Magnitude of negative contrast effect in relation to drive level[1]

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Two levels of drive were combined factorially with two amounts of reward in a runway experiment involving four groups of 12 rats each. After 18 acquisition trials all groups were shifted to the lower reward for 22 additional trials, with drive maintained at the preshift level. A negative contrast effect was obtained only in the goal section at the higher level of drive. A replication of the two reward conditions at the higher level of drive confirmed the finding. The results are consonant with Spence's emotional-motivational theory of contrast effects.

The performance of a group subjected to a decrement in amount of reward typically drops below the level set by a nonshifted low-reward control group. The undershoot is known as *negative contrast effect.*

The phenomenon has been studied as a function of schedule of reinforcement (Mikulka, Lehr, & Pavlik, 1967), magnitude and abruptness of reward shifts (Di Lollo & Beez, 1966; Gonzales, Gleitman, & Bitterman, 1962) and several other variables (Dunham, 1968). Its relationship to level of drive, however, has not been adequately investigated. Besides having empirical relevance, a study of negative contrast effects in relation to drive level has definite theoretical implications, particularly for the emotional-motivational account best exemplified by Spence (1956). Basic to this account is the construct K (incentive motivation), which represents the strength of the fractional anticipatory goal response (r_g) which is in turn determined by variables contributing to the vigor of the consummatory response such as amount of reward and level of drive (Spence, 1956, pp. 134, 197; Black, 1965).

A decrement in reward in the presence of r_g is held to evoke a primary frustration response (R_F) which, in its anticipatory form, r_F, interferes with the ongoing instrumental approach response and determines the observed negative contrast effect. Since the strength of r_F is held to be a function of the vigor of r_g, it may be expected that, following a given decrement in amount of reward, the magnitude of the negative contrast effect should be greater under conditions which enhance the vigor of r_g, notably a high as opposed to a low level of drive.

The effects of a shift in amount of reward at two levels of drive has been investigated by Ehrenfreund & Badia (1964), but the absence of nonshifted control groups precluded definite conclusions regarding contrast effects. In the present study it was expected that the magnitude of the negative contrast effect, as determined by comparison with nonshifted controls, would be greater following a reward shift at a high level than at a low level of drive.

SUBJECTS

The Ss were 48 male albino rats, 90 to 100 days old, obtained from the colony maintained at the Preclinical Animal House, University of Western Australia. They were housed four to a cage, each cage containing two Ss from each reward condition. High- and low-drive groups were housed separately.

APPARATUS

The apparatus was housed in a dimly lit soundproof room and consisted of a straight wooden runway 4 in. wide, 4 in. high, with an 11-in. start box, 25-in. alley, and 12-in. goal box. The three sections were separated by clear plastic sliding doors. A clear plastic lid covered all sections. The walls and floor were painted matt black. Performance times were measured by three Relion 0.01-sec timers. Starting time was measured from the opening of the start door to the interruption of a photo-beam 6 in into the alley. Running time was measured from the interruption of the first beam to a second beam 18 in. further on, and goal time from the second beam to a third beam 12 in. away. The third beam was 1 in. in front of the food cup which consisted of a square metal dish 0.5 in. wide and 0.25 in. deep attached to a metal stand 1.25 in. off the floor so that the approaching Ss could not see the food before the last photo-beam was broken.

PROCEDURE

Two levels of amount of reward (1 or 10 40-mg food pellets) were combined factorially with two levels of drive (22-h or 6-h food deprivation). The 48 Ss were randomly allocated to four groups of 12 Ss each. Letting lower-case letters indicate low and capital letters high values of drive and reward, the four groups were: dr, Dr, dR, and DR. Ten days before the beginning of acquisition the Ss were placed on a feeding schedule and were handled in a communal tray for 30 min each day. Food was available 15 min after the Ss returned to their home cages where water was always available. Food was removed after 30 min for Groups Dr and DR, and after 2 h for Groups dr and dR. This feeding schedule was maintained for the duration of the study. During acquisition each S received four trials each day with an intertrial interval of approximately 25 min. The Ss were removed from the goal box as soon as the reward had been consumed and were returned to individual holding boxes in which water was always available. Beginning from the second trial of

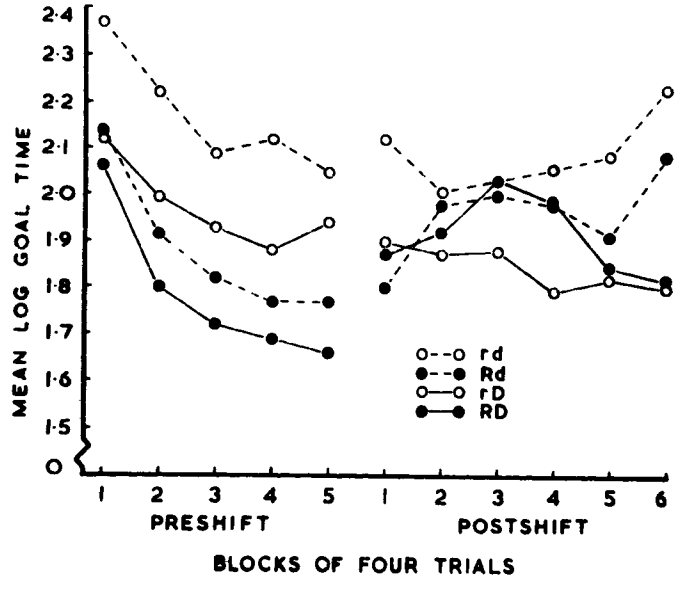

Fig. 1. Mean log goal time (in .01-sec units) for each group during preshift and postshift.

Table 1
F Ratios for Start, Run, and Goal Sections During Acquisition

Source	df	Start	Run	Goal
Drive Level (D)	1	5.08*	7.24**	10.24**
Reward (R)	1	30.27***	15.74***	21.36***
D by R	1	0.98	0.54	1.69
Error (MS)	44	(0.39)	(0.26)	0.11)

* $p < .05$
** $p < .01$
*** $p < .001$

the fifth day of acquisition, and for five additional days (shift stage), the reward was reduced to one pellet for all Ss. All other conditions remained the same.

RESULTS AND DISCUSSION

The running time (in .01 sec) of each S on each trial was transformed logarithmically for each section of the runway and then averaged for each group over the four trials of each day of acquisition and shift. These scores are shown in Fig. 1 for the goal section. Since the reward shift occurred on the second trial of the last day of acquisition, the last points of the acquisition section and the first points of the shift section in Fig. 1 are the averages of two trials each.

An analysis of variance was performed on the total scores for each group during acquisition. The notable absence of interaction effects in the analysis summarized in Table 1 is in agreement with the results reported by Reynolds & Pavlik (1960) and by Weiss (1960) and is consonant with Spence's (1956) proposed additive relationship between D (drive level) and K. The results are not in agreement with those of Ehrenfreund & Badia (1962) who proposed two alternatives to account for the discrepancy between their study and earlier studies; an interaction effect may be obtained in scores derived from the middle portion of the alley (Ehrenfreund and Badia's method) but not in scores including start and goal box performance (as in the earlier studies), or it may be obtained when drive level is controlled in terms of body weight as contrasted with time of deprivation as was done in the earlier studies. The first alternative is contradicted by the present results (Table 1) which show no interaction effects in any section of the runway. In the present study drive level was controlled both by deprivation time and time of food availability; no conclusions can thus be stated with respect to the second alternative. It must be noted, however, that no significant interaction was found by Yarczower, Freygold, & Blum (1962) with drive manipulated by body weight. Since Ehrenfreund and Badia's results were based on only five Ss per group, a replication should be obtained before an attempt is made at settling the issue.

Following a decrement in the amount of reward both shifted groups showed a corresponding decrement in performance in the three sections of the runway. In the start and run sections Group DR reached the level of the controls (Dr) but showed no evidence of contrast effect; the performance of Group dR showed a marked decrement but settled at a level slightly faster than that of the controls (dr). In the goal section (Fig. 1) a negative contrast effect was obtained only under conditions of high drive where Group DR undershot its controls on Days 2, 3, and 4. The largest degree of separation between the two high-drive groups occurred on Days 3 and 4 when the difference in performance reached a reliable level as shown by the significant Drive by Training Reward interaction effect [$F(1/44) = 4.73$, $p > .05$]. No other effects were significant.

A negative contrast effect was thus obtained only in the goal section and under conditions of high drive. The effect vanished by the end of the experiment. In view of the transient and localized nature of the phenomenon, Conditions DR and Dr were replicated using nine Ss in each group. Procedures were the same as those described in the foregoing. The results of the replication were entirely in agreement with the original study; negative contrast was obtained only in the goal section [$F(1/16) = 25.49$, $p > .001$], the greatest separation between the two groups was obtained after the third day of shift, and the effect vanished by the end of the experiment.

This pattern of results is clearly in agreement with predictions from emotional-motivational theory. Negative contrast effects are obtained under conditions of high drive which is held to enhance the vigor of r_g and hence r_F. Furthermore, the effects occur in the goal section, just where the theory predicts that the vigor of r_g and r_F would be greatest. The transitory nature of the phenomenon is also in accordance with the theory.

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NOTE

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