Comparison of time-out and extinction as determinants of behavioral contrast: An analysis of sequential effects*

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A within-S design was used to compare the amount of contrast resulting from time-out and extinction. Five pigeons were trained to keypeck for 10 sessions on a mult VI 1-min VI 1-min schedule with alternating red and green keylights. Beginning with the 11th session, half the green key presentations in each session were preceded by extinction on the red key and half by time-out. Approximately equal amounts of behavioral contrast appeared during the green following the two conditions. However, responding was greater during the first 30 sec of the S+ presentation when the preceding stimulus was extinction than when it was time-out.

Two theories have been developed to explain behavioral contrast. The first, developed by Reynolds (1961), assumes that the rate of responding in the presence of a given stimulus is a function of the frequency of reinforcement in the presence of that stimulus relative to the frequency of reinforcement in the presence of the other stimuli controlling that organism's behavior. Hence, contrast is a result of an increase in the relative frequency of reinforcement in the presence of the stimulus during which the contrast occurs. Reynolds (1961, p. 60) introduced the term "behavioral contrast," which he defined as "an increase in the rate of responding in one component of a multiple schedule when certain changes occur in the other component."

The second theory, developed by Terrace (1963, 1966, 1968), states that response suppression has an excitatory as well as an inhibitory property. According to this theory, the increase in response rate in the reinforced component occurs whenever the response rate in the alternate component is reduced from a baseline level, irrespective of relative reinforcement. However, as Dunham (1968) pointed out in a review of the literature, this analysis fails to account for the occurrence of behavioral contrast when the reinforced component was alternated with time-out, a condition during which few, if any, responses will occur.

The purpose of the present study was to compare time-out and extinction as determinants of behavioral contrast. Time-out was chosen because it provides a situation analogous to physical restraint for the bird, permitting no unreinforced responding, and provides a degree of relative reinforcement equivalent to extinction. Two possible sets of results were expected based on the theoretical explanations discussed above. (1) If behavioral contrast were a function of relative reinforcement, then both conditions would produce an equivalent increase in the rate of responding in the presence of the stimulus correlated with reinforcement. (2) If behavioral contrast were a result of unreinforced responding in the presence of the stimulus correlated with extinction, then contrast would occur in multiple schedule components preceded by extinction but not in components preceded by time-out, since responses during a time-out are quite rare.

Nevin & Shettleworth (1966) reported that the rate of responding in the presence of the reinforced component of the schedule was highest during the period immediately following the offset of extinction. They differentiated the change in response rate within the schedule component from the overall change in response rate across schedule components. They called the change in gross response rates averaged over successive components of the session "sustained contrast" and the change in response rate within the schedule component "transient contrast." Terrace (1966) and Scull, Davies, & Amsel (1970) also found sequential effects in multiple schedules. They suggested that there might be two forms of behavioral contrast, a sequential effect of the immediately preceding stimulus (frustration effect) and an independent overall contrast effect. This study was designed primarily to examine the sequential effects, by analysis of transient contrast.

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SUBJECTS

Five, locally obtained, female White Carneaux pigeons, 4-10 years of age, were maintained at 80% ± 15 g of their free-feeding weights for the duration of the experiment. The birds were experimentally naive at the beginning of the study.

Apparatus

All Ss were run in the same standard Lehigh Valley Model 1519 test chamber equipped with three Model 1348 pecking keys. Only the center key was employed in this experiment. The chamber was equipped with a blower which was used for ventilation and the masking of extraneous sounds. Standard electromechanical equipment located in an adjacent room was used to program the experiment and to record the data.

Procedure

After shaping the response of pecking the key, each bird was trained to respond on a mult VI 1-min VI 1-min schedule. S+ was a green keylight and S— a red keylight. Reinforcement in both S+ and S— consisted of 3.5 sec access to the raised magazine. The S+ component was of 3 min duration and the S— component of 1 min duration. Three minutes was selected for the S+ component because it permitted an analysis of transient contrast. The 1-min length of the S— component permitted a shorter session length. Each training session, consisting of 17 S+ presentations and 16 S— presentations, always began with S+ to allow for stabilization of responding, after which they were presented alternately. Data from the first S+ component of the session was never used in the analysis of the results of the experiment.

During the 11th-20th sessions, each bird was presented with extinction during S— and time-out, with each S+ component being preceded by one of these conditions. The conditions were presented in an ABBA fashion, i.e., four S+ components preceded by S—, eight S+ components preceded by time-out, four S+ components preceded by S—. This procedure was intended to compensate for possible changes in response rate over the session due to satiation or other causes.

In addition, one session was selected at random between the 13th and the 19th sessions for each bird. During this session, latency to the first peck after the reappearance of S+ was recorded with a stopwatch, following both S— and time-out. This was done in order to evaluate the possible effects of differential latencies to first peck after

the offset of time-out as compared to extinction.

RESULTS

Figure 1 shows the mean rate of responding during both S+ and S—, for each discrimination session. The baseline consists of an average of the last 5 days of training prior to the introduction of discrimination training. The increase in the rate of responding during S+, behavioral contrast, which accompanied the introduction of discrimination training was not large, but was clearly evident in four of the five birds tested. Bird No. 174 showed a decrease in response rate, induction. Responses during the time-out were quite rare, as expected. Figure 1 shows that the average rate of responding across the entire S+ component, sustained contrast, was not influenced by the preceding stimulus.

Figure 2 shows an analysis of transient contrast during discrimination training. Since the results of any given session were fairly typical of all other sessions, the rate of responding within each 30-sec segment of the S+ component was averaged across all 10 sessions of discrimination training. Since the latency to first peck during S+ was found to be reliably longer following time-out than following extinction, the data shown in Fig. 2 were corrected to allow for this variable. The higher response rate during the first 30 sec of the S+ component following the termination of S—, as compared to that following the termination of time-out, reflects a fairly consistent finding for all birds and all sessions. For all Ss, the rates during the second through the sixth

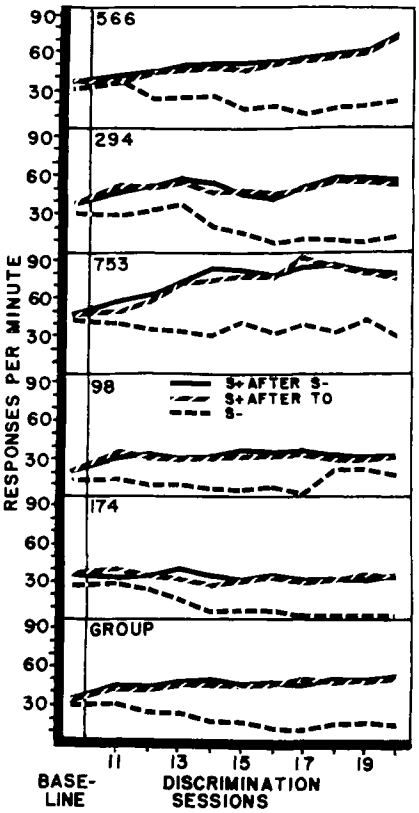

Fig. 1. Mean rates of responding for each S during discrimination training.

segments of the S+ component were not differentially affected by the experimental conditions.

DISCUSSION

The equivalence of the amount of sustained contrast induced by time-out and extinction provided some support for the relative reinforcement hypothesis (Reynolds, 1961). However, the presence of extinction in the session may have affected responding in all of the S+ components; hence, the support is not conclusive.

The analysis of transient contrast supports the interpretation of Terrace (1966) that contrast results from unreinforced responding in S—, since the rate of response during the first 30 sec of S+ following extinction was reliably higher than during the first 30 sec following time-out.

That there are two forms of behavioral contrast, as suggested by Nevin & Shettleworth (1966) and Terrace (1966), is further indicated by these results. The amount of contrast during the first 30 sec of S+ was a direct result of the preceding stimulus, a result parallel to that obtained by Scull, Davies, & Amsel (1970). They suggested that behavioral contrast and the frustration effect may make up different components of the increase in response rate. In the present study, the response rate during the first 30 sec of S+ following extinction could have been a result of frustration induced by unreinforced responding in S—. The physical restraint from responding induced by time-out appears to have had a sequential effect different from extinction in the birds tested. In any case, the sustained contrast appeared to be quite independent of the immediately preceding stimulus, although its cause cannot be ascertained from this design. These results and those of Scull et al (1970) point out the importance of an analysis of sequential contributions to contrast, the absence of which makes studies involving behavioral contrast somewhat difficult to interpret.

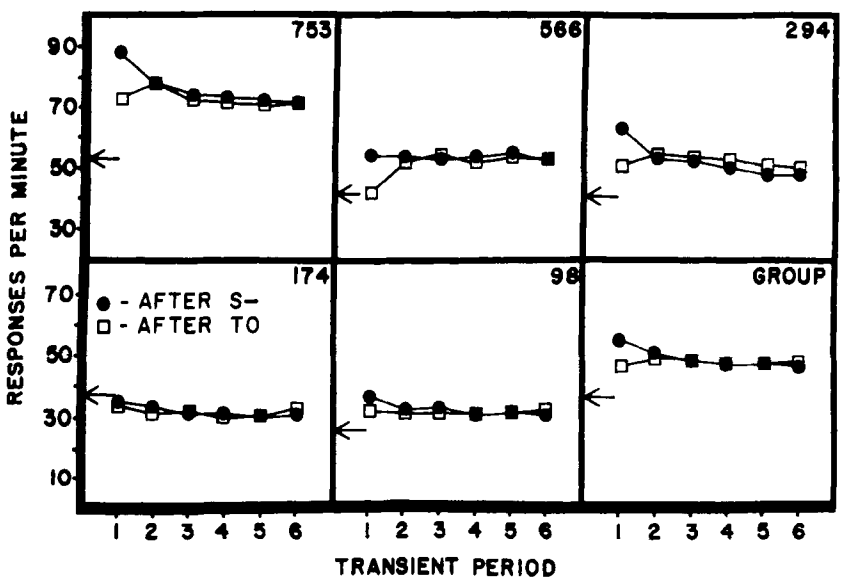

Fig. 2. Mean transients across all test sessions for each S during discrimination training.

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