Negative S- contrast with minimally contingent large reward as a function of trial initiation procedure[1]

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Three groups of 12 rats received acquisition trials in an alley to a one-pellet reward (G–) followed by extinction trials. Acquisition trials were interspersed with other, "G+," reward trials in which Ss were placed on a feeding surface holding 12 pellets (Groups S12 and C12) or one pellet (Group S1). On G+ trials, Group C12 Ss were taken directly to the feeding surface from their home cages, whereas Group S12 and S1 Ss were placed into the alley startbox and then removed to the feeding surface. Group S12, but not C12, displayed a strong depression of response speed in S– during acquisition. All three groups differed in start speeds by the end of extinction with C12 the fastest and S12 the slowest.

It is common in differential-reward conditioning to observe a "negative S– contrast effect" (e.g., Ludvigson & Gay, 1967). That is, a rat's speed of approach to a small reward (G–) in a runway (S–) is depressed when, on other trials, the S is permitted to traverse a different runway (S+) to reach a larger reward (G+). Since it seems unlikely that every experience of a large reward influences performance to a smaller reward, a question of fundamental importance concerns the relation between the experiences of G+ and G– necessary for these interactive effects. Conversely, under what conditions do rewards of different magnitude remain functionally separate and independent events?

Concerned with this general problem, Maxwell et al (1969) reported that when G+ was not contingent upon an instrumental running response, the negative contrast failed to appear in S– runway performance. On a G+ trial, these investigators removed S from a carrying cage and placed it into another cage which contained the large reward. On a G– trial, S was removed from the carrying cage, taken to the runway, and permitted to run the alley to the small reward after maintaining an orientation toward the start door for 3 sec. While contingency of reward may have been critical for the Maxwell et al data, so also may have been the trial-initiation procedure that determined the point at which discriminative stimuli signaled an imminent G– trial. It seems probable that the initial reception of discriminative stimuli occurred well before S ran the runway. Since several studies suggest that the contrast effect is strongest at the point of initial reception of the discriminative cues and weaker at points closer to the goal (e.g., Ludvigson & Gay, 1967; Peckham & Amsel, 1967), it is possible that a "contrast effect" occurred in the Maxwell et al study but then dissipated before a measurement was taken of S's response.

The present study attempted to measure performance to G– immediately after the presentation of the discriminative stimuli, while at the same time administering G+ in such a way that it was contingent upon only minimal instrumental responding and no running response. Thus the present study sought to bring additional data to bear upon the question of whether or not the response-contingency of G+ reward is related to negative contrast and to explore further the effects of trial-initiation procedures.

METHOD

Ss were 36 experimentally naive male Sprague-Dawley rats, 90 days old on Day 1 of the study. They were individually housed and maintained on a 14 g/day food schedule. The apparatus, described elsewhere (Ludvigson & Sytsma, 1967), was a single runway, 7.0 cm wide and 9.2 cm high, consisting of a 30.5-cm startbox (SB), a 1.22-m run section, and a 61.0-cm goalbox. Start, run, and goal times, expressed in meters/second, were measured by photoelectric cells located 15.2 cm, 1.37 m and 1.68 m beyond the SB. The goal time came from the middle 30.5-cm segment of the goalbox.

On each of Days 8-11, an S received 10 45-mg food pellets of the type later used as reward, and on Days 10-11, S was permitted to explore the unbaited runway for 5 min. On Days 12-32, each S received four acquisition trials per day in the repeated order, +––+, ++––, –++–, ––++, +–+–, –+–+, where "+" designates a G+ trial and "–" a G– trial. On each of Days 33-34, eight extinction trials were given in the runway with S detained in the empty goalbox for 2 to 3 sec. Except for the absence of reward, extinction trials were like G– trials.

The Ss were randomly assigned to three groups, S1, S12, and C12, which were run as squads. The order of running the groups was counterbalanced over days. The procedure was the same for all groups on G– trials. An S was removed from its home cage, located about 2 m from the runway, placed into the SB, and permitted to run in S– after it had oriented toward the exit door for 3 sec. On these trials, the reward was one pellet.

On G+ trials, the initial procedure for Groups S1 and S12 was the same as on G– trials, except that after S oriented to the SB exit door for 3 sec, the Plexiglas lid of the SB was flipped open, and S was removed and placed onto a stainless-steel feeding surface located about 1.5 m from the runway. There an S of Group S12 received 12 pellets and an S of Group S1 received 1 pellet. An S in Group C12 also received 12 pellets on the feeding surface on G+ trials, but such trials began from the home cage rather than from the SB, in that E took S directly to the feeding surface from the home cage.

To control odors (cf. Ludvigson & Sytsma, 1967), a fan exhausted the air from the goal end of the alley, and the alley was sponged with clear water after each squad.

RESULTS

Acquisition start, run, and goal speeds in S– as a function of blocks of six trials or

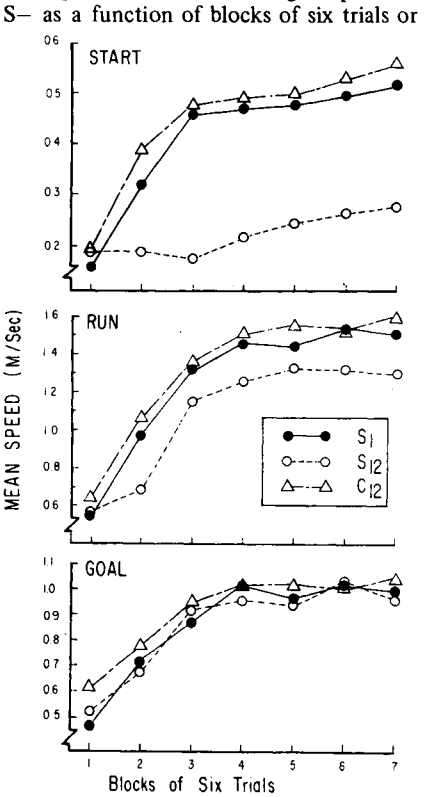

Fig. 1. Mean acquisition speed in meters per second in S– for the three groups, S1, S12, and C12, over blocks of 3 days.

3 days are presented in Fig. 1. A repeated-measures analysis of variance over Blocks 3-7 revealed significant groups effects in the start and run measures, $F(2,33) = 39.70$ and 6.28, respectively, $p < .01$. Subsequent t tests performed on the Block 7 start speeds indicated that Group S12 differed from the other two groups ($p < .001$). Significant differences were also obtained in the run measure on the last block between Groups S12 and C12 ($p < .01$).

Extinction data, in blocks of two trials, are presented in Fig. 2. Analysis of variance for each measure over all eight blocks revealed, in addition to an effect of blocks, significant groups and Groups by Blocks effects in the start speed, $F(2,33) = 22.42$, $p < .01$, and $F(14,231) = 4.55$, $p < .001$, respectively, for the latter effects. Subsequent t tests on Block 8 data supported the graphical impression that all three groups differed in start speed by the end of extinction ($p < .001$).

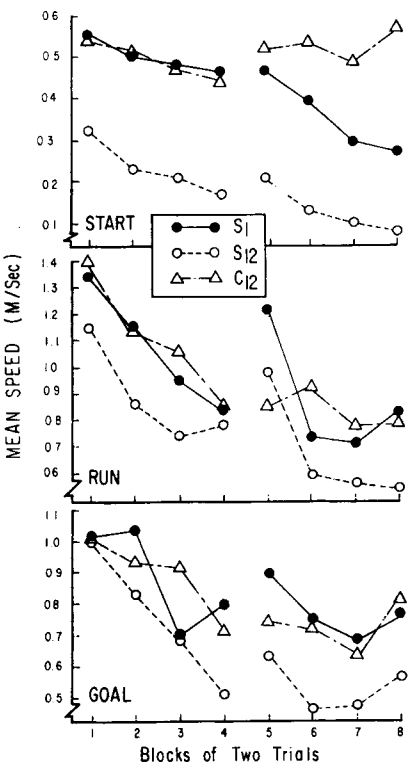

Fig. 2. Mean speed in S– for the three groups over the 2 extinction days (eight trials per day).

DISCUSSION

The fact that the performance of Group S12 was depressed below that of Group S1 is apparent evidence that negative S– contrast can occur even though no running response is required to obtain G+. For Group S1, G+ was contingent upon only minimal instrumental responding, viz, proper orientation to the SB start door and those movements necessary to transport the pellets from the goal cup to the mouth during the act of consumption.

However, it is possible that the performance of Group S12 was at least partially depressed by a competing "prepare- or wait-to-be-picked-up" reaction established by the procedure of requiring S to orient to the SB door prior to G+ as well as G– trials. However, since the contrast effect occurred in running speeds as well as in starting speeds, such an interpretation would have to assume that the competing preparatory response continued to interfere with performance even after S began to run. In fact, the pattern of results in the three speed measures for Group S12 is a strong argument for an interpretation in terms of a genuine contrast effect, since it resembles quite closely that frequently found in differential-reward conditioning (e.g., Ludvigson & Gay, 1967; Peckham & Amsel, 1967). That is, the depression effect is strongest at the point of initial presentation of the discriminative stimuli and substantially weaker at points closer to the goal.

The acquisition data for Group C1 replicate the Maxwell et al (1969) study in suggesting that there is no apparent influence of G+ upon performance to S– when S, on any given trial, is taken either directly to the alley for a G– trial or to another locus for its noncontingent G+ reward. One interpretation of this apparent absence of a contrast effect is simply that G+ and G– are functionally independent under these conditions. A second interpretation utilizes the inference from previous work, mentioned above, that the contrast effect depends upon proximity to the point of initial reception of discriminative stimuli. Assuming that S's initial reception of discriminative stimuli occurred soon after it was removed from its waiting cage and well before its response to these stimuli was measured, a "negative contrast effect" actually occurred en route to the alley, but then dissipated by the time S ran the alley. This latter interpretation has the advantage of explaining the acquisition data of both Groups C12 and S12.

In summary, this study, in conjunction with previous work, suggests that contingency of G+ is of little or no consequence for a negative S– contrast effect, and it points to the importance of the transition from nondiscriminative to discriminative stimuli and the time separating this transition from the measured performance.

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NOTES

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