Nonreward incentive and runway performance*

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Latencies and running times in a runway were measured for inaccessible food incentives of 0, 1, 5, and 25 peanuts. It was predicted that performance would increase linearly as amount of incentive increased. Results were opposite to the prediction, with the 25-peanut group showing the longest latency and running times ($p < .05$). A frustration interpretation was proposed.

Magnitude of primary reward and magnitude of performance asymptote tend to be positively related in general (Kintsch, 1962; Kraeling, 1961). In addition, in a T-maze situation, rats show a preference for the side associated with the visual and olfactory secondary reinforcement characteristics of inaccessible food (Schlosberg & Pratt, 1956), suggesting that both primary and secondary reinforcements function in essentially the same way. However, whether or not animals will perform at systematically different levels for systematically different amounts of secondary reinforcement has been only partially investigated.

Two of the ways in which the magnitude of a secondary reinforcing stimulus might vary are (1) in terms of the quantity of originally associated primary reinforcement, and (2) in terms of the similarity of the current situation to the primary reinforcing situation in which the secondary reinforcement value of a stimulus along a black-white intensity continuum varies as a function of the similarity of this stimulus to the original conditions under which the secondary reinforcer was established. In terms of variations in the quantity of associated primary reinforcement, Dyal (1960) has presented evidence indicating that rats will perform differently with different amounts of primary incentive present, but with actual ingestion the same for both large and small perceived amounts of incentive. This suggests that stimuli proximal to the primary reinforcing substance might vary in strength, according to the perceived size of the primary reinforcement, independently of the actual primary reinforcing value in a way similar to that demonstrated by Bergum. Thus, this experiment was performed to determine the form of this potential relationship between performance level and perceived incentive size. It was hypothesized that systematic variations in the amount of inaccessible incentive would result in reciprocal systematic variations in response latency and running speed in rats.

METHOD

Subjects

The Ss were naive male albino rats of the Sprague-Dawley

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strain, 90 days old at the start of the experiment. The 40 Ss were individually housed.

Apparatus

The apparatus was a straight alley, 270 cm long, 12 cm high, and 14 cm wide. A 25-cm-long startbox and 38-cm² goalbox were separated from the runway by guillotine doors. The startbox and alley were covered by hinged, sanded Plexiglas covers. The goalbox was covered with clear Plexiglas and contained a centrally located hemispherical, dome-shaped fine wire mesh, 6.4 cm in diam and 3.2 cm in height. Dry nonsalted, Spanish peanuts were the incentive substance under the screen.

Latencies were measured 30.5 cm from the startbox door, and running time was measured 213.0 cm from the startbox door.

Procedure

On Days 1-10, Ss were placed on a 23-h deprivation schedule, were familiarized with the peanut incentives, and were allowed to explore the apparatus in groups of five for 15 min on Days 7 and 8 and individually for 5 min on Days 9 and 10.

Beginning on Day 11, each S was given one test trial per day for a period of 24 days. Ss were assigned to one of four groups of 10 Ss each on the basis of body weight, the groups receiving incentives of 0, 1, 5, or 25 inaccessible peanuts in the goalbox. S was placed in the startbox and, 15 sec later, the guillotine door was raised. After entry, S was confined to the goalbox for a period of 30 sec before being returned to the carrying cage. If S did not enter the goalbox within 1 min of the time the startbox was opened, he was forced to enter the goalbox, and a 1-min running time and 20-sec latency were recorded for the trial. Magnitude of incentive was randomly assigned to the four respective groups before training began, and order of testing was randomized for all Ss on each day. After each trial, S was returned to his home cage and fed his daily ration.

Fresh peanuts were used each day at the start of testing, and fresh peanuts were placed under the dome whenever an S was observed or suspected of urinating on the incentive.

RESULTS AND DISCUSSION

Mean latencies and running times for blocks of three trials and for all groups are presented in Tables 1 and 2, respectively. In general, all groups showed decreases in latencies and running times. Contrary to the hypothesized relationships, however, the 25-peanut group (25P) displayed the longest latencies and longest running times.

In the case of latencies, an analysis of variance indicated that the improved latencies across trials was reliable, $F(7,252) = 58.15$, $p < .05$, and that the apparent difference among groups was also reliable, $F(3,36) = 4.85$, $p < .05$. There was no significant interaction effect. Application of the Tukey HSD statistic (Winer, 1962) to the treatments main effect indicated that the reliable F resulted entirely from the longer latencies associated with the 25P group. For significance at the .05 level, HSD (4,36) must equal 3.63 or more, and the smallest observed value in the comparison of the 25P group with all others was 3.97. No other between-group comparisons were reliably different.

Similar analyses were performed on the running time

Table 1
Mean Latencies (Seconds) for All Groups in Blocks of Three Trials

Incentive	Trials							
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24
0	14.4	9.9	10.0	6.8	3.8	2.1	2.0	2.1
1	16.0	10.4	8.9	6.3	5.9	2.0	1.9	2.9
5	18.1	12.1	9.0	2.9	3.9	2.0	2.1	2.0
25	17.0	14.9	15.7	11.9	9.6	6.0	6.2	4.2
	16.4	11.8	10.9	6.7	5.8	3.0	3.1	2.8

Table 2
Mean Running Times (Seconds) for All Groups in Blocks of Three Trials

Incentive	Trials							
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24
0	14.8	9.3	16.1	11.0	7.5	3.9	3.6	8.7
1	10.5	10.4	11.8	7.1	7.0	4.7	6.0	7.6
5	29.0	15.4	14.9	6.3	6.7	3.5	3.6	4.5
25	23.4	20.0	23.6	19.1	14.2	10.3	11.5	10.1
	19.4	13.8	16.6	10.9	8.9	5.6	6.2	7.7

data. As was the case with latencies, the observed decrease in running times across trials was reliable, $F(7,252) = 45.58$, $p < .05$, as was the main groups effect, $F(3,36) = 4.21$, $p < .05$. Again, employing the Tukey HSD statistic, two of the comparisons between groups were reliable. With a required HSD (3,36) value of 7.09 for the .05 level of significance, the comparisons between 25P and OP (HSD = 7.43) and 1P (HSD = 8.47) indicated reliable differences between these groups.

It is apparent that learning occurred in all groups, including the control group (OP), on both response measures. It is equally apparent that the only group to deviate significantly from the others was the 25P group, which deviated in a direction opposite to that predicted initially. Thus, the lesser magnitudes of inaccessible incentive displayed no effect on performance, and the largest magnitude actually interfered with runway performance. Apparently, whatever positive reinforcement occurred in this situation, it was not related to the secondary reinforcing characteristics of the inaccessible incentive, but was more probably due to the delayed reinforcement received in the home cage at the end of the daily test trial.

Two interpretations of these results appear to be potentially viable. One possibility is that experimental extinction of the secondary reinforcing effects of the inaccessible incentive occurred during the test trials and that the perceptibly larger amount of secondary reinforcing value of the 25P incentive facilitated this extinction process. The result was thus that secondary reinforcement contributed *less* for this group to its runway learning performance. However, failure of the 5P and 1P groups to order themselves between the 25P and OP groups tends not to support this hypothesis.

A possible more satisfactory interpretation might be made in terms of the effects of frustration on runway performance. Amsel (1958) has suggested that

encountering a readily perceptible inaccessible incentive produces an aversive motivational state of primary frustration in a hungry rat and that stimuli associated with the inability to consume the incentive substance elicit fractional responses (r_F) anticipatory to frustration. Thus, the instrumental responses (runway performance in this case) normally elicited by a food incentive are extinguished by the presence in the startbox and runway of competing classically conditioned anticipatory responses elicited originally by the frustrating stimuli.

This second view is preferable to the extinction-of-secondary-reinforcement explanation, in that it proposes an active process to account for the observed effects rather than simply a reduction in secondary reinforcement, since the latter does not appear to explain the superior performance of the OP group over that of the 25P group.

In general, the results suggest the need for more specific and analytic predictions regarding the potential effects of secondary reinforcement on performance.

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