Differential reward conditioning: S- contrast as a function of the magnitude of S+¹

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Forty-two rats received 19, 10, or 1 pellets of food reward in one (S+) of two runways of different brightness. In the other runway (S-) all Ss received 1 pellet. In the initial segments of the response chain speeds in S- were an inverse function of reward magnitude in S+. Response speeds in S+ did not differ significantly.

A basic question in the study of instrumental behavior is whether the response to a particular incentive, the "test" incentive, is affected by experience with incentives of different magnitude or quality, that is, "contrasting" incentives. When the response is influenced by such experience a "contrast effect" (CE) is said to be present.

The classic examples of CEs in simple instrumental conditioning are the "depression" and "elation" phenomena reported by Crespi in 1942. More recently a number of investigations have been concerned with CEs in differential conditioning. By and large the data indicate that CEs do exist in differential conditioning, particularly in the response to the stimuli associated with the nominally less favorable alternative (e.g., Davenport, 1962; Spear & Hill, 1965). However, much of the data came from spatial discrimination tasks such as a T maze which may not permit a pure measure of the tendency to approach a single stimulus. When on certain trials Ss are permitted access to only one arm of the apparatus they still have presented to them some cues from the other arm which might elicit the response tendency associated with that arm. In addition, performance may be affected by the S's having to determine which arm of the apparatus is available to it before proceeding.

Considering only studies which presumably minimize such factors by employing a simple brightness discrimination with but one brightness presented on any one trial, the evidence for CEs is not so convincing. Bower (1961) and Porter (1964) found CEs but Goldstein & Spence (1963) reported that response strength was solely a function of the incentive approached, with the presence of contrasting incentives being irrelevant.

The present study was undertaken to bring further data to bear on this problem employing an apparatus similar to that of Goldstein and Spence.

Method

A floor plan of the apparatus is shown in Fig. 1. Only Start Box "d" and Alleys 3 and 4 on the far right were used in this study. The apparatus was 4 in. high and covered with clear Plexiglas. A translucent sky of mat acetate was located 28 in. above the alleys. An evenly-

Fig. 1. Floor plan of the apparatus. Alleys 3 and 4 and Start Box d were used in this study. Retrace doors are indicated by dashed lines and photobeams by solid lines across the apparatus. A start door, not shown, separated the start box from the alley.

distributed array of white, 7-w lamps placed 18 in. above the sky provided relatively homogeneous lighting. Curtains covered three sides, and a one-way mirror, behind which E worked, covered the front side of the apparatus.

Three photobeams permitted, in conjunction with a microswitch on the start door, three successive time measures as a S traversed an alley. These measures were converted to ft./sec. and called start, run, and goal speeds, respectively.

The Ss were 42 naive, female, Sprague-Dawley rats, 60 days old at the beginning of the study. They were randomly assigned to three groups, designated 19-1, 10-1, and 1-1. The first number indicates the number of pellets (45 mg) received as a contrasting incentive and the second number indicates that the test incentive was one pellet. The alleys leading to the contrasting and test incentives were designated "S+" and "S-", respectively. Within each group, half the Ss (a sub-

group) received their test incentive in the black alley and the other half received it in the white alley.

The repeated order of running of the groups for a six-day cycle was ABC, BCA, CAB, ACB, BAC, CBA, where A, B, and C designate groups 1-1, 10-1, and 19-1, respectively. The Ss in one subgroup were rotated through their trials before proceeding to the other subgroup. The order of Ss within a subgroup was constant from trial to trial. The apparatus was swabbed with a damp sponge before each subgroup's trials.

On the fourteenth and fifteenth days after placing the Ss on a 24-hr. deprivation cycle, 5 min. of exploration in each alley were permitted and 10 pellets were incorporated into the daily ration. Training began on Day 16. Except for the first two days in which there were three trials, six trials were given each day. Following the procedure of Goldstein and Spence the first trial was always to S+ and the second to S-. The sequence of S+ and S- on the last four trials of a day, from which the data came, was also the same as that of Goldstein and Spence. The Ss were required to orient to the start door for 1 sec. before the door was raised. They were removed from the goal box as soon as they had finished eating on S+ trials and within 2-3 sec. after eating on S- trials. Within a day the intertrial interval was 4-7 min. Following their daily trials Ss were given enough dry mash to bring their total daily ration to 9 gm including pellets in the alley. Water was available at all times except during trials in a runway.

Results and Discussion

The data are presented in Fig. 2. Separate analyses of variance were performed on the three measures of the

speeds to S- over Blocks 7-12 with Groups and Blocks as the factors. In the start and run measures the three groups differed significantly beyond the .001 level ($F = 19.10$ and 22.12 , $df = 2/36$), but in the goal measure the Groups factor was significant only at the .10 level ($F = 3.01$). Subsequent analyses employing the Newman-Keuls procedure indicated that in the start speeds Groups 19-1 and 10-1 each differed at the .05 level from Group 1-1 in its response to S-. However, the difference between Groups 19-1 and 10-1 did not quite reach significance. In the run speeds all three groups differed from each other at the .05 level. It appears that in the initial segments of the response chain, the greater the reward magnitude on S+, the greater the inhibition of response to S-, while in the goal segment the inhibition on S- is relatively slight.

These data agree with those of Bower (1961), Porter (1964), and others in showing contrast. Some possible reasons for their disagreement with the Goldstein and Spence (1963) data, in spite of the similar apparatus and procedure, are currently under study.

Analyses of speeds to S+ revealed no significant effect of Groups at the .05 level in any measure. Therefore there was no evidence that speed to the positive alley varied with the magnitude of reward in that alley, a finding which agrees with the studies of Davenport (1962) and Spear & Hill (1965). At least in the present study this may have occurred because conditions were such as to produce speeds near the "physiological limit" even in Ss getting a small reward. Alternatively, it is possible that S+ speeds in Groups 19-1 and 10-1 were held down by inhibition generalized from S-.

References

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Notes

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Fig. 2. Response speeds to S+ and S-. Each block represents 12 trials, 6 to S+ and 6 to S-. Within each block, except Block 1, the data are from Trials 3-6 and 9-12, thus omitting the first two trials of a day. Trials 1-6 and 9-12 are represented in Block 1.