Discrimination gradients in human eyelid conditioning

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Human Ss were given five 360 differential conditioning trial sessions with one CS+ and six CS-s. The independent variable was left-most, center, or right-most light in a seven-light array as the CS+. Individual gradients were stable and changed little following the first session. Sequential reinforcement and nonreinforcement effects were observed for the CS-s, but not the CS+. Also, there was no evidence that closer physical proximity of CS-s depressed CS+ performance.

The object of this study was to determine (1) if stable individual-S discrimination gradients could be obtained in human eyelid conditioning, (2) if there were any long-term sequential effects of reinforcement and nonreinforcement in differential conditioning, and (3) if a relevant dimension, spatial separation of CS- and CS+, affected performance as would be predicted from an excitation-inhibition gradient theory of differential conditioning (Spence, 1936).

APPARATUS

The basic apparatus for transducing and recording has been reported by Prokasy, Carlton, & Higgins (1967). CS+ and CS- were changes in brightness of .75-in. diam red cut-glass jewel lighted from behind by a 7.5 W bulb. There were seven such stimuli at a distance of approximately 60 in. in front of S, mounted horizontally, with a spatial separation of 2.5 in. between centers of adjacent stimuli. The UCS was a 50-msec puff of N to S's right cornea, and of sufficient intensity to support a 150-mm column of mercury. CS+ and CS- duration were 500 msec, and the UCS occurred at the offset of CS+.

SUBJECTS

The Ss were 49 students from introductory psychology courses at the Pennsylvania State University.

PROCEDURE

The independent variable was location of CS+. For 13 Ss CS+ was the left-most (Group L), for 24 Ss CS+ was the center (Group C), and for 12 Ss CS+ was the right-most of the seven-light display. All Ss were given five sessions of 360 trials each. One hundred twenty trials were to CS+ and 240 trials were divided equally among the six CS-s. Order of presentation was random with the restriction that the proportions of CS+ and CS-s were corrected within each of two blocks of 180 trials. A CR was defined as a pen movement of at least 1 mm in the interval from 148 to 524 msec after CS onset. The intertrial interval averaged 10 sec.

RESULTS AND DISCUSSION

There was little change in individual-S gradients across sessions. The gradients stabilized during the first session and did not reliably sharpen across the remaining sessions. They were sufficiently alike from S to S within each of the three groups that the mean gradients shown in Fig. 1, and collapsed across all 1800 trials, are reasonably representative of individual-S gradients on a session-by-session basis.

Figure 1, however, provides additional information. In each of the three subfigures are two curves. The lower curve is response probability to a particular stimulus given that the preceding trial was not reinforced (i.e., that one of the six CS-s was presented). The upper of the two is response probability to a particular stimulus given that the preceding trial was reinforced (i.e., that CS+ occurred).

The first question is whether or not there is a discrimination gradient other than the large drop in probability from CS+ to an adjacent CS-. All 13 Ss in Group L, and all 12 in Group R, gave higher mean probabilities to the CS- adjacent to the CS+

than to the CS- furthest away from CS+, $\chi^2(1) = 13.0$ and 12.0, respectively. Similarly, 22 of the 24 Ss in Group C had a higher response probability to the CS- adjacent to the CS+ than their average to the CS-s furthest removed from CS+, $\chi(1) = 16.7$. Thus, the spatial separation of stimuli is a relevant dimension in this situation. Moreover, responding to the most remote CS- is above the chance level. This is determined from the fact that for Group C and Groups L and R combined, 20 and 19 Ss, respectively, responded more following a CS+ than following a CS-, $\chi^2(1) = 10.7$ and 6.5, respectively.

Despite the fact that response probability to each CS- was greater following a reinforced rather than a nonreinforced trial, a similar effect was not obtained with the CS+. A total of only 13 of the 25 Ss in Groups L and R combined, and only 8 of 24 in Group C, exhibited a higher response probability to CS+ following a CS+, rather than a CS-, trial. This outcome is consistent with that reported by Prokasy, Higgins, & Carlton (1968): with sequences of CS+, response probability did not increase following the first (but did following the next) CS+. Since the present study was conducted with 1800 trials per S, and the Prokasy et al study employed 360 trials per S, the

Fig. 1. Response probability to each of the seven stimuli, collapsed across all 1800 trials, as a function of whether the preceding trial was or was not a CS+ trial.

Both the linear operator model of Bush & Mosteller (1951) and the Spence theory of differential conditioning (1936) have in common a prediction that in differential conditioning

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