REPEATED MEASUREMENTS OF REINFORCEMENT SCHEDULE EFFECTS ON GRADIENTS OF STIMULUS CONTROL¹

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Two experiments studied the effects of reinforcement schedules on generalization gradients. In Exp. 1, after pigeons' responding to a vertical line was reinforced, the pigeons were tested with 10 lines differing in orientation. Reconditioning and the redetermination of generalization gradients were repeated from 8 to 11 times with the schedule of reinforcement varied in the reconditioning phase. Stable gradients could not be observed because the successive reconditionings and tests steepened the gradients and reduced responding. Experiment 2 overcame these effects by first training the birds to respond to all of the stimuli. Then, brief periods of reinforced responding to the stimulus correlated with reinforcement alternated with the presentation of the 10 lines in extinction. The development of stimulus control was studied eight times with each bird, twice with each of four schedules of reinforcement. Gradients were similar each time a schedule was imposed; the degree of control by the stimulus correlated with reinforcement varied with particular schedules. Behavioral contrast occurred when periods of reinforcement and extinction alternated and was more durable with fixed-interval, variable-interval, and variable-ratio schedules than with fixed-ratio or differential-reinforcement-of-low-rate schedules.

Although generalization gradients—the gradients used to depict the relation between environmental stimuli and a quantifiable property of responses—vary with the schedule of reinforcement used in training (Hearst, 1965; Thomas and Switalski, 1966), there is no information as to whether these influences continue beyond the first test. Data on the relation between schedules and stimulus control have been obtained by giving animals one cycle of training and testing. A most impressive property of reinforcement schedules, however, is their ability to establish characteristic behavior, for example, the temporal distribution of responses, that is largely independent of experimental history (Ferster and Skinner, 1957). The purpose of the present experiments was to investigate whether schedules might also have characteristic and recoverable effects on gradients of stimulus control.

Subjects

Four White Carneaux pigeons were maintained at 80% of their free-feeding weights

throughout the two experiments. Birds 40, 42, and 46 had not been used in other research; Bird 1 had previously acquired a discrimination among three stimuli differing in size.

Apparatus

The experimental chamber was modified from the standard unit described by Ferster and Skinner (1957). The clear plastic response key (R. Gerbrands Co.), operated by a peck with a minimum force of 12 g, was displayed through a 19-mm diameter hole centered 216 mm above the floor of the chamber. A 51-mm square aperture below the key provided occasional access to mixed grain for 4 sec, and was illuminated by two 6-w clear bulbs when grain was available. The key and aperture lights provided the only sources of illumination. White noise masked extraneous sounds. All phases of the experiment were fully automated.

An inline display projector projected 10 different angular orientations of a white line 19 mm long and 5 mm wide on the rear of the response key. The orientations, designated by their distance from vertical with clockwise differences denoted as positive and counterclockwise differences as negative, were 0° (vertical), ±18°, ±36°, ±54°, ±72°, and 90° (horizontal).

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EXPERIMENT 1: GENERALIZATION TESTS SEPARATED BY EXTENSIVE RECONDITIONING

The standard procedure for obtaining generalization gradients is to train the subject with one stimulus and then test with a range of stimuli in extinction. Therefore, this procedure was used to try to observe stable effects of reinforcement schedules on the gradients. The birds were trained to respond to one stimulus under a particular schedule, were given generalization tests in extinction, were trained under a different schedule, were tested again, *etc.* A concern from the outset, however, was generated by data showing that, after pigeons were trained with one stimulus correlated with reinforcement (S+), gradients changed with repeated testing (Blough, 1961; Guttman and Kalish, 1956; Kalish and Haber, 1963). Later tests did not recover earlier performance; instead, control by S+ increased.

In the Kalish and Haber study, the tests followed each other with no interpolated retraining with S+. In the other experiments, the birds were retrained between the successive tests, but the period of reconditioning was short: Blough used one 2-hr period, and Guttman and Kalish used three 35-min periods. To try to overcome the failure of later tests to recover earlier behavior, the present experiment retrained pigeons for much longer periods between tests.

Procedure

In training, the vertical line (S+) appeared for 30-sec periods followed by 1 sec with the key dark. Sessions ended after 60 reinforce-

ments. Training continued for at least 30 sessions or until performance stabilized after 10 sessions; the stabilization criterion involved total session time on ratio schedules and total number of responses per session on interval schedules, the values for each of three successive days having to be within 10% of the other two days.

On the day after performance stabilized, 30 reinforcements were delivered for responses to S+ according to the schedule used in the preceding session. Then, each subject received seven different sequences of the 10 stimuli with no responses reinforced. The same order of 70 stimulus presentations was used in all generalization tests. Each stimulus appeared for 30 sec with the key dark for 1 sec between stimuli.

Reconditioning with S+ began on the day after the test, and continued for either at least 30 days or until behavior met the stability criterion. Then, there was another test day. The entire procedure of training to a stability criterion and testing in extinction was repeated 11 times for Bird 1, 10 times for Birds 40 and 46, and eight times for Bird 42. Reinforcement schedules changed for each reconditioning: the schedule and the number of days with each is shown in Table 1. The schedules were fixed ratio (FR): reinforcement followed a fixed number of responses; variable ratio (VR): reinforcement followed an irregular number of responses with the mean number specified by the VR value; fixed interval (FI): reinforcement followed the first response occurring after the period of time specified by the FI value; variable interval (VI): reinforcement followed the first response after irregular

Table 1
Sequence of Schedules: Experiment 1

Schedule	Bird 1		Bird 40		Bird 42		Bird 46	
	Schedule	Training Days	Schedule	Training Days	Schedule	Training Days	Schedule	Training Days
1	FR 60	18	VR 60	30	VI 1-min	24	FI 1-min	30
2	FI 1-min	24	FR 60	17	FI 1-min	22	VR 60	21
3	VI 1-min	19	VI 1-min	20	FR 60	18	VI 3-min	18
4	VR 60	18	FI 1-min	15	VR 60	21	FR 60	37
5	FI 1-min	20	VR 60	13	FI 1-min	30	VR 60	17
6	FI 5-min	36	FR 60	18	VI 1-min	15	FI 1-min	24
7	FR 150	20	FR 60	21	VR 60	20	FR 60	19
8	FI 5-min	19	FI 2-min	30	FR 60	23	VI 1-min	21
9	FI 5-min	30	VR 60	16			FI 1-min	28
10	FR 150	18	VI 1-min	18			VR 60	20
11	FI 5-min	22						

times with the mean interval specified by the VI value. Responses and time when the key was dark did not count in meeting the schedule requirements, and intervals were timed from the end of each magazine cycle.

RESULTS

Figure 1 shows that the number of responses per test declined with successive schedules (successive reconditionings). The decline reversed with the first two exposures to FI 5-min, for Bird 1 (Schedules 6 and 8), the first exposure to VI 1-min for Bird 40 (Schedule 3), and the first two exposures to VR 60 for Bird 46 (Schedules 2 and 5).

Under all conditions, the generalization gradients tended to be asymmetrical with more responding to stimuli rotated clockwise from S+ than to stimuli rotated counterclockwise an equal number of degrees. All gradients peaked at S+ except the first for Birds 40 and 46; in these two instances, the most responses occurred to stimuli 18° different from S+ with slightly fewer responses to the vertical line. In all gradients, responding progressively decreased with increased differences between the stimulus controlling the most responses and the other lines.

Fig. 1. Number of responses in generalization tests following each schedule.

The percentage of total responses to S+ measured stimulus control and compensated for differences in the absolute rate of responding. As Fig. 2 shows, responding to S+, relative to responding to the other stimuli, increased with successive schedules for Birds 40, 42, and 46. Bird 1 showed the same tendency for the first five tests, but the sixth, preceded by reconditioning with the FI 5-min schedule, reversed the trend. The next exposure to FI 5-min (Schedule 8) reproduced the lowered relative responding to S+. Control by S+ increased with the third and fourth exposures to the schedule (Schedules 9 and 11). For Bird 1, reversals in the decline of total responses and in the increase in relative responding to S+ occurred with the same schedule; for the other birds, there were no reversals of the increased control by S+.

The patterns of responding during training corresponded to those typical of the various schedules (Ferster and Skinner, 1957). Fixed ratio produced a post-reinforcement pause and an abrupt shift to a high rate of responding that persisted until the next grain presentation; fixed interval resulted in a post-reinforcement pause followed by positively accelerated responding, and variable interval and variable ratio produced steady rates of responding.

Fig. 2. Percentage of total responses occurring to S+ in tests following each schedule.

DISCUSSION

The decline in the absolute number of responses and the increase in relative control by S+ with successive tests replicated the results of earlier experiments (Blough, 1961; Guttman and Kalish, 1956; Kalish and Haber, 1963). Since the prolonged reconditioning of the present experiment resulted in behavior similar to that observed without or with brief reconditioning, the cumulative effects of repeated testing on stimulus control appear not to be overcome by extensive retraining with S+.

Although the schedules determined characteristic rates and patterns of responding, the only evidence for an idiosyncratic schedule effect on stimulus control came from the FI 5-min schedule for Bird 1. The first two applications of this schedule decreased the amount of control and increased the number of responses during the test. However, additional reconditionings failed to maintain these distinctive effects.

EXPERIMENT 2: ACQUISITION OF STIMULUS CONTROL WITH DIFFERENT SCHEDULES OF REINFORCEMENT

In Exp. 1, the birds' responses to a stimulus other than S+ were not reinforced. The situation may be conceptualized as discrimination training, with S+ being the vertical line whenever the stimulus did not change from one 30-sec interval to the next, and S- being the presentation of a changing stimulus or any stimulus different from S+. The progressive increase in stimulus control and decrease in number of test responses fits this hypothesis.

The procedure of Exp. 2 weakened the contrast between conditions. Whenever reinforcement schedules were changed, the birds first received grain for responding to all of the stimuli until they responded equally to each. Next, reinforcement for responses to S+ alternated with extinction periods in which all 10 stimuli were presented without reinforcement. Responding in the extinction periods measured stimulus control. Thus, Exp. 2 differed from Exp. 1 in that stimulus control was eliminated before reconditioning with S+. The new procedure shifted the emphasis from an evaluation of control after a period of expo-

sure to a single stimulus to the progressive development of control by S+, and was used to investigate how different schedules affected the acquisition of a discrimination.

Procedure

The procedure consisted of two phases. In Phase 1, the stimuli changed every 15-sec and food presentation was independent of the stimulus appearing on the key when the schedule requirements were met. In Phase 2, periods with food available for responses to the vertical line (S+) alternated with the presentation of all of the stimuli with no responses reinforced. The seven sequences of stimuli were the same as those of Exp. 1. In each of the seven sequences the ordering of the 10 stimuli differed, but the order of stimuli within each sequence and the order of the sequences themselves were fixed.

Neither responses nor time were counted during the 1-sec stimulus-off periods that occurred every 15-sec in both phases. The same schedule of reinforcement was used throughout a given training and testing series. The schedules and the number of days of training to respond to all stimuli (Phase 1) are shown in Table 2. Each bird had two exposures to each of four different reinforcement schedules. In addition to the schedules of Exp. 1 (fixed-ratio, fixed-interval, variable-ratio, variable-interval), this study used differential-reinforcement-of-low-rate schedules (DRL). A DRL schedule specifies the minimum time that must elapse between successive responses for a reinforcement to occur.

Phase 1 continued until visual inspection revealed stable patterns of responding and an approximately equal number of responses to the various stimuli. The stability criterion of Exp. 1 was abandoned because it would have been met before recovery of the pre-discrimination baseline of equal responding to all stimuli. Sessions ended after 60 reinforcements.

Phase 2 consisted of 15 days of discrimination training. The first day began with reinforced responding to all of the stimuli. When at least 10 reinforcements had been delivered and each stimulus had appeared equally often, this preliminary period ended. Then, the presentation of S+ for 15-sec periods for 10 reinforcements alternated with 15-sec presentations of each of the 10 stimuli with no

Table 2
Sequence of Schedules: Experiment 2

Bird 1			Bird 40		Bird 42		Bird 46	
Schedule	Days in Phase 1		Schedule	Days in Phase 1	Schedule	Days in Phase 1	Schedule	Days in Phase 1
1. FR 60	18		VR 75	20	DRL 10-sec	18	VI 1-min	25
2. FI 5-min	32		VI 1-min	24	FR 60	36	FR 60	17
3. DRL 15-sec	16		FI 2-min	14	FI 2-min	38	FI 5-min	18
4. VI 2-min	20		FR 60	19	DRL 10-sec	19	FR 60	22
5. DRL 15-sec	18		VI 1-min	19	VR 60	17	VI 1-min	24
6. FI 5-min	19		VR 75	23	FI 2-min	17	VR 60	16
7. FR 60	15		FR 60	18	VR 60	15	FI 5-min	13
8. VI 2-min	14		FI 2-min	23	FR 60	14	VR 60	18

responses reinforced. The day ended with the sixtieth magazine cycle. Thus, on the first day of discrimination training there were 10 to 12 reinforcements delivered independent of stimuli, twenty eight 15-sec presentations of each stimulus with no food available for responses, and 48 to 50 reinforcements for responses to S+.

After the first day, there was no preliminary period of reinforcement in the presence of all stimuli. Ten magazine cycles for responding to S+ delivered according to the schedule in force alternated with seven presentations of each stimulus in extinction until there were 60 reinforcements. On each day, therefore, there were thirty five 15-sec periods with each of the 10 stimuli with no food available and 60 reinforcements for responding to S+.

After the 15 days of discrimination training, responses to all stimuli were again reinforced, and the sequence of procedures was repeated with a different schedule of reinforcement.

RESULTS

Gradients of Stimulus Control

Experiment 1 revealed that responses decreased in successive periods of extinction separated by reconditioning with S+. Because of the strength of this cumulative effect, it was impossible to study whether schedules of reinforcement had stable or consistent influences on gradients of stimulus control. It was essential, therefore, to determine if the present procedure, which also involved repeated reconditioning and extinction between applications of different schedules, eliminated the decrement in responding observed in Exp. 1. An important difference between the two experiments was that Exp. 1 involved reconditioning

only with S+, whereas all of the stimuli appeared in Exp. 2.

Figure 3 shows the total number of responses during the extinction periods of the first (open bars) and fifteenth (filled bars) days of discrimination training for both applications of each schedule of reinforcement. Comparisons of the first and second applications indicate whether repeated reconditioning and 15-day phases of discrimination training, involving alternated reinforcement for responding to S+

Fig. 3. Total responses in the test intervals on Day 1 (open bars) and Day 15 (filled bars). The left bar of each pair is the first and the right bar is the second exposure to the schedule.

and extinction with all of the stimuli, influenced the number of responses on each day; comparisons of the first and fifteenth days with each schedule reveal the influence of maintained discrimination training without interpolated reconditioning. The amount of responding on each day of extinction was independent of the number of schedules. With

Fig. 4. Relative gradients of stimulus control for the second exposure to each schedule. The number of responses to each stimulus was divided by the number of responses to S+ (0°). Open circles are Day 2, filled circles are Day 15.

some schedules there was more responding on the first exposure than on the second (left bar of each pair), and with others there was more responding on the second exposure (right bar of each pair). In contrast, with every application of a schedule, the total responses during the extinction periods progressively declined with maintained training. Successive days of discrimination training decreased the frequency of responding, but number of reconditionings had no orderly cumulative effect.

Because successive schedules had no apparent systematic effect on the number of responses during discrimination training, it was possible to study the way different schedules influenced gradients of stimulus control. The changes in responding over days of training, however, required looking at behavior on individual days.

Measures of stimulus control based on the absolute number of responses to each line were variable because the rates of responding during extinction differed, although unsystematically, both for the same and different schedules (Fig. 3). Therefore, gradients were

derived from relative rather than absolute response frequencies. Figure 4 shows relative gradients for only the second and fifteenth days of the second application of each schedule (the relative gradients for the first and second applications were similar). On Day 2, the gradients of Birds 1 and 42 had less slope with DRL than with any other schedule. For Bird 1, FR produced the steepest gradients, next was VI, then FI. For Bird 42, FI and FR were approximately equal and produced more control than did VR. For Bird 40, the steepest gradients were with VI and FR, next was FI, with the flattest gradients with VR. Bird 46 displayed the steepest gradients with FR and VR; FI and VI were approximately equal.

By Day 15, there was clear control by S+ with all schedules. For Birds 1 and 42, however, there was relatively more responding to other stimuli with DRL than with any other schedule. Although the other three schedules (FI, VI, FR) produced similar gradients with Bird 1, FI produced less control than VR and FR with Bird 42. The other birds did not receive DRL, but each showed a schedule effect.

Fig. 5. Percentage of total test responses occurring to S+ over the 15 days of discrimination training. Open circles are for the first exposure to the schedule, filled circles are for the second exposure.

For Bird 40, the flattest gradients occurred with FI, and for Bird 46, the flattest gradients were with VR.

Comparisons among schedules were facilitated by computing the per cent of total test responses made to S+ on each day (Fig. 5). For each bird, a 4 x 15 analysis of variance conducted on the single estimates of the degree of control by S+ compared the different schedules and took into account the variability between the first and second exposures. One factor was the four schedules, the other was the 15 days of training, and the error term was the sum of squares for the first and second exposures. As the interaction between schedules and days was not statistically significant, the general shapes of the acquisition curves across days appeared to be similar for the different schedules. For all birds the difference between schedules and the difference between days of training was significant (for both, $p < 0.01$). The source of the days' effect was obvious from Fig. 5: the percentage of responses to S+ increased with successive days of training. Schedule effects were studied by paired comparisons. Bird 1 revealed less control by S+ with DRL than any other schedule, Bird 42 revealed less control by S+ with DRL than with FR, VR, and FI, and more control with FR and VR than with FI, Bird 40 had more control by S+ with FR than with either VI or VR and greater control with FI than with VI, and Bird 46 had more control by S+ with FR than with any other schedule. The consistent results were that DRL always produced the least control by S+, and FR always resulted in at least as much and often more control than did the other schedules.

Response Rates During Phases 1 and 2

The rate of responding when reinforcement was available changed with the onset of discrimination training (Phase 2). Figure 6 shows response rates during Phase 1, to the vertical line during the reinforced intervals on each day of discrimination training, and to all stimuli during the extinction periods of Phase 2. The data shown are for the last schedule studied with each bird and are representative of those observed with the first use of each schedule. Particular types of schedules produced similar behavior in all birds. The rates of responding during the periods of reinforced responding in Phase 2 were higher than in

Phase 1; this increase occurred at the same time that the rate decreased during the extinction (test) periods. The only schedule not shown, DRL, produced similar rate changes: for Bird 1, the rate increased from 0.13 responses per second in Phase 1 to 0.17 responses per second in the reinforcement intervals of Phase 2, and for Bird 42, rate rose from 0.21 to 0.36 responses per second. For both birds, the rate in extinction fell to 0.03 responses per second. With FI, VI, and VR schedules, the rate during reinforcement periods was higher than that of Phase 1 throughout discrimination training; with FR and DRL, the rate declined to the Phase 1 level after reaching a peak during the first 10 days of training.

Fig. 6. Rate of responding during the periods of each day of discrimination training when reinforcement was available (Reinforcement) and when reinforcement was not available (Extinction). The first point shows the average response rate at the end of Phase 1 when reinforcement was always available: The rates for the last five days of Phase 1 were within 0.1 response per second of the value depicted.

Fig. 7. Cumulative records for the five test intervals of the tenth day of discrimination training. Intervals are stacked in order with the first interval at the top. Data are for the second exposure to each schedule.

The rate of responding in extinction was related both to the stimulus appearing on the key and the point in time of the appearance. Cumulative records for the extinction periods of the tenth day of discrimination training with the second application of each schedule (Fig. 7) show the tendency for the rate of responding to be positively accelerated. Extinction began either with a pause in responding or with a burst of responses followed by a pause, and then responding increased. The positive acceleration appeared by the second day and was maintained despite the decreases in the number of responses over the course of discrimination training, and over the five periods of each day.

The positive acceleration during extinction was unrelated to the patterns of responding when food was available for responses. Fixed-interval schedules produced a post-reinforcement pause followed by positively accelerated responding, FR produced a post-reinforcement pause followed by an abrupt shift to responding at a high rate, VR and VI produced a moderate to high steady rate of responding, and DRL produced a low rate of responding that was either steady or slightly negatively accelerated. These patterns are typical of those observed with the same schedules of reinforcement when pigeons are exposed to a single stimulus (Ferster and Skinner, 1957).

DISCUSSION

The period of reinforcement for responses to all of the stimuli eliminated stimulus control, and discrimination training with the vertical line as S+ and all of the stimuli as S- changed this baseline. Although gradients based on absolute numbers of responses were not recovered, relative gradients were similar with each application of a schedule. The occurrence of significant schedule effects based on the relative measure revealed that the procedure was sufficiently sensitive to permit studying variables influencing gradients of stimulus control.

The principal schedule effect was that DRL produced the least control by S+. When these results are taken together with those of Hearst, Koresko, and Poppen (1964), they show that DRL generates less stimulus control than other schedules in first discriminations for naive pigeons and in repeated discriminations for pigeons given the same stimuli under a variety of schedules. The other consistency was that FR produced as steep or steeper gradients than FI, VI, VR, and DRL. This observation fits with several others showing that stimuli correlated with reinforcement on a fixed ratio rapidly obtain a high degree of control over behavior (Dews, 1963; Ferster, 1960; Morse, 1955; Zeiler, 1968).

Although other values of the schedules used might have produced different gradients, experiments that have manipulated schedule size in simple simultaneous or successive discriminations suggest that schedules are inconsistent in this respect. Stimulus control decreased with increases in the mean value of variable-interval schedules (Hearst *et al.*, 1965), but did not change with the size of fixed-ratio schedules (Zeiler, 1968). Comparisons of these two studies are difficult, however, because the first studied different animals at each VI value, and the second used the same birds under all ratios. The considerable similarity in gradients under VI 1-min and VI 2-min schedules and under FI 2-min and FI 5-min schedules in the present study suggested a minimal role of interval size in birds given repeated training and testing.

The effects of various schedules do not appear to be integrated by reference to frequency of reinforcement (reinforcements per second), probability of reinforcement (reinforcements per response), or rate of responding (responses per second). The order of schedules, from highest to lowest, in frequency of reinforcement was DRL, FR, VR, VI, FI; in probability of reinforcement, the order was DRL, FR and VR, FI, VI; in average rate of responding, the order was FR, VI or VR depending on particular values, FI, and DRL. Thus, FR and DRL were most alike in frequency and probability of reinforcement, but produced the largest differences in stimulus control. In terms of response rate, DRL produced both a much lower rate and less control by S+ than did FR, VR, FI, or VI. However, although FI, the schedule closest in response rate to DRL, produced less control than did FR, VR, or VI for some birds, FI produced a high level of control by S+ together with a low response rate in others. Hearst's (1965) detailed review also showed that schedule influences on stimulus control cannot be attributed to differences in average response rate.

The enhanced rate of responding maintained by all schedules during discrimination training is an example of behavioral contrast. Behavioral contrast has been demonstrated whenever one stimulus is correlated with reinforced responding and another stimulus is correlated with the absence of reinforcement and the stimuli appear successively (see the review and data of Reynolds and Catania, 1961,

for descriptions of contrast obtained with the types of schedules studied in the present experiment).

That FI, VI, and VR schedules produced contrast throughout the discrimination training phase, whereas FR and DRL had more transitory effects, suggests the influence of particular reinforcement schedules on maintained enhanced responding. Although both discrimination and contrast depend on differential reinforcement and on particular reinforcement schedules, the same schedule can influence the two aspects of behavior differently. This possibility is illustrated by the observation that FR and DRL, which produced clear differences in stimulus control, had similar influences on contrast.

In agreement with Ferster's (1960) finding in experiments involving matching-to-sample, characteristic patterns of responding recurred with each application of a schedule despite the frequency of stimulus changes during acquisition. Another regularity was the pattern of responding during extinction: responding was positively accelerated over the wide range of response rates generated by the different schedules. Similar patterns of responding in the presence of a stimulus correlated with extinction when it alternated with one correlated with reinforcement were reported by Morse (1955).

The present experiments did not show whether repeated nondifferential reinforcement with all stimuli followed by discrimination training will yield conclusions similar to those of procedures not involving reinforced responding to all stimuli, or about the type of problem for which the advantages of studying variables in the same individual must be sacrificed in favor of experimental naivete. The literature does suggest, however, that a variety of problems in stimulus control are amenable to study with single organisms. Reynolds (1961) investigated reinforcement and extinction gradients and Blough (1961) was able to study gradients produced at various locations on the wavelength continuum in the same subjects; Lyons and Thomas (1967) reported that the extent of control by S+ could be changed and recovered by varying the type of training with a stimulus lying on another dimension; Sidman and Rosenberger (1967) and Boren and Devine (1968) were able to use the same subjects to explore and replicate an

analysis of the significant variables controlling sequential spatial discriminations. These promising results suggest that there may be nothing inherent in the problems of stimulus control to prevent studying the same individual repeatedly.

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