A TEST FOR POSITIVE TRANSFER IN SUCCESSIVE OPERANT DISCRIMINATION LEARNING

by

E. MARIE BRODIE

B.A. University of South Carolina at Aiken, 1986

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Psychology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1989

Approved by:

Jerome Frieman

Major Professor

Acknowledgments

I would like to thank Dr. Frank Saal and Dr. Stephen Kiefer for serving on my thesis committee. I also would like to express my gratitude to Doug Gragson for preparing the graphs in this document.

Finally, I would like to thank Dr. Jerome Frieman for his encouragement and professional guidance during the preparation of my thesis. Jerry Frieman has found the perfect balance of friendship and mentorship that has been so helpful during my graduate training.

TABLE OF CONTENTS

List of Figures

List of Tables

INTRODUCTION

The enhancement of subsequent performance by prior experience is called positive transfer of training. When prior experience is more than just practice on the following test, task, or problem, we call it non-specific transfer. For example, in successive operant discrimination training, non-specific positive transfer occurs when discrimination training with one stimulus dimension facilitates the acquisition of a discrimination involving a new stimulus dimension.

Non-specific positive transfer effects have been reported with different species (e.g., Thomas, Miller, & Sviniki, 1971), across stimulus modalities (Eck, Noel, & Thomas, 1969; Goyette, 1973), and across response classes (Frieman & Goyette, 1973). Non-specific positive transfer effects also have been found to occur following massed extinction training (Goyette, 1973), following errorless discrimination training (Keilitz & Frieman, 1970), following changes in context (Newlin & Thomas, 1979; Deeds, 1979), and following conditional discrimination training (Goyette & Frieman, 1973). These transfer effects also have been found to be related to the length of exposure to the negative stimulus in the prior discrimination (Keilitz, 1971).

Thomas, Miller, and Sviniki (1971) used a procedure typical of these studies. In their experiment, rats in a true discrimination (TD) group were given successive operant (go/no go) discrimination training between two intensities of the houselight. Responding was reinforced during a high intensity houselight and was not reinforced during a low intensity houselight. Subjects in a pseudodiscrimination (PD) group were given successive presentations of the two intensities of the houselight, but reinforcement and nonreinforcement were not correlated with either stimulus. Finally, the subjects in a single stimulus (SS) group were only exposed to the more intense houselight and reinforced for responding in its presence. In the second phase of this experiment, all groups were trained to discriminate between two successively presented tones--a 2500 Hz and a 4500 Hz tone. The TD group mastered the tone discrimination significantly more rapidly than either the PD or SS groups. The superior performance of the TD group relative to the other groups was interpreted in terms of positive transfer of training.

THEORIES OF GENERAL TRANSFER EFFECTS

Several explanations for such non-specific transfer effects have been offered. They are the general attention hypothesis (Thomas, 1969, 1970), the learning to not respond hypothesis (Frieman, 1976; Goyette, 1973; Goyette & Frieman, 1973), and the blocking by contextual cues hypothesis (Mackintosh, 1977).

The General Attention Hypothesis. Thomas (1969,1970) proposed that non-specific transfer effects are due to the subject experiencing a heightened "general attentiveness" to stimulus differences from the first task. According to Thomas, in order to learn a discrimination task, subjects must learn which stimuli are relevant to solving the task as well as what response to make in the presence of those stimuli. In this way, subjects learn to pay attention to stimulus differences in general. This state of general attention is hypothesized to enhance performance on a subsequent discrimination task.

Pseudodiscrimination training, on the other hand, teaches subjects that external stimuli are not valid predictors; thus, subjects decrease attention to stimuli which do not predict significant events such as rewards. According to Thomas, subjects receiving this training generalize this experience to the later discrimination task. Such generalization leads to poor performance because stimuli are important predictors of reward in a true discrimination task.

The general attention hypothesis considers single stimulus training as the proper control group because these subjects are not exposed to stimulus differences. Single stimulus subjects are expected to learn about the relative validity of different stimuli in the test discrimination without prior single stimulus training either enhancing or interfering with performance.

This hypothesis predicts that prior discrimination training (TD) will result in enhanced performance and prior pseudodiscrimination training (PD) in poorer performance on a subsequent discrimination task when compared with prior single stimulus (SS) training. Thomas' hypothesis accurately predicts non-specific transfer effects for subjects given prior TD training relative to SS groups. However, no significant differences have been reported between the PD and SS groups (e.g., Eck, Noel, & Thomas, 1969).

The Learning to Not Respond Hypothesis. Perkins and Cacioppo (1950) demonstrated that a subject's rate of extinction will increase with each successive extinction series following conditioning and reconditioning. This suggests that extinction is not the unlearning of prior conditioning but the learning of how to behave when reinforcement is no longer given. According to the learning to not respond hypothesis, non-specific transfer effects are mediated by an acquired learned response of "not responding" during the first discrimination carrying over to affect performance on the second discrimination.

In most non-specific transfer studies (e.g., Eck, Noel, & Thomas, 1969; Keilitz & Frieman, 1970; Eck & Thomas, 1970; Frieman & Goyette, 1973; and Goyette & Frieman, 1973), the transfer effects were due to differences in the rate of responding to the negative stimulus in the test discrimination. Subjects exposed to the prior TD task had a rapid reduction in response rate to the negative stimulus (S-) on the subsequent test discrimination; prior PD and SS training produced slower reductions in response rate to S- on the subsequent test discrimination.

In prior PD training, subjects must respond to both stimuli to receive reinforcement. According to the adherents of this theory, the subjects do not have the opportunity to acquire a response of "not responding" in the first task. Subjects who receive prior SS training also do not have an opportunity to acquire this response. Thus, TD training leads to positive transfer on a subsequent discrimination task relative to the PD and SS groups because only the former group has learned how to react to extinction. This hypothesis would suggest that any experience prior to the successive operant discrimination that teaches subjects to withhold responding would result in positive transfer.

EMPIRICAL EVIDENCE

One of the several studies that supports the predictions of the general attention theory is that of Eck, Noel, and Thomas (1969). Subjects were divided into four groups: TD, no line control (NLC), PD, and SS. The TD and NLC groups received discrimination training in Stage 1 with a vertical line for the positive stimulus (S+) and a 60 degree line angle as the negative stimulus (S-). In Stage 2, all groups received TD training with S+ being a 555 nm (green) light and S- being a 538 nm (blue-green) light. Both S+ and S- had a vertical line superimposed over it for the TD, PD, and SS group, but not for the NLC group. The TD group mastered the discrimination in Stage 2 at the same rate as the NLC group. The authors concluded that this supports a notion of general attention in that the vertical line that previously was S+ for the TD group did not subsequently hinder performance on the successive operant discrimination task when the vertical line was superimposed on both S+ and S- in the test discrimination.

Eck and Thomas (1970), in a replication of the study just described, superimposed the previous S- stimulus on the response key during the TD test phase instead of the S+ stimulus. Again, the TD group mastered the discrimination task more rapidly than the PD group; attention to the line did not prevent the TD group from learning the role of another orthogonal stimulus. Clearly, these experiments point to a general, non-stimulus specific mechanism like general attention.

Keilitz and Frieman (1970) gave three groups of pigeons either errorless discrimination training (ETD), TD, or SS training. The purpose of errorless training was to eliminate experience with extinction in the prior discrimination by reducing the amount of responses made to S-. In errorless discrimination training, subjects are exposed to S- at lowered intensities and keypecking is never shaped. The intensity of the stimulus is slowly increased to its normal intensity. These periods of exposure to S- are alternated with periods of S+ when keypecking is shaped and reinforced. On a subsequent discrimination task orthogonal to the first, the ETD group performed as well as the TD group. The authors concluded that because the ETD group had minimal exposure to nonreinforcement, general attention to the different stimulus conditions was responsible for the results. Thus, the experiment was also taken as support for the general attention hypothesis.

Goyette and Frieman (1973) provided further support for the general attention hypothesis in an experiment using a conditional discrimination instead of the usual successive go/no go discrimination. A conditional discrimination was used to eliminate learning to not respond on the discrimination task. Subjects in the TD group were reinforced for keypecking during a 555 nm (green) light and for ring pulling during a red houselight. Two single stimulus groups were used as controls. One SS group was trained to ring pull for reinforcement and the other was trained to key peck for reinforcement. All subjects were then given a successive go/no go discrimination between two auditory stimuli. The purpose of the conditional discrimination in Phase 1 was to rule out an explanation of the results based on the learning to not respond hypothesis. The conditional TD group learned the go/no go auditory discrimination task significantly more rapidly than the single stimulus groups.

However, the results of the aforementioned studies can certainly be explained in terms of the learning to not respond hypothesis. If the conditions which produced such learning were expanded to include errorless discrimination training (where subjects were trained to respond in the presence of one stimulus and to not respond via a fading procedure in the presence of another stimulus) and conditional discrimination training (where subjects must refrain from one response to perform another response), then the learning to not respond hypothesis was also applicable.

Other experiments apply more directly to the learning to not respond hypothesis. Goyette (1973) gave four groups of pigeons either TD, PD, SS, or massed extinction (ME) training with chromatic stimuli. All groups were subsequently given a successive operant discrimination task with auditory stimuli. The two ME groups and the TD group mastered the discrimination task significantly more rapidly than the SS or PD groups. These results correspond with the hypothesis that prior training to not respond (in the absence of explicit discrimination training) facilitates learning on a subsequent discrimination task.

Further support is provided by Keilitz (1971). He gave subjects varying exposures to S- in prior discrimination training, either 0 seconds (which is SS training), 20 seconds, 1 minute, 3 minutes, or 9 minutes duration of S-. Subjects were then given a discrimination task with a stimulus dimension orthogonal to the first task where S- was of the same duration for all subjects. The subjects with the longest exposure to S- in the first phase learned the test discrimination task more rapidly than the subjects with successively less exposure to S-. Keilitz concluded that these data also support the learning to not respond hypothesis.

Blocking by Contextual Cues--A third alternative. Another possible explanation of transfer effects is a modified form of stimulus selection theory (Wagner, 1969). This theory states that cues in the environment compete for control over the behavioral effects of reinforcement and nonreinforcement. If one cue becomes a signal for reinforcement, it will block or retard learning about other cues. Extending this concept, Mackintosh (1977) proposed that "since instrumental responses are typically reinforced only in a particular situation, some aspects of that situation should gain control over responding" (p.491). The context of an operant experimental chamber provides such competing cues--the houselight, the interior of the chamber, masking noise, etc.

According to the blocking by contextual cues hypothesis, the experimental chambers will gain control over the behavior of subjects exposed to single stimulus training and pseudodiscrimination training because these stimuli are as predictive of reinforcement as the stimuli on the response key. When subjects are given a discrimination task involving novel stimuli in the same context in which they received prior PD or SS training, the control of responding by the context interferes with the acquisition of the discrimination task. This results in inferior performance for PD and SS groups compared to TD groups.

On the other hand, in discrimination training, the stimuli correlated with reinforcement and nonreinforcement are more predictive of reinforcement than the context. That is, the contextual stimuli are the same during periods of reinforcement and nonreinforcement, and the discriminative stimuli are the only valid predictors of reinforcement and nonreinforcement. For subjects given prior TD training, the context is hypothesized not to interfere with performance on the new discrimination. Likewise, if subjects are given prior ME, the context will lose control of responding. In both cases, the context should not block the acquisition of new discriminations.

Clearly, the typical results from studies of non-specific transfer can be explained as blocking by contextual cues: prior PD or SS training allows contextual cues to interfere with performance on a subsequent discrimination task--this interference leads to negative transfer. Prior TD or ME training prevents contextual cues from gaining control of responding and thus interfering with performance of a subsequent discrimination for these groups. If interference by context leads to negative transfer in PD and SS groups, it becomes unclear whether the relative advantage of TD and ME training reflects positive transfer. The possibility of negative transfer from PD and SS training is an indication of the inappropriateness of these as control groups.

An experiment by Welker, Tomie, Davitt, and Thomas (1974) provides some support for a blocking hypothesis. Subjects were given SS training with a darkened response key in the presence of a houselight and a 1000

Hz tone. In Stage 2, all subjects were given a TD task. One group experienced the houselight and tone only during S+ periods, one group experienced the houselight and tone only during S- periods, and one group experienced the houselight and tone during both S+ and S- periods. Pairing the contextual stimuli with S+ on the discrimination task enhanced performance and pairing them with S- on the discrimination task retarded performance. The group with context paired with S+ and S- performed worse than the group exposed to S+ paired with contextual stimuli and better than the group with the contextual stimuli paired with S-. The group with the context paired with S+ and S- sustained responding to S- on the discrimination task. Welker et al. concluded that contextual stimuli in single stimulus training are highly significant in controlling operant responding and these contextual stimuli may block other sources of stimulus control in a discrimination task.

Utilizing Pavlovian procedures, Tomie (1976) also demonstrated how contextual cues can interfere with later training. In a set of experiments, Tomie showed that pretraining with unpredictable conditioned stimulus-unconditioned stimulus (CS-US) presentations only interfered with the acquisition of subsequent autoshaping when that autoshaping training was in the same context as the exposure to unpredictable CS-US pairings. Tomie altered the lining of the experimental chambers as contextual cues. He also demonstrated that nonreinforced exposure to the chamber could extinguish the context's interference with autoshaping. Blocking by contextual cues can account for certain aspects of transfer of training with Pavlovian conditioning as well as with operant conditioning.

Farmer (1975) first suggested that prior TD training does not lead to positive transfer, but that prior PD and SS training may lead to negative transfer. Using pigeons, Farmer found that intervening PD or SS training interferes with prior exposure to a TD task. Her experiment consisted of three phases. Two groups had either PD or SS training intervening between two TD tasks. A third group had a hold period between two TD tasks, and another group had two TD tasks with a hold period in the first phase. Two final groups had either PD or SS training followed by two TD tasks. The groups with intervening PD or SS training between two TD tasks had poorer performance on the final TD task in comparison to the groups with no intervening PD or SS training, or with PD or SS training followed by the two TD tasks. These results show that PD and SS disrupt performance on a subsequent TD task. In a second experiment, TD training followed by SS training was again found to disrupt performance on a final TD task. That intervening PD or SS training dirsrupts performance on the final TD task for groups first receiving TD training suggests that PD and SS training lead to negative transfer. If PD and SS training both lead to negative transfer, then the role of SS training as a control group becomes questionable.

Deeds (1979) also suggested that prior TD training may not lead to positive transfer by attempting to demonstrate the role that contextual cues play in transfer studies. Deeds suggested that prior TD training may not facilitate performance on a subsequent discrimination task--it simply fails to retard subsequent discrimination performance as SS and PD training do. He hypothesized that when contextual cues remain the same from PD or SS training to a TD task, subsequent TD performance would be hindered. This would indicate that SS and PD training lead to negative transfer. If the context changes from prior PD or SS training to TD training, then it is hypothesized that either of these prior trainings will have no effect on subsequent TD training. In prior TD training, the discriminative stimuli are better predictors of reinforcement availability than the context and thus have more control over responding than the context. Changing the context should not affect the influence of TD training on subsequent TD performance in a transfer task. Here again, positive transfer remains indeterminate when comparing TD groups to PD and SS groups that experience negative transfer.

Deeds (1979) tested the role of context in transfer of training by exposing TD, PD, SS, and ME (massed extinction) groups to prior training in one context and a test TD task in a different context. The change in context for the PD and SS groups was expected to remove any negative transfer effects and these groups were expected to perform as well as the TD and ME groups on the TD task. This would indicate that contextual cues mediate the negative transfer of the PD and SS groups. Deeds found that groups receiving SS training in a different context from the test discrimination did perform as well as groups receiving prior TD training. However, the groups receiving PD training in a different context from the test discrimination did not perform as well as the groups receiving prior TD.

Deeds concluded that the results partially support a blocking by contextual cues hypothesis which implies that general transfer effects are due to negative transfer from PD and SS training rather than positive transfer from TD or ME training. Context changes removed the negative transfer effect for the SS group, but not for the PD group. Without a context change, both groups did poorly on the discrimination task.

In a second experiment, Deeds (1979) exposed pigeons to either TD or SS training in one context; both groups then received TD training to a novel stimulus in a different context. Other TD and SS groups received the subsequent TD task in the same context as their prior training. A single stimulus group receiving both SS and TD training in the same context performed poorly on the subsequent TD task. Deeds hypothesized that when the context does not change for the SS group, the contextual cues during SS training may gain control of responding and block the acquisition of control by subsequently presented discriminative stimuli. When the SS subjects received subsequent TD training in a different context from their prior training, they did not differ from the groups receiving prior TD training. Thus it appears that changing the context from SS to TD training removed the control of the context. Deeds concluded that the results support a blocking by contextual cues hypothesis.

All of the aforementioned experiments suggest that general transfer effects are due to negative transfer from PD and SS training rather than positive transfer from TD or ME training.

In all of the early non-specific transfer experiments, single stimulus training was considered the appropriate control group because its subjects were not exposed to stimulus differences prior to the TD task. This lack of exposure to stimulus differences was expected to eliminate the possibility of either positive or negative transfer. Therefore, the SS group was expected (according to the general attention hypothesis) to outperform the PD group, but do poorer than the TD group on the subsequent TD task. However, the PD and SS groups performed similarly on the subsequent TD task in addition to performing worse than the TD group (e.g., Thomas, Miller, & Sviniki, 1971; Eck, Noel, & Thomas, 1969, 1970; Goyette, 1973). The single exception is Deeds' (1979) finding that PD performed worse than SS when the context changed. The non-neutrality of SS training casts doubt on the conclusion that TD leads to positive transfer of training.

Subjects receiving PD training in the previously mentioned studies were expected to perform poorly on subsequent discrimination training (relative to subjects receiving TD training) either because they need not attend to the stimuli (general attention hypothesis), they do not learn a pattern of not responding to the negative stimulus or, as Deeds (1979) suggests, the contextual cues predict reinforcement as well as the stimuli in PD training and thus control responding in the subsequent TD task. Past research clearly indicates that SS groups typically perform as poorly as PD groups on subsequent TD tasks.

The poor performance of SS and PD groups indicates the need for a proper control condition to determine if prior TD training does lead to positive transfer. In the absence of such a control condition, one cannot evaluate the general attention hypothesis and the learning to not respond hypothesis. Both these hypotheses are based on the occurence of positive transfer following TD training. The purpose of the present experiment was to use a more appropriate control group than an SS group to determine if prior TD training does lead to positive transfer.

The general plan of the present experiment was to compare three groups that were exposed to different amounts of TD training prior to the tested discrimination task. One group was trained to peck and then was exposed to the test discrimination--they were not exposed to prior training known to lead to negative transfer. Another group learned a line angle discrimination before learning the test discrimination, and a final group learned both a chromatic and a line angle discrimination before learning the test discrimination. The test discrimination was an auditory discrimination in all cases. Comparing groups with differing levels of exposure to TD training should eliminate the problem of assessing transfer by comparing a TD group with groups exposed to training that may lead to negative transfer (i.e., SS and PD training). This should clarify whether TD leads to positive transfer or simply does not hinder performance on a final TD task as prior PD and SS training appear to do.

METHOD

Subjects

The subjects were 18 experimentally naive pigeons maintained at 80% of their free feeding weight for the duration of the experiment.

Apparatus

This experiment was performed in three operant conditioning chambers having approximately identical internal dimensions of 32 cm X 26 cm X 34.5 cm. The experimental chambers are constructed of 3/4 inch plywood and have wire mesh floors approximately 1 cm from the floor of the chambers. Located on one wall of each chamber was a response key 17.5 cm from the floor. Below this key, 5 cm from the floor, was a 5.2 cm X 6.4 cm opening allowing access to a grain hopper. A 7 watt, 110 volt houselight was mounted on the wall opposite the response key and was diffused by a styrofoam covering. This light provided illumination except during blackouts and reinforcement presentations. During the latter events, the grain hopper light was illuminated. Visual stimuli were projected onto the response key by Industrial Electronics display cells equipped with General Electric No. 44 miniature lamps. Chromatic stimuli of peak wavelengths 538 nm and 555 nm were produced by Kodak Wratten filters No. 99 and 74 in the display cells. The display cells also produced a white line .32 cm wide X 2.22 cm high in a sixty degrees from horizontal and a ninety degree (vertical) position. White noise produced by a homemade white noise generator, and a 1000 Hz tone produced by a Hewlett-Packard audio oscilator Model 201CR were used as auditory stimuli.

Automatic relay programming equipment for all chambers located in an adjacent room was used to record responding. Ventilating fans attached to the experimental chambers provided masking noise.

Procedure

The eighteen subjects were divided into three groups of six subjects each. Utilizing a Latin square design, the subjects were assigned to one of the three operant chambers so that two subjects from each group were trained in each of the three operant chambers.

Preliminary Training. On Day 1, all subjects were magazine trained and hand shaped to peck at a key illuminated by a light of 555 nm for approximately 30 reinforcers on a continuous (CRF) schedule. The next day, subjects received 30 more reinforcers on CRF. On day 3, subjects received 30 reinforcers on a variable interval 10-s schedule of reinforcement (VI 10-s) and on Day 4, they received 30 reinforcers on a VI 20-s schedule. For the next three days, subjects received VI 30-s training such that each day consisted of 15, 1-min stimulus on periods separated by 10-s blackout periods during which the response key was darkened. No reinforcement was available during blackout periods.

Phase 1. Only one of the three groups was exposed to the Phase 1 discrimination training. This group is referred to as the Three Discriminations Group and is designated G3. In Phase 1, each daily session for this group consisted of 30 stimulus on periods of 1-min duration separated by 10-s blackouts. The positive stimulus (S+) was a 555 nm light and the negative stimulus was a 538 nm light. In the presence of S+, responses were reinforced according to a VI 30-s schedule, and in the presence of S-, no responses were reinforced. Stimulus periods were randomly alternated with the restriction that no more than two S+ or S- periods would appear successively and within each block of 10 stimulus presentations S+ and S- would appear five times each. Each subject in G3 received Phase 1 training until a criterion of three consecutive days of responding at a rate of 10 responses to the positive stimulus for each response to the negative stimulus was attained.

Phase 2. The second group, referred to as the Two Discriminations Group and designated G2, received Phase 2 training following preliminary training. Each subject in G3 received Phase 2 training directly following completion of Phase 1 training.

In this phase, the subjects were given 15 days of discrimination training between a 90 degree white line superimposed on a 555 nm surround as the positive stimulus and a 60 degree white line superimposed on a 555 nm surround as the negative stimulus. In the presence of S+, keypeck responses were reinforced on a VI 30-s schedule and in the presence of S-, no responses were reinforced. Each daily session of discrimination training consisted of 30 stimulus on periods of 1-min duration and positive and negative stimulus periods alternated in quasi-random sequence with the same restrictions as used in Phase 1 discrimination training.

Phase 3. The third group, referred to as the One Discrimination Group and designated G1, received Phase 3 training only following preliminary training. The subjects in G2 and G3 received Phase 3 training following the fifteenth day of Phase 2 training.

In this phase, the subjects were given 10 days of discrimination training between a 1000 Hz tone as the positive stimulus and white noise as the negative stimulus. The response key was illuminated by a 555 nm light with a 90 degree line superimposed on it during both positive and negative stimulus periods. In the presence of S+, keypeck responses were reinforced on a

VI 20-s schedule and in the presence of S-, no responses were reinforced. Each daily session of discrimination training consisted of 20 stimulus on periods of 1-min duration and positive and negative stimulus periods alternated in quasi-random sequence with the same restrictions as used in Phase 1 discrimination training.

Data Analysis. Individual rates of responding to the positive and negative stimuli were computed for each session of Phase 2 and Phase 3 discrimination training. These response rates were converted to a discrimination index which was the percentage of the total responses which were made to S+. This percentage was used as an index of the overall discrimination performance and transfer of training effects in Phase 2 and Phase 3.

RESULTS

Phase 1. The average number of days required to reach criterion on the wavelength discrimination was 5.67 with a range of 4-9. Group G3 was the only group exposed to this discrimination.

Phase 2. The two groups, G2 and G3, were given the line angle discrimination task in Phase 2 for 15 consecutive days.

A discrimination index score was also calculated for each subject for the 15 days of Phase 2 training. The mean group discrimination index scores for groups G2 and G3 during Phase 2 are presented in Figure 1. The values plotted represent group means calculated from individual discrimination indices.

The lack of meaningful differences between these groups is apparent; therefore, no statistical test was performed. If positive transfer results from true discrimination training, a difference between the two discrimination indices would be expected here.

The mean group response rates emitted in the presence of S+ for the groups G2 and G3 during Phase 2 are presented in Figure 2 and the mean group response rates emitted in the presence of S- for the groups G2 and G3 are presented in Figure 3. The values plotted represent group means calculated from individual response rates.

A Groups X Days analysis of variance (ANOVA) of the mean response rates to S+ in Phase 2 yielded

Figure Caption

Figure 1. Mean group discrimination index scores for groups G2 and G3 during the 15 days of the Phase 2 discrimination.

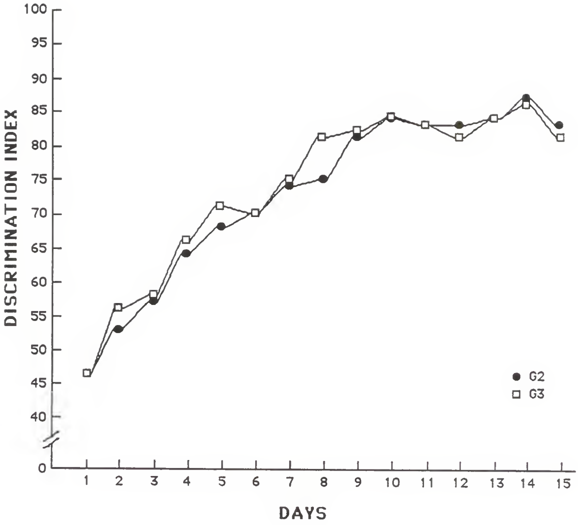
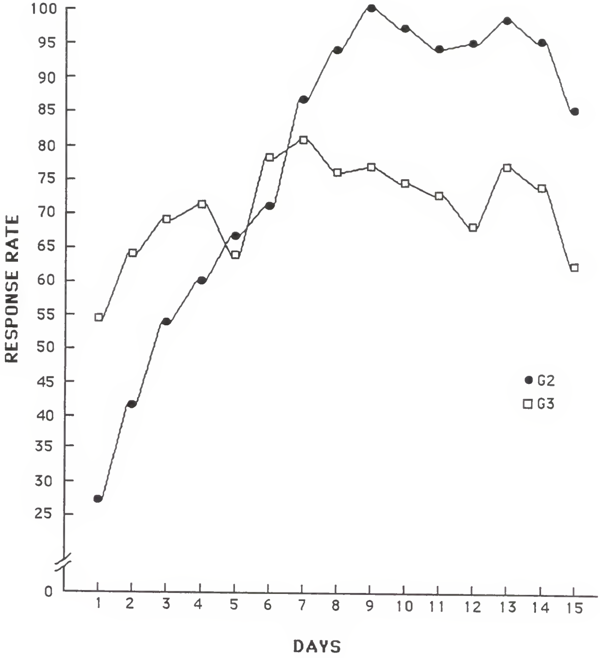

DISCRIMINATION INDEX
100
95
90
85
80
75
70
65
60
55
50
45
40
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DAYS
G2
G3

Figure Caption

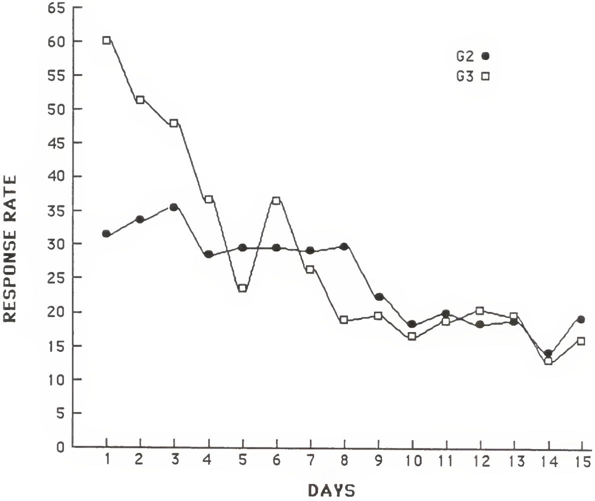
Figure 2. Mean group response rates to the positive stimulus (555 nm light with 90 degree line) for groups G2 and G3 for the 15 days of Phase 2.



100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0
RESPONSE RATE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DAYS
G2
G3

Figure Caption

Figure 3. Mean group response rates to the negative stimulus (555 nm light with 60 degree line) for groups G2 and G3 for the 15 days of Phase 2.



65
60
55
50
45
40
35
30
25
20
15
10
5
0
RESPONSE RATE
G2
G3
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
DAYS

statistically significant differences for Days, $F(9,90) = 12.40$, $p<.01$, omega squared = .19, and the Groups X Days interaction, $F(9,90)= 4.12$, $p<.01$, omega squared = .05. No reliable Group effect was found (see Table 1). The significant Day effect reflects changes in response rates over the 15 days of Phase 2 training.
From Figure 2 it can be seen that the significant Groups X Days interaction was due to the sharper increase in responding to S+ over the days for the group G2.

A Groups X Days ANOVA of the mean response rates to S- in Phase 2 yielded significant differences for Days, $F(9,90) = 6.23$, $p<.01$, omega squared = .15, and for the Groups X Days interaction, $F(9,90) = 2.50$, $p<.01$, omega squared = .04 (see Table 2). The significant interaction effect represents a carryover of behavioral contrast from the prior discrimination for the group G3 in which responses to S- were maintained on the first few days of training before decreasing in rate (see Figure 3). The lack of statistical differences in response rates to the positive and negative stimuli for the two groups is a further indication of no positive transfer.

TABLE 1

Analysis of variance of the mean response rates to the positive stimulus in Phase 2.

Source	DF	MS	F
Between Subjects			
Group	1	290280.03	.952
Error	10	75124875.00	
Within			
Days	9	30266991.00	12.40 *
Group X Days	9	10064206.00	4.12 *
Error		2440266.40	

* p<.01

TABLE 2

Analysis of variance for the mean response rate to the negative stimulus in Phase 2.

Source	DF	MS	F
Between subjects			
Groups	1	7519012.00	.605
Error	10	26427231.00	
Within			
Days	9	11022819.00	6.23 *
Groups X Days	9	4426008.70	2.50 *
Error	90	1769591.00	

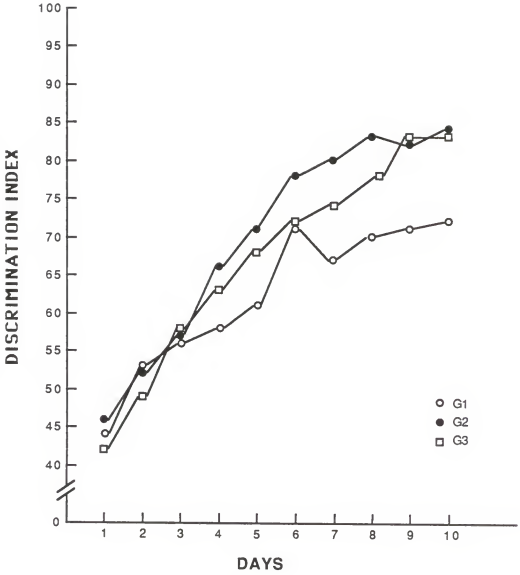
* $p < .01$

Phase 3 The three groups, G1, G2, and G3, were given the auditory discrimination task in Phase 3 for 10 consecutive days. The mean group discrimination index scores for the groups G1, G2, and G3 during the Phase 3 are presented in Figure 4. The values plotted represent group means calculated from individual discrimination indices.

A Groups X Days analysis of variance (ANOVA) of the mean discrimination indices yielded a statistically significant effect for Days, $F(9,135) = 63.70$, $p<.01$, omega squared = .63, but not for Groups or Groups X Days (see Table 3). The significant Days effect reflects changes in the acquisition of the discrimination task over the ten days of training. The nonsignificant Group effect suggests that the three groups acquired the discrimination at similar rates. The nonsignificant Group X Days interaction indicates that all of the groups exhibited similar patterns of acquisition during the ten days of Phase 3 training. Although the course of acquisition of the control group G1 appears to be different from that of the groups G2 and G3 (see Figure 4), the results of the ANOVA

Figure Caption

Figure 4. Mean group discrimination index scores for Groups G1, G2, and G3 for the 10 days of the Phase 3 discrimination.



DISCRIMINATION INDEX
100
95
90
85
80
75
70
65
60
55
50
45
40
0
1
2
3
4
5
6
7
8
9
10
DAYS
G1
G2
G3

Table 3

Analysis of variance of the mean discrimination indices of the auditory discrimination task of Phase 3.

Source	DF	MS	F
Between Subjects			
Groups	2	897.49	2.62
Error	15	342.25	
Within			
Days	9	2798.14	63.70 *
Groups X Days	18	66.72	1.52
Error	135	43.93	

* $p < .01$

indicate that all of the groups acquired the Phase 3 discrimination at similar rates. This indicates that neither of the experimental groups exhibited positive transfer compared to the control group.

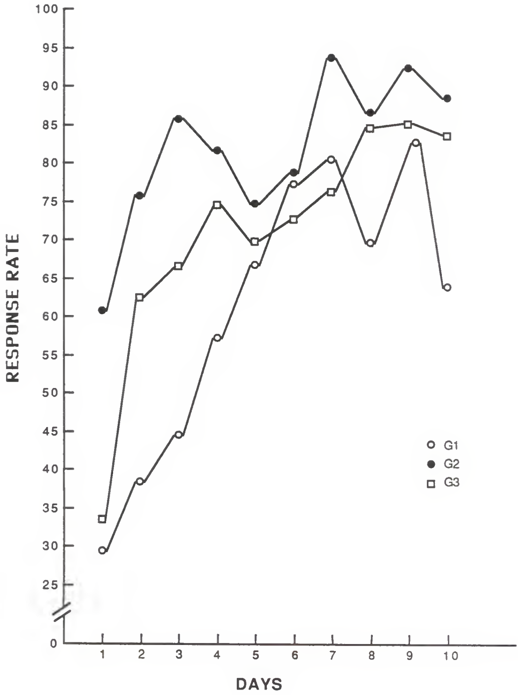
The mean group response rates emitted in the presence of S+ and the mean group response rates emitted in the presence of S- for the groups G1, G2, and G3 during Phase 3 are presented in Figures 5 and 6, respectively. The values plotted represent group means calculated from individual response rates.

A Groups X Days ANOVA of the mean response rates to S+ in Phase 3 yielded significant differences for Days, $F(9,135) = 14.41$, $p<.01$, omega squared = .12, but not for Groups or Groups X Days (see Table 4).

A Groups X Days ANOVA of the mean response rates to S- in Phase 3 revealed a significant effect for Days, $F(9,135) = 19.70$, $p<.01$, omega squared = .36, and for the Groups X Days interaction, $F(9,135) = 4.37$, $p<.01$, omega squared = .15 (see Table 5). The significant Days effect reflects changes in response rates over the ten days of Phase 3 training. The significant Groups X Days interaction was due to a carryover of behavioral contrast from prior training for the group G3 in which responses to S- were maintained at rates similar to the levels of responding to S+ for the first two days of Phase 3 training. The lack of significant Group effects for S+ and S- is a further indication of no positive transfer of training relative to the control group.

Figure Caption

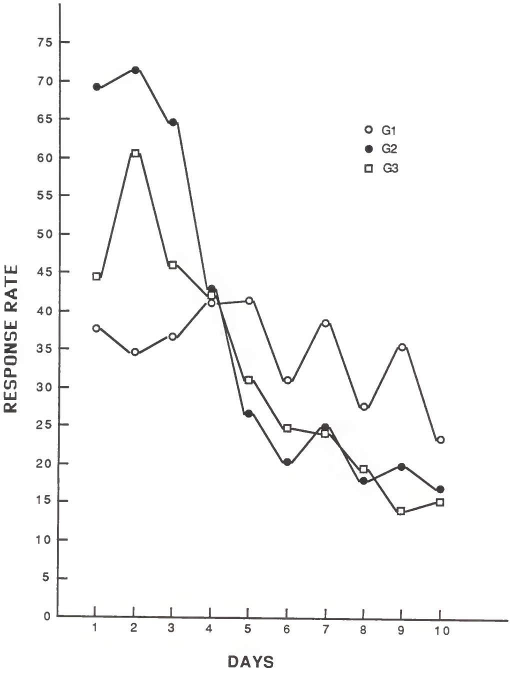
Figure 5. Mean group response rates to the positive stimulus (555 nm light with 90 degree line and 1000 Hz tone) for Groups G1, G2, and G3 for the 10 days of Phase 3.



100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0
RESPONSE RATE
1
2
3
4
5
6
7
8
9
10
DAYS
G1
G2
G3

Figure Caption

Figure 6. Mean group response rates to the negative stimulus (555 nm light with 90 degree line and white noise) for Groups G1, G2, and G3 for the 10 days of Phase 3.



75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
RESPONSE RATE
G1
G2
G3
1
2
3
4
5
6
7
8
9
10
DAYS

Table 4

Analysis of variance of the mean response rate to the positive stimulus in Phase 3.

Source	DF	MS	F
Between Subjects			
Groups	2	64673117	1.00
Error	15	64882538	
Within			
Days	9	32620717	14.41 *
Groups X Days	18	3542107.40	1.57
Error	135	2263011.40	

* $p < .01$

Table 5

Analysis of variance of the mean response rate to the negative stimulus in Phase 3.

Source	DF	MS	F
Between Subjects			
Groups	2	396824.20	.48
Error	15	8185911.00	
Within			
Days	9	32392385.00	19.70 *
Groups X Days	18	7191092.80	4.37 *
Error	135	1644121.90	

* $p<.01$

DISCUSSION

In the present study, three groups of pigeons were given varying amounts of prior TD training before comparing the groups on a final successive operant discrimination task. The group with no TD training prior to the final auditory TD task served as the baseline or control group. The major finding of the present study was the absence of positive transfer of training from prior TD training relative to a control group with no prior TD training. Within the parameters of this experiment, additional TD training did not facilitate non-specific transfer.

The purpose of the present experiment was to use a more appropriate control group than an SS group to determine if prior TD training leads to positive transfer in successive operant discrimination training. Past transfer of training studies have typically compared groups with prior TD, SS, or PD training on a subsequent TD task to determine transfer effects. When TD groups are compared to PD and SS groups, the possibility that prior PD or SS training lead to negative transfer makes it unclear whether prior TD training leads to positive transfer. To determine if prior TD training leads to positive transfer of training, TD groups should be compared to a control group that does not experience training that results in negative transfer.

Several studies support the claim that prior SS training leads to negative transfer on a subsequent discrimination task. Farmer (1975) concluded that PD and SS training lead to negative transfer by demonstrating that when either PD or SS training intervenes between two TD tasks, performance on the second TD task is hindered. This disruptive effect of intervening SS indicates the nonneutrality of this group.

Deeds (1979) also concluded that prior TD training does not lead to positive transfer of training. Using PD and SS groups for comparison, Deeds (1979) found that PD and SS training, when given in the same context as the test TD task, hinder performance on the final TD task. SS training would not be expected to hinder TD performance to the degree of a PD group if it were a neutral control group. The results of the present study are similar to Deeds' (1979) conclusion that TD does not lead to positive or negative transfer.

Transfer of training studies typically have been done to discover the conditions under which transfer occurs and to discover the mechanisms underlying it. Three hypotheses have been proposed to explain transfer of training, but all of the past research designed to test them has used SS or PD for control groups. I used a different control group to study transfer of training without attempting to test directly any of the three current explanations of transfer of training. Nevertheless, the present results have implications for the three hypotheses dealing with transfer of training.

The general attention hypothesis predicts that prior TD training will lead to positive transfer of training because the subjects learn a general attentiveness that aids them in later discriminations. This result was not demonstrated in the present study. The two groups with exposure to prior TD problems did not perform better on a test discrimination when compared to a group with no prior experience with discrimination training. If prior TD training were leading to an enhanced attentiveness that results in positive transfer, one would expect the groups exposed to one and two prior discriminations to perform better on the test discrimination than a group that had no prior experience with discrimination training. This was not the case in the present study.

Rodgers and Thomas (1982) attempted to test whether prior TD training leads to positive transfer of training by comparing groups that received prior go/no-go discrimination training or prior go/no-go PD training before being switched to a test discrimination utilizing successive conditional discrimination training. Two other TD and PD groups received prior training with successive conditional training before being switched to the successive conditional discrimination. Four other groups had the same prior training as the groups just mentioned and then were all tested on a go/no-go discrimination problem. The results showed that TD groups performed better on the subsequent TD task when the task was of the same type as the prior training.

Rodgers and Thomas (1982) concluded that the learning of an appropriate response strategy as well as attentiveness to specific stimuli are transferable. They went on to state that the response strategy seems to be the more important factor leading to positive transfer of training. Otherwise, the TD groups, regardless of type of discrimination training, would have been expected to perform equally well on the subsequent TD tasks. They believed that both TD groups learn attentiveness, but not appropriate response strategies for the test discrimination. As with previous studies, Rodgers and Thomas (1982) used PD groups for controls--this prevents us from determining whether TD training did produce positive transfer as they suggest.

Even with the recognition of the importance of response strategies, the predictions of the general attention hypothesis do not accommodate the results of the current study. The group with the most experience attending to stimuli and performing the correct response strategy as well as the group with only one experience with TD training would be expected to show positive transfer relative to the control group according to the general attention hypothesis. The three groups in the present study, regardless of experience, performed similarly on the final TD task.

The learning to not respond hypothesis states that any prior training that teaches a subject to not respond will lead to positive transfer of training. Again, in prior studies, groups with training involving not responding were compared to groups that possibly exhibited negative transfer. In the present study, all groups except the control group had training that would lead to acquiring a response strategy of not responding, but none of the groups performed better than the control group on the test discrimination. This suggests that acquiring a response strategy of not responding when facing nonreinforcement does not necessarily lead to positive transfer relative to a control group that does not have this opportunity.

Rodgers and Thomas (1982) concluded in their study that positive transfer effects are the result of a combination of attentiveness to specific stimuli and task-appropriate response strategies. These are the two learning processes involved in the two-stage model of discrimination learning (Mackintosh, 1965). These two processes may be the two key elements in learning a discrimination, but this does not mean that a group with prior exposure to discrimination training will experience positive transfer on a test discrimination.

The blocking by contextual cues hypothesis proposes that the context causes a disruption in performance for PD and SS groups because the context is as predictive of reinforcement as the stimuli for reinforcement. This disruption is not supposed to occur for TD groups because the stimuli for reinforcement are more predictive of reinforcement than the context. The present study does not deal with context changes, thus it is not known what effects context changes would have for a group that was not exposed to prior training known to hinder performance on a final TD task. As Deeds (1979) pointed out, however, it appears that SS and PD lead to negative transfer more than TD leads to positive transfer. The present study would lend further evidence to support the claim that TD does not appear to lead to positive transfer even though the negative transfer of PD and SS are not dealt with here.

In the present study, the shaping and VI training of the control group prior to the test discrimination may have produced some negative transfer. This would account for the appearance of a group effect in the Phase 3 discrimination (refer to Figure 6). If the effect does exist, it is small as indicated by the nonsignificance of the group effect in the Phase 3 discrimination.

The three hypotheses on transfer of training would predict that a control group like the one used in the present study would not experience training that either hinders or enhances performance on a subsequent TD task. According to these hypotheses, the control in this study would be the appropriate neutral control group to study transfer of training because this group should not learn attention to stimulus differences or "not responding." Also, this group does not experience interference by contextual cues prior to the discrimination task. Because the control group in this study performed as well as the groups receiving prior TD training, this result may be taken as support for Deeds' conclusion that subjects will acquire succesive operant discriminations with relative rapidity unless they have a treatment that is known to retard performance (Deeds, 1979).

REFERENCES

Deeds, W.C. (1979). The effects of context on transfer of training. Unpublished Ph.D. dissertation. Kansas State University.

Eck, K.O., Noel, R.C., & Thomas D.R. (1969). Discrimination learning as a function of prior discrimination and nondifferential training. Journal of Experimental Psychology, 82, 156-162.

Eck, K.O., & Thomas, R.C. (1970). Discrimination learning as a function of prior discrimination and nondifferential training: A replication. Journal of Experimental Psychology, 83, 511-513.

Farmer, J.E. (1975). Disruptive effects of pseudodiscrimination and single stimulus training on transfer of training. Unpublished Masters thesis. Kansas State University.

Frieman, J. (1976). Transfer of training in successive discrimination learning: Learning to "not respond." Paper presented at the Seventeenth Annual Meeting of the Psychonomic Society, St. Louis, Missouri.

Frieman, J., & Goyette, C.H. (1973). Transfer of training across stimulus modality and response class. Journal of Experimental Psychology, 97, 235-241.

Goyette, C.H. (1973). Transfer of training, general attention, and learned response tendencies. Unpublished Ph.D. dissertation. Kansas State University.

Goyette, C.H. & Frieman, J. (1973). Transfer of training following discrimination learning with two reinforced responses. Learning and Motivation, 4, 432-444.

Keilitz, I. (1972). Discrimination learning, transfer of training and response inhibition. Unpublished Ph.D. dissertation, Kansas State University.

Keilitz, I., & Frieman, J. (1970). Transfer following discrimination learning without errors. Journal of Experimental Psychology, 85, 293-299.

Mackintosh, N.J. (1965). Selective attention in animal discrimination learning. Pschological Bulletin, 64, 124-150.

Mackintosh, N.J. (1977). Stimulus control: Attentional factors. In W.K. Honig & J.E.R. Studdon (Eds.), Handbook of operant behavior. Englewood Cliffs, N.J.: Prentice Hall.

Newlin, R.J., & Thomas, D.R. (1978). Nondifferential training of pigeons retards acquisition of subsequent discriminations involving other stimuli. Animal Learning and Behavior, 6, 385-390.

Perkins, C.C., Jr., & Cacioppo, A.J. (1950). The effect of intermittent reinforcement on the change in extinction rate following successive reconditionings. Journal of Experimental Psychology, 40, 794-801.

Rodgers, J.P., & Thomas, D.R. (1982). Task specificity in nonspecific transfer and in extradimensional stimulus generalization in pigeons. Journal of Experimental Psychology: Animal Behavior Processes, 8, 301-312.

Thomas, D.R. (1969). The use of operant conditioning techniques to investigate perceptual processes in animals. In R.M. Gilbert & N.S. Sutherland (Eds.), Animal discrimination learning. London: Academic Press.

Thomas, D.R. (1970). Stimulus selection, attention, and related matters. In J.H. Regnierse (Ed.), Current issues in animal learning. Lincoln: University of Nebraska Press.

Thomas, D.R., Miller, J.T., & Svinicki, J.G. (1971). Non-specific transfer effects of discrimination training in the rat. Journal of Comparative and Physiological Psychology, 74, 96-101.

Tomie, A. (1976). Interference with autoshaping by prior context conditioning. Journal of Experimental Psychology: Animal Behavior Processes, 2, 323-334.

Wagner, A.R. (1969). Incidental stimuli and discrimination learning. In R.M. Gilbert & N.S. Sutherland (Eds.), Animal discrimination learning. London: Academic Press.

Welker, R.L., Tomie, A., Davitt, G.A., & Thomas, D.R. (1974). Contextual stimulus control over operant responding in pigeons. _Journal of Comparative and Physiological Psychology_, _86_, 549-562.

Appendices

Response rates to S+, response rates to S-, and discrimination index scores for individual subjects in group G3 on the chromatic discrimination task in Phase 1.

		SUBJECTS						
DAY		16	24	28	38	37	34	Mean
1	S+	12.61	56.32	63.33	63.97	64.22	35.11	49.26
	S-	6.20	12.87	24.13	23.53	27.80	14.33	18.14
	DI	.67	.81	.72	.73	.70	.71	.72
2	S+	35.54	106.67	61.86	114.61	82.04	52.19	75.48
	S-	1.73	11.60	2.47	8.80	11.93	3.30	6.64
	DI	.95	.90	.96	.93	.87	.94	.93
3	S+	38.46	62.44	63.46	128.81	84.94	57.05	72.53
	S-	.20	.60	.73	41.47	9.07	2.20	9.04
	DI	.99	.99	.99	.76	.90	.96	.93
4	S+	38.37	68.01	87.78	138.07	90.52	48.34	78.52
	S-	.13	.87	3.67	9.80	5.07	.20	3.29
	DI	1.00	.99	.96	.93	.95	1.00	.97
5	S+		73.58		127.31	81.04		46.99
	S-		.47		14.07	11.73		4.38
	DI		.99		.90	.87		
6	S+				123.79	77.62		33.57
	S-				54.53	6.87		10.23
	DI				.69	.92		
7	S+				121.93	72.13		32.34
	S-				9.27	.40		1.61
	DI				.93	.99		
8	S+				121.34	59.18		30.09
	S-				.33	1.27		.27
	DI				1.00	.98		
9	S+				101.74			16.96
	S-				19.18			3.30
	DI				.84			

Response rates to S+, response rates to S-, and discrimination index scores for individual subjects in group G3 on the line angle discrimination task in Phase 2 (days 1-8).

DAY		SUBJECTS 16	24	28	38	37	34	Mean
1	S+	12.06	54.13	70.70	114.41	52.93	20.00	54.04
	S-	16.33	59.27	80.20	113.73	63.73	28.87	60.36
	DI	.42	.48	.47	.50	.45	.41	.46
2	S+	23.27	76.67	80.52	110.96	49.19	42.91	63.92
	S-	22.67	31.07	50.80	109.40	47.73	44.73	51.07
	DI	.51	.71	.61	.50	.51	.49	.56
3	S+	24.91	91.59	85.93	114.46	54.20	39.93	68.50
	S-	24.53	30.07	53.33	98.40	40.73	40.33	47.90
	DI	.50	.75	.62	.54	.57	.50	.58
4	S+	24.12	94.59	96.24	105.93	54.76	50.00	70.94
	S-	23.87	7.93	34.53	90.87	32.27	31.33	36.80
	DI	.50	.92	.74	.54	.63	.61	.66
5	S+	35.70	89.11	102.09	39.78	56.97	58.05	63.62
	S-	22.80	2.67	24.07	27.40	31.73	32.20	23.48
	DI	.61	.97	.81	.59	.64	.64	.71
6	S+	37.99	84.74	101.74	115.70	59.63	68.15	77.99
	S-	24.07	.53	19.80	84.33	41.40	47.07	36.20
	DI	.61	.99	.84	.58	.59	.59	.70
7	S+	47.01	82.00	99.93	126.52	60.89	67.78	80.69
	S-	27.20	.40	19.47	35.73	35.33	39.00	26.19
	DI	.63	1.00	.84	.78	.63	.63	.75
8	S+	51.93	70.96	88.43	118.15	64.96	59.63	75.68
	S-	15.33	.33	9.87	36.07	30.00	22.40	19.00
	DI	.77	1.00	.90	.77	.68	.73	.81

Response rates to S+, response rates to S-, and discrimination index scores for individual subjects in group G3 on the line angle discrimination task in Phase 2 (days 9-15).

DAY		SUBJECTS 16	24	28	38	37	34	Mean
9	S+	42.47	72.30	92.62	134.22	61.26	54.26	76.19
	S-	9.53	.13	16.20	57.47	25.33	9.60	19.71
	DI	.82	1.00	.85	.70	.71	.85	.82
10	S+	39.78	78.46	84.81	123.63	68.81	49.89	74.23
	S-	3.53	.60	18.40	43.07	19.80	15.53	16.82
	DI	.92	.99	.82	.74	.78	.76	.84
11	S+	48.15	85.04	68.30	123.56	75.37	33.19	72.27
	S-	6.40	.93	14.93	56.33	30.47	4.40	18.91
	DI	.88	.99	.82	.69	.71	.88	.83
12	S+	40.37	79.85	65.63	96.96	82.74	41.63	67.86
	S-	4.60	1.13	8.13	45.80	50.20	13.00	20.48
	DI	.90	.99	.89	.68	.62	.76	.81
13	S+	41.68	79.48	65.48	132.30	82.83	57.89	76.61
	S-	4.33	1.40	17.93	61.20	31.33	3.47	19.94
	DI	.91	.98	.79	.68	.73	.94	.84
14	S+	41.78	75.11	68.52	123.85	81.85	50.11	73.54
	S-	1.33	6.80	16.07	20.07	20.53	13.33	13.02
	DI	.97	.92	.81	.86	.80	.79	.86
15	S+	46.91	13.14	69.93	119.48	76.91	44.93	61.88
	S-	2.53	2.60	18.40	44.20	14.73	17.87	16.72
	DI	.95	.83	.79	.72	.84	.72	.81

Response rates to S+, response rates to S-, and discrimination index scores for individual subjects in group G3 on the auditory discrimination task in Phase 3 (days 1-10).

DAY		16	24	28	38	37	34	Mean
		SUBJECTS						
1	S+	16.55	7.93	38.64	61.17	50.06	27.03	33.56
	S-	31.20	13.80	42.00	87.40	57.40	34.40	44.37
	DI	.35	.36	.48	.41	.47	.44	.42
2	S+	19.07	48.24	62.11	134.71	55.44	54.71	62.38
	S-	21.60	82.00	62.40	76.50	53.70	67.00	60.53
	DI	.47	.37	.50	.64	.51	.45	.49
3	S+	30.71	43.29	63.06	121.53	81.29	59.29	66.53
	S-	23.90	38.80	44.20	49.40	64.40	55.10	45.97
	DI	.56	.53	.59	.71	.56	.52	.58
4	S+	36.21	66.59	59.76	144.12	75.91	63.86	74.41
	S-	23.10	61.80	20.90	45.00	55.90	45.60	42.05
	DI	.61	.52	.74	.76	.58	.58	.63
5	S+	32.49	60.82	67.13	125.76	68.21	63.84	69.71
	S-	15.10	56.80	16.10	23.30	39.60	39.40	31.72
	DI	.68	.52	.81	.84	.63	.62	.68
6	S+	36.69	74.47	60.94	143.88	67.84	52.33	72.69
	S-	23.80	28.70	20.40	21.40	21.40	33.60	24.88
	DI	.61	.72	.75	.87	.76	.61	.72
7	S+	33.06	82.94	72.00	158.72	66.63	43.79	76.19
	S-	14.70	48.20	17.10	22.40	24.30	17.90	24.10
	DI	.69	.63	.81	.88	.73	.71	.74
8	S+	41.29	102.12	79.88	158.00	70.59	56.00	84.65
	S-	19.20	11.30	15.30	14.50	21.10	41.30	20.45
	DI	.68	.90	.84	.92	.77	.58	.78
9	S+	36.96	104.35	79.30	162.82	78.84	47.98	85.04
	S-	11.40	23.40	13.10	7.20	10.80	19.10	14.17
	DI	.76	.82	.86	.96	.88	.72	.83
10	S+	46.90	92.24	81.98	153.76	72.94	52.78	83.43
	S-	7.80	19.20	12.90	7.20	9.70	33.80	15.10
	DI	.86	.83	.86	.96	.88	.61	.83

Response rates to S+, response rates to S-, and discrimination index scores for individual subjects in group G2 on the line angle discrimination task in Phase 2 (days 1-8).

DAY		SUBJECTS 21	17	27	32	29	39	Mean
1	S+	11.99	24.07	40.00	18.93	33.60	35.15	27.29
	S-	16.27	27.00	36.47	32.47	39.13	37.27	31.44
	DI	.42	.47	.52	.37	.46	.49	.46
2	S+	16.76	41.55	73.14	27.33	64.07	24.72	41.26
	S-	19.27	35.87	50.60	19.93	47.80	30.13	33.93
	DI	.47	.54	.59	.58	.57	.45	.53
3	S+	28.58	54.29	134.15	27.29	42.59	33.61	53.42
	S-	28.13	42.13	51.47	15.60	41.20	33.40	35.32
	DI	.50	.56	.72	.64	.51	.50	.57
4	S+	27.35	54.46	135.93	40.30	66.07	34.37	59.75
	S-	22.13	35.33	18.07	15.67	46.73	32.53	28.41
	DI	.55	.61	.88	.72	.59	.51	.64
5	S+	37.56	62.67	116.57	70.37	77.93	33.04	66.36
	S-	28.87	35.53	3.87	14.87	65.33	29.07	29.59
	DI	.57	.64	.97	.83	.54	.53	.68
6	S+	34.71	59.85	108.82	93.93	98.15	35.65	71.85
	S-	18.87	22.53	2.33	43.47	57.73	30.87	29.30
	DI	.65	.73	.98	.68	.63	.54	.70
7	S+	69.22	66.10	122.23	103.63	116.89	39.33	86.23
	S-	22.53	34.47	1.20	22.40	61.33	32.27	29.03
	DI	.75	.66	.99	.82	.66	.55	.74
8	S+	81.65	82.30	126.07	115.25	110.40	45.06	93.45
	S-	16.87	22.33	1.27	42.33	55.60	40.93	29.89
	DI	.83	.79	.99	.73	.67	.52	.75

Response rates to S+, response rates to S-, and discrimination index scores for individual subjects in group G2 on the line angle discrimination task in Phase 2 (days 9-15).

		SUBJECTS						
DAY		21	17	27	32	29	39	Mean
9	S+	74.33	94.33	126.27	134.93	119.92	48.52	99.72
	S-	11.47	15.53	.87	24.73	34.47	45.53	22.10
	DI	.87	.86	.99	.85	.78	.52	.81
10	S+	71.27	89.33	123.81	111.79	129.41	54.15	96.63
	S-	9.93	9.20	.93	4.67	33.93	52.00	18.44
	DI	.88	.91	.99	.96	.79	.51	.84
11	S+	84.54	87.11	122.64	103.26	103.85	60.22	93.60
	S-	23.60	4.47	.13	9.20	28.40	54.20	20.00
	DI	.78	.95	1.00	.92	.79	.53	.83
12	S+	80.45	84.46	121.87	116.81	98.89	62.15	94.11
	S-	35.20	5.87	0.00	7.53	13.27	50.60	18.75
	DI	.70	.94	1.00	.94	.88	.55	.83
13	S+	72.60	89.04	112.35	129.44	104.37	80.15	97.99
	S-	37.80	7.93	0.00	6.47	16.73	45.73	19.11
	DI	.66	.92	1.00	.95	.86	.64	.84
14	S+	67.73	82.97	106.49	110.37	120.00	79.33	94.48
	S-	18.40	12.13	0.00	8.07	8.07	39.07	14.29
	DI	.79	.87	1.00	.93	.94	.67	.87
15	S+	72.66	79.10	97.23	101.56	83.41	79.41	85.56
	S-	11.60	7.27	.40	31.87	29.93	35.67	19.46
	DI	.86	.92	1.00	.76	.74	.69	.83

Response rates to S+, response rates to S-, and discrimination index scores for individual subjects in group G2 on the auditory discrimination task in Phase 3.

DAY		21	17	27	32	29	39	Mean
		SUBJECTS						
1	S+	40.12	40.71	57.51	124.56	51.18	48.57	60.44
	S-	51.60	37.10	75.70	99.30	78.70	72.60	69.17
	DI	.44	.52	.43	.56	.39	.40	.46
2	S+	55.39	55.41	102.34	79.88	84.76	75.53	75.55
	S-	45.30	70.90	96.80	88.40	56.50	71.00	71.48
	DI	.55	.44	.51	.47	.60	.52	.52
3	S+	76.82	61.16	111.95	100.47	78.12	86.47	85.83
	S-	46.20	73.60	84.70	48.10	59.20	76.00	64.63
	DI	.62	.45	.57	.68	.57	.53	.57
4	S+	83.53	57.65	109.94	116.61	73.65	55.33	82.78
	S-	33.90	49.10	67.70	27.30	37.80	37.30	42.18
	DI	.71	.54	.62	.81	.66	.60	.66
5	S+	70.18	18.35	109.88	71.56	86.47	92.12	74.76
	S-	23.70	17.30	45.60	26.50	20.90	26.40	26.82
	DI	.75	.51	.71	.73	.81	.78	.71
6	S+	60.46	49.42	111.70	113.61	49.63	85.18	78.33
	S-	20.90	21.00	14.30	27.80	25.50	13.90	20.57
	DI	.74	.70	.89	.80	.66	.86	.78
7	S+	77.86	91.88	107.34	111.29	84.35	89.88	93.77
	S-	22.20	60.30	9.70	14.40	22.00	20.80	24.90
	DI	.78	.60	.92	.89	.79	.81	.80
8	S+	61.28	83.53	106.43	100.83	82.82	84.35	86.54
	S-	8.30	36.40	12.10	22.10	8.70	20.50	18.02
	DI	.88	.70	.90	.82	.90	.80	.83
9	S+	76.80	100.47	108.52	95.88	90.24	80.71	92.10
	S-	14.00	26.90	3.60	26.40	25.50	23.00	19.90
	DI	.85	.79	.97	.78	.78	.78	.82
10	S+	70.88	95.18	110.53	98.93	90.24	64.00	88.29
	S-	9.10	30.40	1.80	19.10	20.00	21.90	17.05
	DI	.89	.76	.98	.84	.82	.75	.84

Response rates to S+, response rates to S-, and discrimination index scores for individual subjects in group G1 on the auditory discrimination task in Phase 3.

		SUBJECTS						
DAY		25	22	20	35	33	31	Mean
1	S+	38.83	19.13	20.12	36.53	25.53	37.87	29.67
	S-	65.40	28.50	33.10	30.60	32.20	37.00	37.80
	DI	.37	.40	.38	.54	.44	.51	.44
2	S+	54.15	25.70	31.86	30.99	30.71	57.50	38.48
	S-	42.70	17.60	31.60	29.10	25.00	62.20	34.70
	DI	.56	.59	.50	.52	.55	.48	.53
3	S+	52.82	25.18	43.14	42.24	36.71	69.07	44.86
	S-	43.60	21.30	32.40	29.90	25.40	68.70	36.88
	DI	.55	.54	.57	.59	.59	.50	.56
4	S+	67.06	20.57	76.59	39.42	52.94	86.40	57.16
	S-	57.10	16.30	48.00	26.80	35.30	67.70	41.87
	DI	.54	.56	.61	.60	.60	.56	.58
5	S+	70.89	21.59	112.47	48.77	48.12	98.35	66.80
	S-	51.40	14.40	52.20	32.30	29.50	69.40	41.53
	DI	.58	.60	.68	.60	.62	.59	.61
6	S+	66.05	35.35	100.23	80.23	65.53	116.63	77.34
	S-	32.80	15.80	23.10	40.20	32.00	42.30	31.03
	DI	.67	.69	.81	.67	.67	.73	.71
7	S+	70.66	36.16	116.24	91.35	52.82	114.77	80.33
	S-	39.90	26.00	43.00	39.50	25.50	56.30	38.37
	DI	.64	.58	.73	.70	.67	.67	.67
8	S+	46.81	30.22	75.90	77.40	59.76	127.26	69.56
	S-	29.70	19.00	18.10	28.00	27.40	45.00	27.87
	DI	.61	.61	.81	.73	.69	.74	.70
9	S+	66.04	46.51	112.66	96.71	60.47	113.29	82.61
	S-	16.80	23.30	16.80	47.90	30.80	77.50	35.52
	DI	.80	.67	.87	.67	.66	.59	.71
10	S+	62.25	49.29	103.87	70.82	31.41	66.19	63.97
	S-	19.79	19.30	4.20	33.90	22.60	39.20	23.15
	DI	.76	.72	.96	.68	.58	.63	.72

A TEST FOR POSISTIVE TRANSFER IN
SUCCESSIVE OPERANT DISCRIMINATION LEARNING

by

E. MARIE BRODIE

B.A. University of South Carolina at Aiken, 1986

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Psychology

Kansas State University
Manhattan, Kansas

1989

Abstract

In successive operant discrimination training, non-specific positive transfer occurs when discrimination training with one stimulus dimension facilitates the acquisition of a discrimination involving a new stimulus dimension. A typical conclusion drawn from past transfer studies is that prior true discrimination (TD) training produces positive transfer when compared to groups receiving prior single stimulus training. However, several studies indicate that SS training produces negative transfer and is not the appropriate control group to evaluate positive transfer effects from TD training.

The purpose of the present experiment was to use a more appropriate control condition to determine if prior TD training does produces positive non-specific transfer. Groups of pigeons were exposed to different amounts of prior TD training before a final discrimination task. No positive transfer of training was found in this experiment. The results suggest that past studies have used a control group that experiences negative transfer making it impossible to determine positive transfer for TD groups. With an appropriate

control group, positive transfer from prior TD training is not demonstrated.