

The effect of increasing the response rate in S_1 and S_2 on stimulus generalization and the peak shift*

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In the present study it was found that differentially increasing the response rate in both S_1 and S_2 by changing from Mult VI 5- VI 5-min reinforcement schedule to Mult VI 1- VI 3-min schedule produced a peak shift in five of six pigeons. The results suggest that a change in reinforcement density independent of a response rate reduction in S_2 is a sufficient condition to produce the peak shift.

Terrace (1968) reported three separate but related experiments, the results of which suggest that response rate reduction in the S_2 (the changed component of the multiple schedule) is a necessary and sufficient condition for the production of behavioral contrast and the peak shift. Behavioral contrast is defined as an increase in the response rate in S_1 (the unchanged component of a multiple schedule) as a function of a reduction in the response rate in S_2 , while the peak shift is a change in the modal response category of a postdiscrimination generalization gradient away from S_1 in a direction further removed from S_2 . The three methods Terrace (1968) used to reduce the response rate in S_2 were: (1) shifting the reinforcement schedule from a variable interval (VI) 1 min to a VI 5-min in the presence of one discriminative stimulus (S_2), (2) introducing punishment in S_2 , and (3) requiring the S to respond at a low rate in S_2 by correlating it with a differential reinforcement of low-rate (DRL) schedule. The reinforcement schedule in S_1 remained a VI 1 min throughout discrimination training. Terrace (1968) related these findings to those of his earlier work (Terrace, 1966) to conclude that a response rate reduction in S_2 is a necessary and sufficient condition to produce contrast and the peak shift. Later Terrace (1972) modified his position to include only those situations where antagonistic responses produced the response rate reduction in S_2 as both necessary and sufficient conditions for the production of contrast and the peak shift.

The purpose of the present study was to determine the effect of differentially increasing the response rates in S_1 and S_2 on a postdiscrimination generalization gradient. If a peak shift resulted with this procedure, it would show that a response rate reduction in S_2 is neither necessary nor sufficient to produce the peak shift.

METHOD

Subjects

The Ss were six experimentally naive adult Silver King pigeons maintained at 70%-75% of their free-feeding weight throughout the experiment.

Apparatus

The apparatus consisted of two commercially available Grason-Stadler pigeon chambers (Model 1100PB) and associated automatic programming and recording equipment. The stimuli were provided by Industrial Electronics Engineers in-line display cells and consisted of five Kodak Wratten filters which could be combined in such a way so as to produce an additional four wavelength stimuli.¹ A Grason-Stadler white noise generator provided masking noise to each chamber throughout the experiment.

Procedure

Upon arrival at the laboratory, all Ss were individually caged and allowed free access to food and water until a stable weight level was obtained, at which time each bird was reduced to 70%-75% of its free feeding weight. Water remained available in the home cages throughout the experiment.

During the first training session, all Ss were magazine and keypeck trained, then allowed to obtain 50 continuous reinforcements (CRF) for keypecking. Reinforcement consisted of a 3-sec access to the food hopper which contained a mixed grain pigeon food. For three of the birds the stimulus on the pecking key was a 548-nm light, while for the remaining three pigeons it was the 555-nm light. During the next two training sessions, an additional 50 CRF were earned by each bird with the 548-nm and 555-nm stimuli alternated.

On Day 4 the reinforcement schedule was changed to a VI 15-sec schedule, and the stimulus-on periods were changed to 50 sec each, with each period separated from the next by a 10-sec blackout of the key and "houselight." On Days 5-7 the reinforcement schedule was gradually changed from VI 30 sec to VI 5 min, while the number of stimulus-on periods was increased to 30. During all this preliminary training, equal reinforcement was presented in the presence of both the 555-nm and the 548-nm stimuli which were randomly alternated on each training day.

For the next 10 training sessions, each bird received 30 50-sec stimulus-on periods, each separated from the next by the 10-sec blackout. For 15 of the periods, the pecking key was transilluminated by the 555-nm stimulus, while for the remaining 15 periods the key was illuminated by the 548-nm stimulus. The stimuli were alternated in a quasirandom sequence, with a VI 5-min reinforcement schedule in effect in the presence of both wavelengths.

On Day 18 discrimination training began with the reinforcement schedule in the presence of the 555-nm (S_1) light changed to VI 1 min, while in the presence of the 548-nm (S_2) stimulus the reinforcement schedule was changed to VI 3-min schedule. Each bird was given 12 days of this discrimination training.

On the day following the completion of the discrimination training, each S was given a generalization test to the wavelength dimension. The test stimuli consisted of nine different wavelengths and included 501, 511, 538, 548, 555, 576, 589, and 606 nm. The nine test stimuli were randomized within a series, and five different random series were presented to each pigeon. All generalization testing was conducted during extinction. Prior to test, each bird received a 5-min warm-up consisting of three S_1 periods (VI 1-min reinforcement) alternated with two S_2 periods (VI 3-min reinforcement).

RESULTS AND DISCUSSION

Figure 1 presents the training and test data for Ss F1, F2, and F3. The left panel shows the training data, while the right panel depicts the generalization test results. Note that all birds responded about equally to both stimuli during the nondifferential training (i.e., Mult VI 5 VI 5 min). With the schedule changed to VI 1 VI 3 min, Birds F1 and F3 demonstrate a clear increase in the response rate to both S_1 and S_2 over the last 3 days of baseline training. However, S F2 shows the rate increase only in the presence of 555 nm (S_1), while the rate in S_2 tends to decline from the peak level attained during Mult VI 5- VI 5-min training. That is, a behavioral

contrast-like effect occurred for this S. The generalization test data reveal a peak shift for Birds F1 and F3, but no peak shift for Bird F2.

Figure 2 presents the training and test data from Ss F4, F6, and F8. Observe that nondifferential training again produced about equal responding in both S_1 and S_2 . This was followed by a rate increase in the presence of both stimuli during the discrimination training phase of the experiment. Generalization testing revealed a peak shift in the gradients obtained from all three birds.

These results refute Terrace's (1968, 1972) contention that a response rate reduction in S_2 (whether produced by antagonistic responding or not) during discrimination training is a necessary precursor of the peak shift during generalization testing. The average response rate in S_2 during discrimination training was higher than the average rate for the last 5 days of baseline training in all five birds showing the peak shift. Only Bird F2, the one S failing to show a peak shift, responded at a lower rate in S_2 during discrimination training than during the last 3 days of baseline training.

The data from the present experiment suggest that what is significant in the development of the peak shift is a training procedure which produces differences in

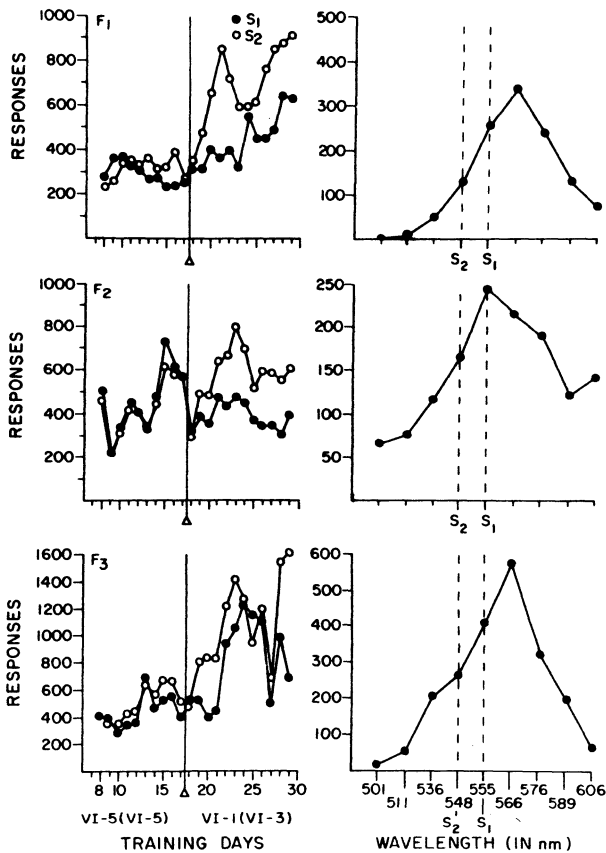


Fig. 1. The Mult VI 5 VI 5 and Mult VI 1 VI 3 training data (left panels) and wavelength generalization test data (right panels) for Birds F1, F2, and F3.

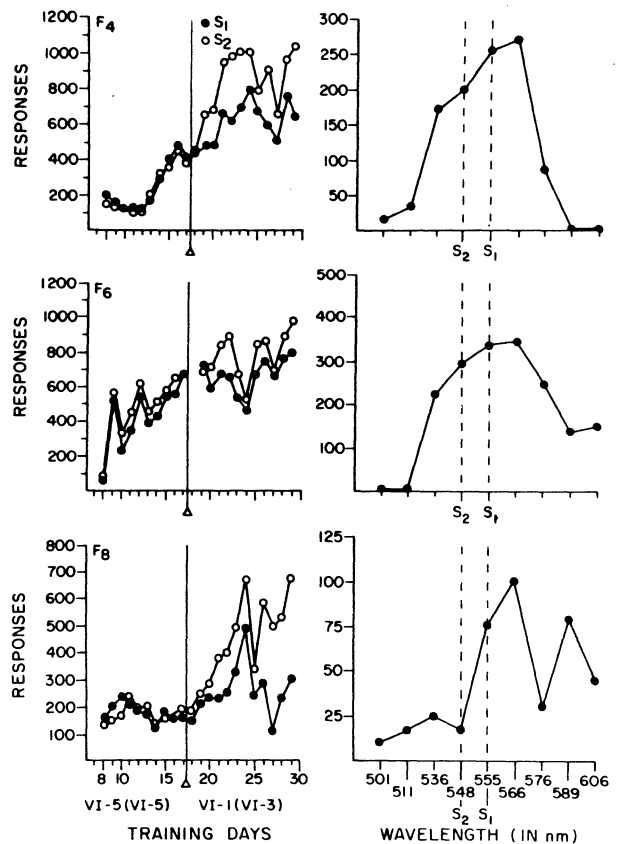


Fig. 2. The Mult VI 5 VI 5 and Mult VI 1 VI 3 training data (left panels) and wavelength generalization test data (right panels) for Birds F4, F6, and F8.

reinforcement in S_1 and S_2 which correlate with changes in the response rate in S_1 or S_2 or both. This position is not incompatible with Terrace's (1968) results if one assumes that the procedures used to reduce the response rate in S_2 (i.e., punishment and a DRL reinforcement schedule) affected the "quality" of reinforcement and thereby effectively reduced the reinforcement in S_2 .

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NOTE

1. These stimuli are thought of as being an ordinal rather than an interval scale and are not considered monochromatic. (cf. Lyons & Klipec, 1971 for details of the procedures used to produce the wavelengths.)

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The effects of social interaction upon persistence of self-punitive behavior

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Four groups of rats were trained to escape shock in a straight runway prior to institution of punishment conditions in an attempt to assess the effect of the presence of another S upon the persistence of self-punitive behavior. All rats first received the usual 35 shock escape training trials. Then, during extinction when no shock was present in the goalbox or startbox, Ss were put into one of four groups: punished, nonpunished, punished with a naive S, and punished with another punished S. Results showed that punishment produced self-punitive behavior and that the presence of another S decreased the number of trials a punished S would perform. The presence of a naive S had more effect than the presence of a trained S. The results are discussed in terms of generalization decrement, social interaction, and fear.

Since the first study which definitely established the self-punitive paradigm with shock escape training (Brown, Martin, & Morrow, 1964), most of the research in this area has been concerned with establishing the optimum conditions for producing the phenomenon (Martin & Melvin, 1964; Melvin & Martin, 1966). (For a review of the literature, see Brown, 1971.) Recently, however, some studies have been done about the methods of inhibiting the phenomenon.

Treatment conditions for stopping self-punitive behavior have consisted of an 18 min rest interval between acquisition and extinction trials (Martin, 1969), the administration of chlorpromazine (Martin, Deemer, & McArdle, 1971), electroconvulsive shock treatments (Stofiel & Martin, 1966) and both implosive therapy and desensitization therapy (Martin & Willoughby, 1973). All of these treatment conditions have been successful, in varying degrees, in inhibiting self-punitive behavior. In all of these studies, the Es have had as their aim the reduction of fear. The results of these studies supported the Mowrer-Brown fear hypothesis as the most viable theoretical explanation of the phenomenon.

Recently there have been several studies of the effects

of social interaction as a method of reducing fear in rats. Latané (1968) found that rats tested singly and in pairs showed less fear (as defined by freezing) of a strange place when in pairs and that gregariousness increased and fear decreased over time. A followup study by Latané and Glass (1969) confirmed these results. Davitz and Mason (1955) found that the presence of another rat could reduce the fear response (as defined by freezing) of a fearful rat which had received shock paired with a light. Less fear was exhibited when another fearful rat was present and least fear when a nonfearful rat was present. Similarly, Marina and Bauermeister (1974) found that the presence of another rat reduced fear in a one-way hurdle jumping situation where the S had been trained to avoid shock paired with a light and tone.

Since the presence of another rat can reduce fear as defined by freezing and fear as defined by hurdle jumping, then it should also reduce fear as defined by running as it occurs in self-punitive behavior. Therefore, rats which had been trained to escape shock were tested in four conditions: alone in the punished conditions; alone in the nonpunished condition; paired with another similarly trained rat in the punished