The Effect of Discrimination Training on Responses to a New Stimulus

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THE EFFECT OF DISCRIMINATION TRAINING ON RESPONSES TO A NEW STIMULUS

by

Kathleen Hammer

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Submitted to the
Faculty of the School of Graduate Studies in partial fulfillment of the
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INTRODUCTION

Many diverse techniques have been used in the investigation of the variables that control the responding to an S- during operant discrimination. The term S- will be used to refer to a stimulus during which no response is reinforced, and S+ will be used to refer to a stimulus during which some responses are reinforced. These studies of S- responding can be divided into two main groups: (1) On the one hand are those studies which measure responding to S- while responses during some other stimulus, an S+, are reinforced. Examples of this type are the studies by Terrace (1963) in which S- responses were measured during a period of discrimination acquisition. The term conditioning measure will be used to refer to this sort of measure of responding to an S-. Note that it is not S- that receives conditioning or reinforcement, but some other stimulus, an S+, that is reinforced during the same experimental sessions. (2) On the other hand, in many studies of the responding to an S-, no responses are reinforced while S- responses are being measured. In these studies an earlier period of reinforcement of an S+ precedes the measurement of S- responses, and the S- responses are measured during a period of extinction of all responding. The widely used generalization gradient technique falls into this category. The term extinction measure would be the broad and symmetrical term to use to refer to this measure of responding to S-. However almost all of these measurements have been made in generalization gradient...
experiments, consequently it may be clearer and more specific to use the term generalization measure.

When S- responding is changed by some independent variable, do these two measures of S- responding react comparably? The literature has data for the effect of the following independent variables on one or both of the above dependent measures: (1) The physical difference between S- and S+, (2) the amount of previous S+ training, (3) the kind of previous S+ training, (4) the amount of previous discrimination training, training on both S+ and another S-, and (5) the kind of previous discrimination training.

(1) The physical difference between S- and S+. The experiments by Frick (1948) and Raben (1949) are examples of studies using the conditioning measure to determine how the physical difference between S- and S+ affects S- responses. Frick found that fewer S- bar-press responses are emitted when there is a large difference between S+ and S- than when there is a small difference. Raben's experiment confirmed these results by showing that latencies of a running response increase as the difference between S+ and S- increases.

The same conclusion is apparent from many generalization studies. The sloping generalization gradient clearly demonstrates that stimuli far away from the reinforced stimulus control less responding than those which are physically less different.

(2) The amount of previous S+ training. Skinner (1938, pp. 201-7) was the first to use a conditioning measure to show that more responses occur to S- when it is introduced after many S+
reinforcements, than when it is introduced after few S+ reinforce­ments. In a discrimination between the presence and absence of a light, rats made many fewer errors when the first S- was introduced after only one reinforcement of the response to S+, than when S- was introduced after 50 reinforcements. A comparison of Terrace's (1963) early constant and late constant groups leads to the same conclusion. If S- was introduced during the first day of S+ train­ing, between 100 and 200 responses to S- were usually made during that session. If it was introduced after 21 days of training, however, between 1500 and 4500 S- responses were made.

Here again the generalization measure is in agreement with the conditioning measure. Margolius (1955) found higher latencies and fewer responses to generalization test stimuli after 4 reinforcements than after 104 reinforcements. Sixteen and 64 reinforcements produced intermediate latencies and responses.

(3) The kind of previous S+ training. There have been no conditioning-measure studies which have directly studied how the kind of previous S+ training affects S- responding. Hearst, Koresko, and Poppen (1964) did two generalization-measure experi­ments on the effect of kind of S+ training on relative and absolute generalization. They found in Experiment 1 that animals that had received 6-sec DRL (differential reinforcement of low rate) showed more relative generalization than animals that had received 1-min VI (variable interval) training. Although the VI training produced a greater difference in responding between the previous S+ stimulus and the new S- stimuli (steeper gradient), the absolute number of
responses to the test S- stimuli was much less with DRL training. Experiment 2 showed that previous training on the longer reinforcement schedules (of VI 30-sec, 1-, 2-, 3-, and 4-min) were followed by more relative generalization during testing. Although the shorter schedules produced steeper gradients, the absolute number of S- responses was not ordered according to schedule length. These results support the findings of Haber and Kalish (1963) who also found steeper gradients after VI training on shorter schedules.

(4) The amount of previous discrimination training. In a generalization measure experiment, Hanson (1959) gave a control group of pigeons five days of VI reinforcement for responses in the presence of a 550 mp stimulus and then tested for generalization with stimuli at 480, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, and 620 mp. Four other groups of pigeons also received five days of VI training to a 550 mp stimulus, but then received discrimination training to a criterion, with VI reinforcement for responses to the 550 mp stimulus and extinction for responses to a stimulus of either 555, 560, 570, or 590 mp depending on the group. These groups were then tested for generalization at the same stimulus values as the control group. Each group which received discrimination training made fewer responses in the generalization test than the control group, not only to the stimulus which was previously S-, but also to the stimuli near S-, especially those on the side away from S+. It should be emphasized that the groups with discrimination training made fewer responses to some new stimuli than groups without discrimination training, despite more
S+ training for the discrimination groups than for the control group.

Similar results were obtained by Honig, Thomas, and Guttman (1959) in a procedure like that of Hanson except that the discrimination groups of Honig, et al., after VI training on 550 µ, were given either 20 or 40 min of continuous extinction in the presence of a 570 µ stimulus, then a generalization test, then 10 continuous reinforcements with 550 µ, and then discrimination training with a 550 µ S+ and a 570 µ S-. The second generalization test showed even bigger differences between the control and discrimination groups than those of Hanson. Jenkins and Harrison (1962) plot a difference gradient based on the results of Honig, et al., and show that the post-discrimination gradient is lower than the control points immediately left of S+ (away from S-). Again the discrimination groups received more reinforcements in the presence of S+ than the control group.

Although not as pronounced, the same effect can be seen in the generalization gradient experiment of Terrace (1964). The gradients after discrimination training (either with or without errors) are flatter in the region of stimuli to the side of S- which is farther from S+.

In studies of the shape of the gradient after discrimination training, subjects have been given discrimination training either until some low level of S- responding is reached or for a fixed duration. Different durations of discrimination training have not been compared. Nevertheless, the above studies clearly show that some unspecified amount of discrimination training changes the
gradient from that found after training only with S+, without discrimination training.

However, the amount of previous discrimination training has received no study with the conditioning measure. Behavioral contrast studies (e.g., Reynolds, 1961) are not an exception; although they use conditioning measures, they are concerned with the effect of discrimination training on S+ responding, not S- responding. The generalization-measure data would lead us to expect that after discrimination training introduction of a new stimulus on the side away from S+ would result in fewer responses than without previous discrimination training.

But all of the studies with the generalization measure have been carried out after at least moderate training on S+ and S-. With conditioning measures data can be obtained during the first day of training. Consequently conditioning measures may detect effects difficult to detect with generalization measures. In this regard it should be noted that discrimination training is also training on S+, and training on S+ increases S- responding, the opposite of the reported effect of discrimination training. Thus the conditioning measure might conceivably detect both the increasing effect from S+ training and the decreasing effect of discrimination training.

In addition, Terrace (1963, 1966) has given examples of the inability to predict results with conditioning measures from results with generalization measures, or from the interaction of excitation and inhibition gradients. He has emphasized the need for more
comparisons and more detailed comparisons of conditioning and generalization measures before we assume that results with one can be predicted from the other.

The object of the present experiment was to obtain the missing data on the effect of discrimination training on S- responding with the conditioning measure, thereby making possible another comparison of a conditioning and a generalization measure. The conditioning measure also may detect other effects not detected by the generalization measure.

(5) The kind of previous discrimination training. Terrace (1963) demonstrated with a conditioning measure that the kind of previous discrimination training also influences the number of errors that are made to a new S-. He found that if discrimination training is begun with an S- that differs from S+ in wavelength, brightness, and duration, and this S- is slowly changed until it differs from S+ in wavelength only, then many fewer S- responses occur than if training is begun with an S- which differs in wavelength only. The first kind of discrimination training he called progressive introduction (of S-) and the second he called constant introduction. The lowering of S- responses or the reduction of learning time by the progressive introduction of S- had also been reported by Schlosberg and Solomon (1943), and Lawrence (1952).

By combining progressive introduction of S- with the early introduction of S-, discussed in (3) above, Terrace (1963) was able to train wavelength discriminations in pigeons without the occurrence of responses to S-. The constant and late introduction of S-
(after 21 sessions of S+ conditioning), however, produced from over 1500 or over 4500 S- responses. Pigeons which received either early and constant, or late and progressive introduction of S- made an intermediate number of S- responses.

Progressive introduction has not been studied with the generalization measure, but would be difficult to use in most generalization-gradient tests, due to the brief time available.

Although not comparable with the above study of Terrace as far as the variables manipulated, there is a study with the generalization measure of the effect of the kind of preceding discrimination training on S- responding. This is the study mentioned in (4) above by Honig, Thomas, and Guttman (1959). Birds were given VI training on an S+ of 550 mp and were later given either 20 or 40 min of continuous extinction on 570 mp with no 550 mp stimulus presented. The generalization gradient after this treatment showed fewer responses than the control group without extinction, to nearly all test stimuli (except those farthest from S+). The response was then reconditioned and successive discrimination training was given in which both S+ (550 mp) and S- (570 mp) were presented, with reinforcements given for responses to S+. The generalization gradient after this treatment showed fewer responses than the control group at or near S- mp values, but showed more responses than the control group at S+ and at values to the opposite side of S+ from S-. When compared with continuous extinction, discrimination training caused a more specific depression in the gradient, rather than a general response decrement.
The above discussion has shown that although some variables affecting S- responding have been studied with both the generalization measure and with the conditioning measure, others have been studied with only one of these measures. Both measures have been used in studies of the effect of the physical difference between S- and S+, and the amount of previous training on S+. Both measures have been used in studies of the effect of the kind of previous discrimination training, but the kinds of previous training have not been comparable. However, only the generalization measure has been used in studies of the effect of the kind of previous S+ training, and the effect of the amount of previous discrimination training. The following experiment uses the conditioning measure to test how the amount of previous discrimination training affects S- responding.

In the present experiment, discrimination training between a yellow stimulus (S+), and both a red stimulus (S-) and a green stimulus (S-) was given before introduction of a new S- (a blue stimulus). In order to explore the dimensions of the effect, four different amounts of discrimination training were used before introduction of the new stimulus. These were 0 days, 1 day, 3 days, and 9 days. A secondary aim of the experiment was to determine whether or not this less complicated technique could produce few enough errors to be comparable with Terrace's (1963) "errorless" discrimination.
METHOD

Subjects

The subjects were 32 experimentally-naive, female (retired breeders), White King pigeons. Each bird was reduced to approximately 70% of its ad libitum weight, and then was fed a fixed amount of food each day in the home cage immediately after the experimental session. Adjustments in the after-session feeding were made only to adjust for the amount of feeding in the experimental session or a consistent trend in weight. Birds were housed in individual cages where grit and water were always available.

Apparatus

The experimental chamber was a standard Lehigh-Valley-Electronics 2-key chamber except the houselight was changed to a 120-volt, 6-watt bulb. The key had a diameter of 1 in, was mounted 3/16 in behind the surround, and required a displacement of 3/64 in. Only pecks on the right key had any effect. The right key was illuminated by an Industrial Electronics Engineers, Inc., Series-10, projector. Four stimuli were used. Red, green, and yellow stimuli were obtained from 25VDC on a GE 1820 bulb behind IEE filters. A blue stimulus was obtained in the same manner, except that two layers of blue transparent plastic were used in place of an IEE filter.

The chamber was located in a room which was separated from
the electro-mechanical programming and recording equipment by a hall.

Key-peck Training

All birds were trained to key-peck by an adaptation of the auto-shaping procedure of Brown and Jenkins (1968). Seven-second presentations of a yellow key-light, immediately followed by 3 sec of food access, were given on a variable interval 1-min (VI 1-min) schedule. A peck to the yellow key-light immediately terminated it and produced food access (3 sec), while a peck to the dark key had no consequence. After the fourth peck to a yellow key-light and the resulting feeding, the yellow key-light came on again and stayed on during 10 continuous reinforcements (CRF), after which the session terminated. Unless four pecks occurred by the 40th key-light, the session was terminated and another auto-shaping session with 40 key-light and food pairings was given on the following day. One to three auto-shaping sessions were generally required, and birds were discarded if pecking did not develop in five sessions. One bird was discarded.

Discrimination Training

The basic procedure consisted of 20-sec presentations of the four stimuli in semi-random order and separated by a 12-sec inter-trial interval (ITI) during which the key was dark but the house-light remained on. Key pecks during the yellow stimulus (S+) were reinforced with 3 sec of food access on a VI 30-sec schedule.
Responses during the red, green, or blue (all S-) stimuli were never reinforced. Responses in the last 5 sec of ITI delayed presentation of the next colored stimulus for another 5 sec.

 Discrimination training began on the day following the ten continuous reinforcements of auto-shaping. All birds began training on yellow S+, red S-, and green S- on session 1 of discrimination training. Introduction of blue S- occurred either on session 1 (for Day-1 Group), session 2 (for Day-2 Group), session 4 (for Day-4 Group), or session 10 (for Day-10 Group).

 In order to rapidly increase the time between reinforcements while reliably avoiding long pauses in responding, the following adjustments were made in session 1 of discrimination training. Session 1 began with repeated 20-sec presentations of S+ in which all responses were reinforced until the end of the S+ presentation containing the third reinforcement. The next nine reinforcements were programmed on a VI 15-sec schedule, and the first S- was presented after the fifth reinforcement on this schedule. The first S- was always green, and the next 25 stimuli were presented in the sequence given in Table 1. The rest of the stimuli of the session were programmed in the same semi-random order used in later sessions. The reinforcement schedule was changed to VI 30-sec after nine reinforcements on VI 15-sec had occurred.

 During all discrimination sessions after the first one, responses during a yellow S+ were reinforced on a VI 30-sec schedule. Each of the 20-sec stimuli included in that session was presented 24 times. Thus there were 24 yellow, 24 red, and 24
green stimuli before blue was introduced; after blue was introduced there were an additional 24 blue stimuli.

To reduce variability between groups, birds were assigned to groups 2, 4, and 10 according to their responses to the yellow S+, red S-, and green S- on the first day of discrimination training. No such adjustment was possible with the Day-1 Group, of course, because no data were available on red and green S- responses before the blue S- was introduced on day 1.
<table>
<thead>
<tr>
<th>Ratio of S- to S+</th>
<th>Day-1 Group</th>
<th>Day-2 Group</th>
<th>Day-4 Group</th>
<th>Day-10 Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Blue stimuli present)</td>
<td>(Blue stimuli absent)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All S+</td>
<td>Yellow presentations until fifth VI 15-sec reinforcement Green</td>
<td>Yellow presentations until fifth VI 15-sec reinforcement Green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One S- per S+</td>
<td>Yellow Blue Yellow Red Yellow Green Blue Yellow</td>
<td>Yellow Red Yellow Green Yellow Green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two S- per S+</td>
<td>Yellow Red Green Yellow Blue Red</td>
<td>Yellow Red Green Yellow Red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three S- per S+</td>
<td>Yellow Green Red Blue Yellow Green Red</td>
<td>Yellow Red Green Red</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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RESULTS AND DISCUSSION

The above described attempt to equalize red and green S-responses among different groups was reasonably successful; a Kruskal-Wallis (Kerlinger, 1964) non-parametric analysis of variance on the red plus green errors of day 1, did not reach the .3 level of significance.

Figure 1 shows the frequency of different numbers of responses to blue S- during the first session it was presented. The Kruskal-Wallis analysis of variance was not significant (p = .2). Hartley's test ($F_{max}$) (Winer, 1962) for heterogeneity of variance showed that the difference between the variances was significant at the .01 level. Boneau (1960) has shown that this heterogeneous variance combined with heterogeneous skewness, also present here (Fig. 1), can seriously affect the shape of the F distribution. Hence results from a parametric analysis of variance would be questionable.

However the significant $F_{max}$ indicates that the groups are drawn from more than one population and therefore indicates that the difference in treatment had an effect. Although Hartley's test is not robust for non-normality, the observed $F_{max}$ in this case was 322.82, and an $F_{max}$ of 12.1 is significant at the .01 level. Thus the observed $F_{max}$ is far beyond that which would occur by chance even with a large effect of skewness on the $F_{max}$ distribution.
Figure 1. Frequency distributions of each of the groups. The distributions show the number of birds in each group that made each number of blue S-responses on the first day blue was presented.
Responses to Blue S- on First Day of Blue S-
In view of the evidence of some difference in variance between groups, individual F tests were conducted to determine which variances were different. It was found that the variance of the Day-10 Group was significantly different from the variances of each of the other groups beyond the .002 level. None of the other three group variances differed significantly from each other.

Since the difference in variance between the Day-10 Group and the other groups does not seem to be due to chance, this Day-10 Group seems to be drawn from a different population than the other groups. Consequently, it seems reasonable to determine whether the Day-10 mean is different from the common mean of the other three groups. When Day-1, Day-2, and Day-4 Groups were pooled and compared with the Day-10 Group, a Mann-Whitney U test (Siegel, 1956) indicated a difference in the means significant beyond the .01 level. The comparison of the mean, median, and variance of each of the four groups is shown in Fig. 2.

Thus it appears quite likely that the introduction of blue S- on day 10 changes the distribution, reduces the variance, of blue S- responses, compared with the distribution when blue S- is introduced on day 1, 2, or 4. It also appears likely that the mean responses of the Day-10 Group to blue S- is less than with earlier introduction, though this conclusion is less firmly established.

These results with a conditioning measure agree with the results using a generalization measure discussed earlier. The generalization-measure studies showed that discrimination training
Figure 2. The mean, median, and variance of responses to blue S- on the first day blue was presented for each of the four groups.
Mean and Median of Responses to Blue S-

Groups (Day of Introduction of Blue S-)

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reduced the responses to new S- stimuli that were more different from S+ than previous S- stimuli. The present evidence of a decrease in S- responses after nine days of discrimination training seems to fit with the generalization data. However, it was pointed out in the introduction that training with S+ alone increases S- responses and that with the conditioning-measure early in training it might be possible to see other effects besides the decrease in S- responses due to S- training. Fig. 2 shows that there is an increase in the mean and median from the Day-1 to the Day-2 Group. Since there is neither a significant difference in variance between these two groups, nor is there a significant analysis of variance, this difference could well be due to chance variation. However, this rise might be comparable to the increase in errors seen in other conditioning-measure studies after S+ training (i.e., Skinner, 1938; Terrace, 1963), and hence the data will be examined more closely.

The distribution of the Day-1 Group seems to deserve comment. Fig. 1 shows that the blue S- responses from seven of the eight birds in this group were 7 or less, while the eighth bird made 66 responses to blue. Consequently, this one bird, #4532, had a great influence on both the mean and variance, raising the mean from 3.3 to 11.2, and the variance from 9 to 500. When this one bird, #4532, is compared with the distribution of the other seven birds (see Fig. 1), it is 21 standard-deviations from the mean of the other seven birds. (The Day-4 Group, however, had one bird that was 7 standard-deviations from the remaining birds.)
In addition, this high response bird in the Day-1 Group, #4532, differed from all other birds in the experiment in the responses to blue on the second and third day after blue was introduced. The highest responses seen in any other bird on day 2 of blue was 5, and on day 3 was 6. The median responses were less than 1 on both days. Bird #4532 made 71 and 20 responses on these two days respectively. Thus #4532 may represent a highly deviant bird that needs separate study.

Exclusion of the data from bird #4532 would make the rise between the Day-1 Group and the Day-2 Group even more pronounced. Without bird #4532 the variance of the Day-1 Group is significantly different from that of the Day-2 Group beyond the .002 level. A Mann-Whitney U test indicates the difference in means between these two groups to be significantly different at the .05 level. It would be unwise to claim that a difference between Day-1 and Day-2 Groups is established by these data. However it would be equally unwise to ignore this evidence of some other effect on S-responding besides the decrease in S- responding with the nine days of training; there is a possibility that the variance and mean may increase between Day-1 and Day-2 so that there is first an increase and then a decrease in responses to a new S- in the range studied. It seems possible that the introduction of a new S- after brief discrimination training produces more responses to the new S- than either a very small amount or a larger amount of discrimination training.

It has already been mentioned that other conditioning-measure
studies have indicated an increase in S- responses with S+ training similar to this possible increase between Day-1 and Day-2. Thus Terrace (1963) showed that S- responses were more when S- was introduced on the 22nd day of S+ training compared with S- introduction on the first day. Although this amount of training was much greater than that used before Day-2 in the present study, a similar increase in S- responding was found by Skinner (1938) after a number of reinforcements (50) closer to the number given before Day-2 in this study (30). The problem clearly needs further study. However these results provide some encouragement that improvements in this technique may enable it to demonstrate both the increased S- responses from S+ training and the decreased responses from S- training.

It was mentioned earlier that an attempt was made to equalize the groups according to the independent measures of yellow S+ responses, and red and green S- responses. Since red, green, and blue are all S- stimuli, it might be expected that the number of responses to each of these stimuli would be highly correlated in individual birds. This should be especially true for the Day-1 Group since there was no experimental difference in the three stimuli, but should also be true of the other groups if the experimental manipulation had little effect.

To examine this possibility, product-moment correlation coefficients between blue S- responses (on the first day blue was presented), and red plus green S- responses (on the first day of discrimination training) were calculated. The resulting
correlations are given in the left column of Table 2. It can be seen that the correlation is high for the Day-1 Group (significant at the .01 level), while the correlation is low for the other three groups (not significant). This difference in correlation suggests that the control of blue S- responses on the first day is different than on later days, and may support the earlier evidence of a difference between S- responses on Day-1 versus Day-2 or 4. The number in parentheses in Table 2 for the Day-1 Group is the correlation coefficient calculated after omission of the data from the deviant bird with 66 responses (#4532) to blue. This second calculation was made to show that the high correlation was not due mainly to the deviant bird. The r of .87 is significant at the .05 level.

Although the correlation between the blue responses and the red and green responses on the first day of training does not appear when blue is introduced on later days, perhaps the blue responses are related to some other measure of red and green responses. Blue responses might be correlated with the red and green responses that occur on the first day blue is presented. In the Day-1 Group this correlation is the same as the earlier one because the first day of discrimination training is identical with the first day blue is presented. But for the other groups, these correlations are not the same; the first day of discrimination training and the first day blue is presented are different. However, it can be seen from the middle column of Table 2 that the present data does not support this possibility. Day-2, Day-4, and
TABLE 2

Correlations Between Responses to Blue and Responses to Red and Green

<table>
<thead>
<tr>
<th>Group</th>
<th>First day of discrim. training</th>
<th>First day blue is presented</th>
<th>All days up to and through first day of blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day-1</td>
<td>.94 (.87)</td>
<td>.94</td>
<td>.94</td>
</tr>
<tr>
<td>Day-2</td>
<td>.28</td>
<td>.02</td>
<td>.31</td>
</tr>
<tr>
<td>Day-4</td>
<td>-.54</td>
<td>-.05</td>
<td>-.12</td>
</tr>
<tr>
<td>Day-10</td>
<td>.24</td>
<td>.36</td>
<td>.52</td>
</tr>
</tbody>
</table>
Day-10 Groups all show a low correlation between blue responses and red and green responses on the first day blue is presented.

Another possibility is that blue responses are determined by the same variable(s) controlling red and green responses, but that the variable controlling red and green responses is better measured by number of responses across all the days of discrimination training, than by either the number of responses on the first day they are presented, or by the current level of responding on the day blue is introduced. Red and green errors were therefore summed from day 1 of discrimination training up through the day blue was introduced and the correlation of this sum with the number of blue responses was determined. Again, this correlation for the Day-1 Group is by definition identical with the earlier described two correlations, but the other three correlations are different. The right column of Table 2 shows that this correlation is low between blue responses and the sum of red and green responses on all days up through the introduction of blue.

Although by no means conclusive, the lack of correlation after Day-1 in any of these measures would indicate an influence on blue responses after Day-1 by some variable other than, or in addition to, that which controls the responses to red and green. These findings agree with the weak indication seen earlier that discrimination training increases blue responses between Day-1 and Day-2. The initial discrimination training seems to increase blue responses and the additional responses seem to have little or no correlation with the various measures of responses on red and green.
Consequently the total blue responses do not correlate with any of the measures of red and green responses after this increase between Day-1 and Day-2.

The preceding analysis probably only applies to the Day-2 and Day-4 Groups. The situation with the Day-10 responses has other complications. The very low values and small range of blue responses on the tenth day may obscure any correlation, or it may be that whatever is responsible for the decrease of blue responses with increased discrimination training is also uncorrelated with the various measures of red and green responding.

The relatively uncomplicated technique used in the present study can apparently produce a level of S- responding as low as that found by Terrace (1963). However, the present difference between S+ and S- was probably greater than that used by Terrace. Terrace's technique formed discriminations which had some characteristics unlike those of discriminations formed with errors. Whether the discriminations developed here show those characteristics is an interesting question that will require further study.
REFERENCES


