Conditional discrimination learning in rats¹

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Criterion on a conditional discrimination was attained by 20 of 24 rats. No significant differences were found between Ss trained with and without correction and between Ss trained with one dimension black and white as opposed to horizontal and vertical striations. Test trials following criterion revealed the response-eliciting cues to be stimulus compounds, the simplest stimulus arrangements permitting problem solution.

Conditional discrimination learning has been demonstrated on several occasions in the rat (e.g., Lashley, 1938; North, Maller, & Hughes, 1958). In addition, North et al presented data showing that problem solution was based on the acquisition of approach responses to stimulus compounds rather than to stimulus configurations. However, to date there are almost no data relating the rate of conditional discrimination learning to variables known to affect other types of discriminative learning in rats.¹ The present study was directed towards this task; the effects of training procedure (correction vs. noncorrection) and stimulus dimension (the pairing of forms with vertical and horizontal striations as opposed to black and white) were evaluated in a 2 by 2 factorial design. In addition, test trials, identical to those employed by North et al, were administered following acquisition to determine the response-eliciting cue.

Subjects

The Ss were 24 naive male hooded rats, approximately 90 to 120 days old at the beginning of training. Ss were placed on a 23-hr. feeding schedule and maintained at 90% of their ad-lib weight.

Apparatus

A Wisconsin General Test Apparatus, modified for the rat, was employed. The stimuli were wooden circles and triangles onto which black and white or horizontally and vertically striped, cardboard cutouts could be attached.

Procedure

Twelve Ss were trained under a correction schedule and 12 Ss under a noncorrection schedule. Six Ss within each group were trained with black and white forms and six with striped forms.

Figure 1 presents two sample problems and their corresponding test-trial stimuli. In the problem shown in the upper left-hand portion of Fig. 1, the triangle was positive and circle negative when both figures were black, while the reverse was true when both figures were white. In this problem form is the dimension differentiating stimuli within a pair, and brightness is the conditional or between-pair differentiating dimension. A similar problem can be constructed for the

SAMPLE PROBLEMS

1) FORM PLUS BRIGHTNESS

TRAINING

TEST

2) FORM PLUS STRIPES

TRAINING

TEST

Fig. 1. Two sample training problems and their corresponding test stimuli.

two striped subgroups by substitution of horizontal and vertical stripes for black and white, as shown on the lower left-hand portion of Fig. 1. Within each of the four subgroups, three Ss were trained with form as the within-pair dimension and brightness or stripes as the between-pair or conditional dimension, and vice versa for the three remaining Ss.

The orders for presentation of stimulus pairs over trials and positioning of the correct stimulus were determined by Gellermann series. All Ss received 25 trials per day, five days per week, until reaching a criterion of 20 of 25 responses correct on two consecutive days, or until 800 trials had been presented.

On the day following attainment of criterion, 10 additional training trials and then 20 test trials were given. The righthand side of Fig. 1 shows the test-trial stimuli for the two sample problems. Test-trial stimuli differed from training stimuli in that the positive stimulus from one pair of stimuli was combined with the negative stimulus from the second, and conversely. In this manner, two new configurations were arranged while maintaining the previously positive and negative

compounds. The expectation is for chance performance given response tendencies to configurations and better than chance performance given responses to stimulus compounds.

Results

All but four animals achieved criterion within 800 trials, and the distribution of failures was not systematic. The two striped subgroups had one failure each, and the black-white correction subgroup had two failures. A 2 by 2 factorial analysis of variance, performed on trials to criterion, revealed no significant main effects or interaction.

The mean number of trials to criterion for the 20 learners was 354, and the mean level of performance during the two criterial sessions was better than 87%.

Of the 20 Ss reaching criterion, 13 made fewer than two errors, and only one S made as many as five errors. The obtained mean of 1.4 errors was significantly less than 10 errors, the expected number had Ss been responding to configurations during the training phase ($t = 24.6$, $df = 19$, $p < .001$).

Discussion

The results of the present study, although showing conditional discrimination learning in rats to be unaffected by correction or stimulus variables, are not without interest when compared with the results obtained by North et al. For not only did a greater proportion of the present Ss attain criterion, 83% versus 41% ($z = 2.8$, $p < .01$), but the number of trials to criterion for these Ss was also fewer by over 400. An examination of procedural factors yielded two probable sources of facilitation: (a) training procedure; and (b) apparatus. As for training procedure, North et al treated each of the two stimulus pairs constituting the conditional discrimination as separate problems. That is, training was accomplished by having Ss reach criterion on the

first pair and then on the second pair, with this sequence being repeated four times. Note, however, that until Ss learn to respond to both the within-pair and between-pair cues as a unitary pattern of stimulation, they are in fact undergoing a short series of successive reversals, an experimental situation known to produce negative transfer at least over the early reversals. The random alternation of the two pairs of stimuli over trials precludes this source of interference. Use of the WGTA may also have produced a facilitative effect by eliminating the considerable emotionality associated with the Lashley Jumping Stand, especially when the problem is difficult and the errors and punishment are numerous.

As for the test-trial data, the finding of approach responses to stimulus compounds confirmed the earlier results of North et al and supported Spence's (1952) conception of the stimulus in discrimination learning. Spence hypothesized that rats may learn approach responses to components, compounds, or transverse patterns (configurations), these responses being to the simplest stimulus arrangements permitting problem solution—compounds in the present experiment.

References

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