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Runway performance and reward magnitude*

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The training, extinction, and retraining performance of three groups of rats with large rewards (11 45-mg), small (45-mg) rewards, and small (45-mg) rewards with intertrial feedings (10 45-mg) was investigated in a runway. The results were in accord with the generalization that asymptotic performance is directly related to the magnitude of reward and differed from results recently reported by McCain.

There is considerable evidence (Pubols, 1960; Logan, 1960; Bitterman & Schoel, 1970) demonstrating that asymptotic performance in noncompetitive instrumental response situations is directly related to the magnitude of reward. Recently, Black (1969) and McCain (1970) have reported data contrary to this generalization. McCain has concluded that "... after about 60 consistently reinforced acquisition trials in a straight alley, the acquisition effects of different reward magnitudes are either minimal or absent [1970, p. 140]." The main purpose of the present study was to check McCain's conclusion in an investigation involving relatively long-term training and reward magnitudes comparable to those employed by McCain. Since both the Black and McCain studies used more than one trial per day, it is possible that their magnitude results were confounded by drive differences. Accordingly, a control group with intertrial rewards was included to evaluate the possible role of drive confounding.

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SUBJECTS

The Ss were 30 naive female Holtzman albino rats, about 70 days old at the start of the study. They were kept in individual cages and were randomly assigned in equal numbers to the three reward treatments described below.

APPARATUS

The apparatus was a 50-in.-long black L-shaped runway that has been described fully elsewhere (Wike & Atwood, 1970). The 13.5 x 8 x 5.5 in. goalbox contained an aluminum reward dish that was 3.85 in. in diam and 0.9 in. deep. The intertrial rewards were given in a glass furniture coaster, located in a 10 x 10 x 7.5 in. white goalbox that was placed adjacent to and 1 ft from the runway goalbox. Start and running times were taken from two Hunter Klockounters. The start time was the period from the elevation of the start door to S's breaking a light beam 1 ft from the door; running times were measured over the next 31 in. of the runway.

PROCEDURE

During the first 8 days, the Ss were reduced to 80% of their normal body weights, handled, and adapted to the runway. On Days 9 and 10 the Ss had one rewarded runway trial and two trials on Day 11. The Ss in Group 1 received one 45-mg Noyes pellet; the Ss in Group 11 got 11 pellets. The Ss in Group 1-10 got one pellet in the runway goalbox, were kept in a handling box for 30 sec, were given 10 pellets in the white intertrial box, and were then returned to the handling box. The Ss were run in squads of six, with two Ss from each treatment. Training consisted of 21 days with four trials per day rotated among six Ss. The intertrial interval was approximately 5 min throughout the study. Extinction lasted for 8 days with four rotated trials per day. Following extinction, the Ss were retrained for 8 days under the same reward conditions as in training. During training and retraining, the Ss were confined to the goalbox until the reward was consumed. In extinction the Ss were kept in the goalbox for 15 sec. If an S's running time exceeded 60 sec, it was placed in the goalbox for the usual detention period, and a running time of 60 sec was recorded.

RESULTS

Each S's daily median start and running times were transformed into reciprocals. The transformed scores were divided into blocks of 3 days in training and blocks of 2 days in extinction and retraining. The mean starting speeds for the three reward groups during the three phases of the study are shown in Fig. 1. The overall Ms for the three groups differed significantly in training ($F = 22.30$, $df = 2/27$, $p < .001$) and retraining ($F = 8.44$, $df = 2/27$, $p < .01$) but not in extinction ($F < 1$). Tukey b tests (Ryan, 1959) of the Ms in training and retraining revealed that in each phase Group 11 started significantly faster ($p < .01$) than Groups 1 and 1-10 and that the latter two groups did not differ from one another.

The mean running speeds for the three reward groups during three phases of the experiment are shown in Fig. 2. The overall Ms in training and for the last three blocks of training for the three reward groups differed significantly ($Fs = 19.62, 15.96$; $df = 2/27$, $p < .001$). During extinction the performance did not vary from chance ($F = 1.82$), but in retraining the groups again differed significantly ($F = 16.01$, $df = 2/27$, $p < .001$). By use of Tukey b tests it was found that all comparisons among the overall Ms in training and at the asymptote of training were significantly

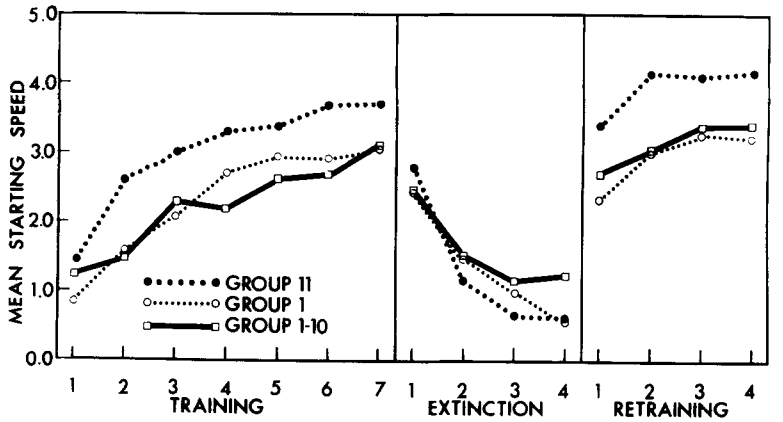

Fig. 1. Mean starting speeds for the three reward groups during training, extinction, and retraining.

different ($p < .01$); i.e., Group 11 ran reliably faster than Group 1 and Group 1 ran reliably faster than Group 1-10. Tukey tests of the retraining Ms disclosed that Group 11 was significantly faster ($p < .01$) than Groups 1 and 1-10 and that the latter groups did not differ from one another.

DISCUSSION

The acquisition running speeds in the present experiment were clearly not in accord with those reported by McCain (1970, Experiment 1). No discernible differences between McCain's large- and small-reward groups were evident in the last 36 trials of training. Our large reward group, on the other hand, ran significantly faster at the asymptote of training and during retraining. Thus, the present results are congruent with those observed in earlier magnitude studies (Armus, 1959; Reynolds & Pavlik, 1960; Pavlik & Reynolds, 1963; Zaresky, 1965; Roberts, 1969) employing relatively long-term training and confirm the generalization (Pubols, 1960; Logan, 1960; Bitterman & Schoel, 1970) that asymptotic performance in noncompetitive instrumental response situations is directly related to the magnitude of reward.

The question may be raised as to why our results differed from McCain's. While the procedures of the two studies were not identical in a number of respects, one procedural difference is worthy of note. McCain's large-reward group received a single 500-mg pellet; the present large-reward group got 11 small 45-mg pellets. Unfortunately, there is a paucity of data on the effects of a number of pellets vs a single large pellet. Wolfe & Kaplon (1941) reported that four quarters of a piece of popcorn had greater reward value for chickens than did a single whole piece of popcorn. More recently, Logan (1960, p. 35) observed that a six-pellet group (0.5 g) ran slightly faster than a one-pellet group (0.5 g) but not reliably so. When the rewards were reversed after 70 training trials, the six-pellet group did run significantly faster than did the one-pellet group. Obviously, further studies are needed to determine whether or not this procedural difference between McCain's and the present study was critical.

Finally, a comment is in order regarding the performance of the control group with intertrial rewards. The intertrial feedings produced significantly slower running speeds in comparison to a group with a large goalbox reward but equivalent drive (Group 11) and a group with higher drive but an equivalent goalbox reward (Group 1). In contrast to these running-speed results, however, the start times of Group 1-10 did not differ significantly from those of Group 1. The importance of the drive control was lessened by the fact that McCain's results could not be replicated under the conditions of the present study.

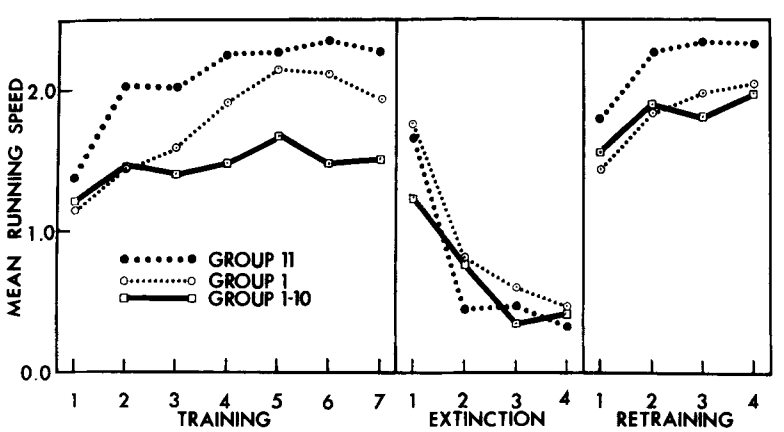

Fig. 2. Mean running speeds for the three reward groups during training, extinction, and retraining.

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