Discriminated lever-press avoidance¹

ELVIS C. JONES AND ALBERT M. SWANSON

SACRAMENTO STATE COLLEGE

Two lever-press avoidance experiments were conducted with rats. In the first, it was found that avoidance behavior was produced when a lever press and release sequence was shaped and when intertrial responses were punished. In the second experiment, an improved technique using variable shock intensities was tested successfully. Results were interpreted using the principles of response differentiation and discriminatory cue acquisition.

Despite frequent references to avoidance conditioning as a model of behavioral control, lever-press avoidance with rats is very difficult to achieve, usually requiring thousands of trials (Meyer, Cho, & Wesemann, 1960). The rats continually freeze on the lever and although the warning signal (WS) invariably precedes the noxious stimulus (NS), Ss wait until the onset of the NS before they respond.

Feldman & Bremner (1963) found that by giving brief shocks when the Ss held the lever between trials, 70%-80% avoidance was achieved within 50-60 trials. They felt that failure to avoid was due to competition between the lever pressing response and a reflexive freezing response. They also felt that their method produced avoidance because the Ss were being punished for freezing. The present investigators, carrying the analysis further, felt that the Feldman-Bremner method works because (a) a lever press and release sequence is shaped and (b) the method produces discrimination learning. Experiment I assessed the effects of these factors.

Method

Experiment I. The Ss were 12 male, Sprague-Dawley rats, 90-120 days old, trained in a Scientific Prototype rodent box, Model A-105. The WS was a tone produced by a Bud Codemaster and the NS was a .2 ma AC shock. All Ss were shaped (without the WS) to escape shock by lever pressing in 50 trials, administered in one day at a rate of one trial per 30 sec. The Ss were then divided into three groups to receive 100 training trials on the following day. One group was trained by the traditional method (TM group), one by a method designed to enhance discrimination of the WS (SD group), and one by a method designed to enhance response differentiation (RD group). An S in the TM group could escape or avoid by pressing the lever down. An S in the SD group could escape or avoid by pressing the lever down, but S was shocked whenever he held the lever down for 3 sec. at any time between the occurrence of the last response and the start of the next trial, except that no shock was administered during the 10 sec. immediately following an escape or avoidance response. An S in the RD group had to press and then release the lever in order to escape or avoid. In all

training methods onset of the WS preceded onset of the NS by 5 sec. and the intertrial interval was 20 sec. long. Response latencies were recorded automatically and E counted intertrial responses following every fifth trial.

Experiment II. An attempt was made to improve on the SD method used in Experiment I, by punishing not only lever holding, but also the tendency of some Ss to avoid the lever itself. Two shock generators (Grason-Stadler, Model E 1064GS) provided independent, .1 ma and .2 ma shocks. One group of eight Sprague-Dawley rats was trained like the SD group in Experiment I, with the .1 ma shock serving as the NS. A similar group of eight Ss was trained with adjusted shocks. As long as an S in the latter group was avoiding, the NS remained at .1 ma. If S failed to approach the lever prior to the NS, then beginning with the next trial the NS was increased to .2 ma while the NS used to punish lever holding remained at .1 ma. Similarly, if S held the lever until the onset of the NS, beginning with the next trial the NS used as punishment for lever holding was increased to .2 ma, but the NS on regular trials was kept at .1 ma. All shocks were returned to .1 ma if S avoided.

Results and Discussion

As can be seen in Fig. 1, the SD group in Experiment I avoided more than did the RD group, and the RD group more than the TM group. Comparisons based on the last 20 trials indicated that the SD/RD difference was significant ($F=14.05$, $df=1/9$, $p<.005$), as was the SD/TM difference ($F=17.33$, $df=1/9$, $p<.005$). The

Fig. 1. Avoidance performance in Experiment I, expressed as the per cent of trials, for each group, on which Ss avoided the NS.

difference between the RD and TM groups was significant only when the comparison was based on all trials ($p < .05$).

As Fig. 2 shows, both the RD and SD groups in Experiment I made more spurious (intertrial) responses than did the TM group. Although the RD and SD groups did not differ from each other in the total number of spurious responses, trend analysis (over blocks of 20 trials) indicated that they had different trends ($F = 13.74$, $df = 4/24$, $p < .005$). A comparison on the last 20 trials indicated that the SD group made fewer spurious responses than did the RD group ($F = 31.96$, $df = 1/6$, $p < .001$). By the end of training, most of the SD group's responses occurred during the WS-NS interval although this period constituted only 20% of the NS-NS interval. Apparently the WS became a discriminatory cue for the SD group, but no similar evidence was found for the RD and TM groups.

As illustrated in Fig. 3, the Ss that received adjusted shocks in Experiment II avoided more throughout the entire 100 trials. The difference over all trials was significant at the .01 level ($F = 8.90$, $df = 1/14$).

When shocks of different severity are given in the two compartments of a shuttle box Ss often fail to avoid the weaker shock since to do so would place them in a position to receive the stronger shock. Migler (1963b) has shown that rats would accept hundreds of shocks with short durations rather than a single long shock. In the lever-press situation, shocks which begin with the S off the lever are long because the S must approach and press the lever. Similarly, if the lever is being held down when the NS begins, the S must release it and press again to terminate the NS. If Ss can discriminate between the durations of shocks which begin when they are on or off the lever, it might explain

Fig. 2. Occurrence of spurious responses in Experiment I. Each point is the mean number of intertrial responses occurring during the 5th, 10th, 15th, and 20th trials of each block.

Fig. 3. Avoidance performance in Experiment II, comparing the NS-level adjustment method with the nonadjusted procedure.

why Ss fixate at preparatory positions (Migler, 1963a).

The present investigators conclude that: (a) Response differentiation is improved by punishing failure to release the lever following an escape or avoidance response. This also equates the severity of on-lever shocks with off-lever shocks and makes it impossible for Ss to minimize shock durations merely by assuming a preparatory position. Ss begin to vacillate on and off the lever, producing many spurious responses. (b) Since Ss are restricted to a small compartment, fear is probably associated with the compartment as a whole. Thus, onset of the WS is a poor fear cue and the offset is an ineffective fear reducer. However, by punishing intertrial responses, but not those responses which occur in the presence of the WS, the WS becomes effective as a discriminatory cue. (c) Adjustment of NS level upward following failure to avoid accelerates acquisition and discourages inappropriate behaviors, including the tendency of some Ss to avoid the lever itself.

References

- Feldman, R. S., & Bremner, F. J. A method for rapid conditioning of stable avoidance bar pressing behavior. *J. exp. Anal. Behav.*, 1963, 6, 393-394.
- Meyer, D. R., Cho, C., & Wesemann, A. F. On problems of conditioning discriminated lever-press avoidance. *Psychol. Rev.*, 1960, 67, 224-228.
- Migler, B. Bar holding during escape conditioning. *J. exp. Anal. Behav.*, 1963a, 6, 65-72.
- Migler, B. Experimental self-punishment and superstitious escape behavior. *J. exp. Anal. Behav.*, 1963b, 6, 371-385.

Note

1. Portions of this research constituted a part of the first author's master's thesis at Sacramento State College. The first author is presently at Texas Christian University.