

# Contrast effects with a shift in work load

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Both positive and negative contrast effects resulted from switching lever counterweights from heavy to light and light to heavy in a standard bar-pressing situation. Ss under the above two conditions were compared to control groups which continued with either heavy or light counterweights throughout the study. Differences between postshift performance and the controls were significant ( $p < .01$ ), but they did not persist in extinction. The results were interpreted as supporting a relative position concerning perception.

Contrast effects, or shifts in performance compared to a control, have typically been related to shifts in reward magnitude. Thus, positive contrast effects (PCE) would be inferred from a rise in performance by a group shifted from lesser magnitude to greater, as compared with a control which has consistently been reinforced with the greater magnitude throughout training. The converse situation would imply negative contrast effects (NCE).

Evidence for PCE is equivocal although it has been obtained under a number of experimental conditions (e.g., Collier & Marx, 1959; Ehrenfreund & Badia, 1962; DiLollo, 1964). Other investigators (Spence, 1956; Bower, 1961) report only NCE. Spence argued that PCE, as obtained by Crespi (1942) and Zeaman (1949) was an experimental artifact, in reality improvement with additional practice. Black (1968) also argued against the reality of the phenomenon while presenting an absolute position concerning reward.

A different explanation for the uncertainty of PCE, when compared to NCE, is that response limits may provide the distinction. When S is responding at an asymptotic level on a simple task, his response rate or magnitude has less room to rise than to fall.

The present study attempted to provide such room. It predicted that when restraints placed on a particular response are lessened, PCE would occur; similarly, with an increase in restraint, NCE would occur. The position taken was a relative one that proprioceptive feedback would, at any time, be related to a proprioceptive norm afforded by past training. Specifically, the study predicted that switching counterweights on a Skinner box lever from heavy to light and from light to heavy would lead to PCE and NCE, as compared to control Ss which responded to heavy or light counterweights throughout.

## METHOD

Thirty-three male Holtzman rats, about 100 days old at the start of the study, were run under 100% reinforcement in six Skinner boxes (Gerbrands, Model B). The boxes were isolated in separate rooms, with masking noise present at 70 dB, pressure level. Reinforcement was a 45-mg food pellet.

A 22-h deprivation schedule was started concurrently with habituation to the apparatus, continuing for five days, at the end of which all Ss had learned to bar press for food. At the

Table 1  
Bar Counterweights during Acquisition and Extinction

Group	Phase	Phase	Extinction
	Acquisition 1	Acquisition 2	
H-L (N = 10)	33 g	16 g	16 g
H-control (N = 6)	46 g	46 g	46 g
L-H (N = 11)	16 g	33 g	33 g (N = 6) 16 g (N = 5)
L-control (N = 6)	16 g	16 g	16 g

Table 2  
Pre-Shift, Initial (I), and Terminal (T) Post-Shift Performance (mean number of bar presses over three days) for H-L, L-H, and Control Groups

Group	Pre-Shift (8.9.10)	I. Post-Shift (11.12.13)	T. Post-Shift (18.19.20)
PCE			
H-L	284	340	312
L-control	281	272	256
NCE			
L-H	321	308	273
H-control	320	371	343

end of Day 5, Ss were randomly assigned to six groups for further testing. Each test session lasted 1 h, and Ss received wet mash for an additional hour in their home cages.

All groups received 100% reinforcement, the only condition distinguishing them being differences in the bar counterweights, hence, the amount of effort needed to activate the feeder switch. Treatments for the four main groups are shown in Table 1.

It may be seen that the two experimental groups stand in reverse relationship, except for the extinction condition. The duration of the phases was as follows: Acquisition(1), 10 days; Acquisition(2), 10 days; Extinction, six days. For the two control groups, there was no treatment difference between the first two phases.

## RESULTS

Individual performance was variable over trials; accordingly, asymptotic performance was difficult to determine. In most instances some stabilization appeared to have taken place prior to the last three days of acquisition, and the mean for these days constituted a base line measure against which performance shifts were evaluated. With reference to the question of the persistence of CE, initial [first three days of Acquisition(2)] and terminal [last three days of Acquisition(2)] postshift performance were separately evaluated. The mean performance for each of these comparisons is shown in Table 2. These figures, then, constitute the values used in the subsequent data analysis for the determination of PCE and NCE and their persistence.

### POSITIVE CONTRAST

Preshift base line and shift performance for H-L and L-control are shown in Fig. 1. Inspection of shift performance

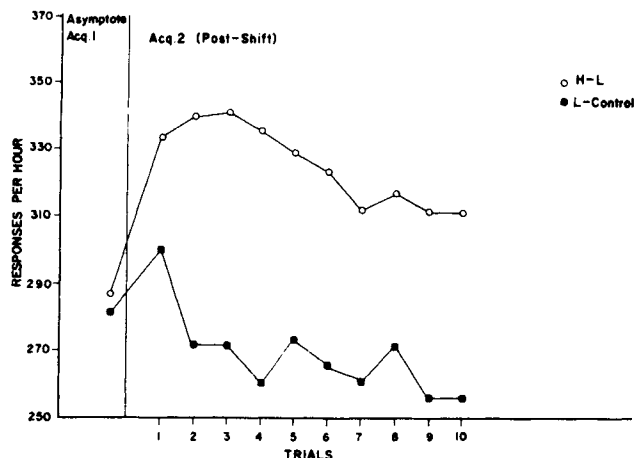


Fig. 1. Performance changes for H-L during postshift period and L-control (curve smoothed by successive averages).

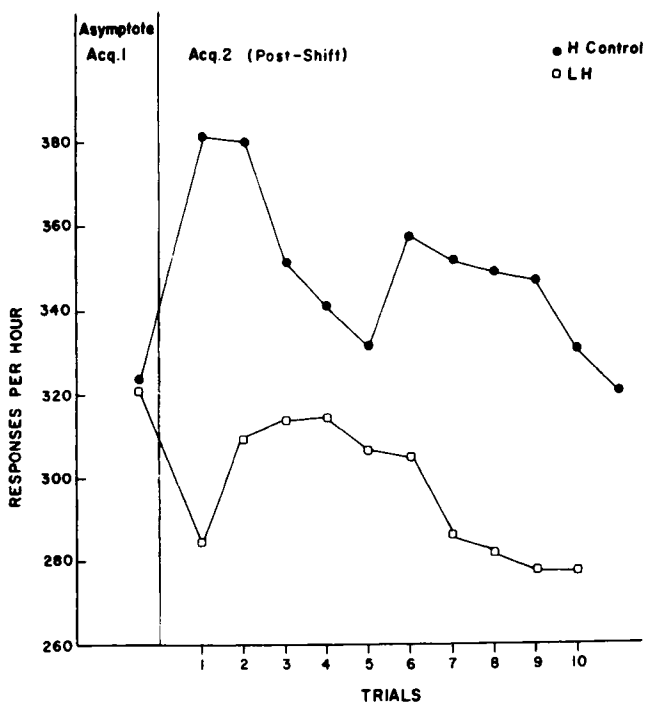


Fig. 2. Performance changes for L-H during postshift period and H-control (curve smoothed by successive averages).

suggests the possibility that PCE was obtained but might be transient. Mean comparisons (see Table 2) indicate comparable performance for both groups prior to the shift. Following the shift, mean performance of the experimental group shows a rise in responses while the L-control group shows a slight decrease in responses. Analysis of variance showed significant interaction effect ( $F = 10.48$ ,  $df$  1 and 14;  $p < .01$ ). Subsequent analysis of simple main effects supported the observation of PCE. The significant differences ( $F = 10.51$ ,  $df$  1 and 28;  $p < .01$ ) were shown to be related to the postshift means. Consequently, the raised performance of the H-L group may be attributed to the shift to the lighter counterweight and is significantly above the performance of Ss maintained under light conditions.

A similar comparison between Acquisition(1) and terminal postshift means indicates that the elevated performance level, PCE, was maintained throughout the postshift period. Analysis of simple main effects shows that the terminal postshift means were significantly different from the preshift means ( $F = 6.20$ ,  $df$  1 and 28;  $p < .05$ ). Evidently, PCE was maintained relative to lowered performance for L-control.

#### NEGATIVE CONTRAST

Figure 2 shows base line and shift performance for L-H and H-control. The L-H curve apparently indicates that NCE, if demonstrated statistically, is not to be inferred as an absolute shift from base line performance. Inspection of means (see Table 2) concurs with this view, showing a slight drop in performance for L-H and raised performance for H-control during Acquisition(2). The statistical comparisons made were identical to those for PCE. Analysis of simple main effects

showed that the postshift means were significantly different ( $F = 9.72$ ,  $df$  1 and 30;  $p < .01$ ), while there was no significant difference prior to the shift. Thus, NCE are indicated, at least initially, after the counterweight shift. The shift to a heavier counterweight resulted in significantly lower response ratios than those of Ss maintained at a heavier counterweight.

The apparent accentuation of NCE over the postshift period was confirmed by a comparison between initial and terminal differences between H-control and L-H ( $F = 10.43$ ;  $df$  1 and 30;  $p < .01$ ).

#### EXTINCTION

Comparisons between H-L vs L-control, L-H vs H-control, and L-H vs L-control did not yield significant differences, although there was a suggestion of greater resistance to extinction for the shift groups.

#### DISCUSSION

The results support the prediction of PCE under circumstances which permit it to be evidenced. Since reinforcement was not varied, the study does not directly relate to controversies about the action of reward. It does, however, if one grants the assumption that Ss were reacting to proprioceptive stimuli, support a general relativist position such as that advanced by Bevan & Adamson (1960) and Helson (1964).

In addition, the appearance of PCE following S's history of a heavy work load raises serious questions about the Hullian concept of response-induced inhibition. The results were, however, consistent with Logan's (1960) view that the effort variable represents the amount of work anticipated. More generally, the results demonstrated CE under conditions in which it was not linked to shifts in reward. It is possible that the phenomenon may ultimately return to the perceptual context it started from.

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#### NOTE

1. The data reported herein were contained in an M.A. thesis by Diana Gunn and directed by Robert Adamson. The study was supported by the Air Force Office of Scientific Research, Grant No. 1163-66.