Effects of complete and incomplete reward reduction on a subsequent response¹

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Abstract

Four groups of 6 rats received 48 acquisition and 36 postshift trials in an L-shaped double alley. Groups were differentiated by the amount of reward received in the first goal box (G_1) on each acquisition trial. In the postshift phase, three groups received test trials on which reward in G_1 was reduced by varying amounts. Analyses of second alley speeds indicated facilitative effects of complete removal of reward in G_1 but not of incomplete reward reduction.

Problem

Several studies have shown that rats run faster in the second alley (A_2) of a double alley apparatus following nonreinforcement as compared with reward in the first goal box (G_1). Wagner's (1959) study, in which an experimental group received both rewarded and nonrewarded trials in G_1 and a control group never received reward in G_1 , showed that A_2 speeds of the experimental group following nonreward were greater than A_2 speeds of the control group. These data support the contention that increases in A_2 speeds result from omission of an expected reward.

Recent evidence (McHose & Ludvigson, in press) indicates that incomplete reduction in G_1 reinforcement, to some nonzero value, does not facilitate A_2 response speeds. The previous observation (Bower, 1962) that A_2 speeds increase as reduction value (training minus obtained magnitude) increases presumably reflects the effect of the absolute amount obtained, which was confounded with reduction value. In this connection, the McHose & Ludvigson data do indicate that A_2 speeds vary inversely with the absolute amount received in G_1 . The generality of the McHose & Ludvigson data are limited by the fact that only one amount of incomplete reduction from one training magnitude was employed. The present study involved several initial training magnitudes and varying amounts of reward reduction. This study also provides data on the effects of complete removal from various training magnitudes.

Method

Twenty-four hooded and albino rats received 48 acquisition and 36 postshift trials in an L-shaped double alley apparatus previously described (McHose & Ludvigson, in press). The apparatus consisted of two runways in series each comprised of a start, alley and goal section with the first goal box (G_1) serving as the start box for the second alley (A_2). Photocell-clock circuitry provided traversal time measures in A_2 .

Ten days prior to the first training day, Ss were placed on a 23-hr. food deprivation cycle maintained throughout the experiment. On the two days immediately preceding the first training day, Ss received approximately 1 gm of 45-mg Noyes pellets, identical with the subsequent reinforcement pellet, prior to their daily ration.

Four groups of six Ss each were randomly constituted and designated according to the number of pellets received in G_1 on each acquisition trial: Groups 12, 8, 4, and 0. During the postshift period each group received their training magnitude in G_1 on 75% of the trials, the remaining trials being equally distributed among a variety of "test trial" conditions. On test trials each group received, over the postshift period, each relevant multiple of a 4 pellet reduction in G_1 . Thus Group 12 received, on various postshift trials, 12, 8, 4, or 0 pellets (conditions 12-12, 12-8, 12-4, and 12-0 respectively); Group 8 received 8, 4, or 0 pellets etc. All Ss always received 2 pellets in the second goal box.

Reciprocal traversal time for an intermediate 1-ft section of A_2 was recorded on each trial.

Results

In Fig. 1 the combined mean running speeds over trials 49-60 and 73-84 for the various conditions of G_1 reward decrement are plotted relative to those for the control group trained at, and obtaining, the test value (e. g., the 12-0, 8-0, and 4-0 speeds relative to

Fig. 1. Mean A_2 running speed deviations, experimental minus control for each of the various reductions as a function of training magnitude.

those for the 0-0 group; the 12-4 and 8-4 relative to the 4-4, etc.). Thus ordinate deviations from 0 are effects of G_1 reward reduction per se on A_2 speeds. As may be seen, only complete reward reduction appeared to facilitate A_2 speeds. Variance analysis of the complete reduction trials (12-0, 8-0, 4-0, 0-0) yielded a significant groups effect, $F(3, 16) = 33.46$, $p < .01$. Using the Tukey (a) technique (Winer, 1962) ($\alpha = .01$), each experimental group differed significantly from the (0-0) control condition. Group 4-0 was also significantly faster than Groups 12-0 and 8-0. No other contrasts were significant.

Two notable results are not depicted in Fig. 1. First, within each group, A_2 speeds increased in proportion to the amount of reward reduction. Only 3 of the 36 different individual organism comparisons did not show this ordinal relationship. Variance analysis of the 12-12, 8-8, 4-4, and 0-0 data yielded a significant groups effect, $F(3, 16) = 33.41$, $p < .01$. Speeds varied inversely with the amount of reward received in G_1 , with the exception of those for Group 0-0, which were slightly below those for Group 4-4.

Discussion

The present data confirm and extend the results of McHose & Ludvigson (in press) in that no facilitative effects of incomplete reward reductions per se were observed. Moreover, both studies yield an inverse relationship between absolute amount obtained in G_1 and A_2 speeds. The latter variable accounts for the observation in these and Bower's (1962) data that A_2 speeds increase when G_1 reward is decreased. The present data serve to emphasize the need for control of obtained (absolute) magnitude in assessing the effects of the (training minus obtained) reduction variable. In

each instance complete removal of reward did facilitate A_2 performance, a finding in accord with previous data (Wagner, 1959). The only explicit theory applicable to partial as well as complete reduction in the reward, Bower's (1962) r_g perseveration hypothesis, does not adequately describe the present results, since it predicts facilitative effects of both incomplete and complete reward reductions.

According to Amsel's (1958) frustration theory, the facilitative effects of nonreinforcement should vary directly with G_1 training magnitude, since the amount of frustration-drive increment is said to vary with r_g level and r_g in turn is directly related to training magnitude in the present data. It should be noted, however, that Peckham & Amsel (1964) report faster A_2 speeds following nonreward in an 8 as compared with a 2-pellet A_1 discriminandum.

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Notes

1. Supported in part by grant MH 10340 from the United States Public Health Service.
2. Conducted during tenure as NDEA predoctoral Fellow.