floor position) which was not varied during discrimination training. In fact, it may be that the extradimensional training actually produced the control exerted by the horizontal floor position. Recall that the gradient for the control Ss peaked not at the horizontal floor tilt, but at a floor tilt of 5 deg clockwise from horizontal. If one assumes the preference for the floor tilt of 5 deg to be real, then the demonstration of control by the flat floor following discrimination training requires the overcoming of the preference of the tilted floor. Clearly, this was the case in this study, making the effect of extradimensional training on stimulus control by an irrelevant stimulus all the more convincing.

The data from this experiment strongly support the Thomas et al (1970) position that discrimination training has a general effect on attention rather than a selective one. That is, the animals learn to "pay attention" to many of the stimuli present during discrimination training rather than selecting specific stimuli involved in the discrimination test to the exclusion of other stimuli as theorists such as Sutherland (1964), Mackintosh (1965), and Trabasso & Bower (1968) suggest.

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(Received for publication August 25, 1972.)