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The Efficacy of Response Prevention with Multiple Treatments

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THE EFFICACY OF RESPONSE PREVENTION
WITH MULTIPLE TREATMENTS
BY
PAULA J. MARTASIAN

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTERS OF ARTS IN PSYCHOLOGY

UNIVERSITY OF RHODE ISLAND
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Abstract

The purpose of this thesis was to investigate the effect of repeated Response Prevention (RP) treatments on the persistence of avoidance behavior using an animal model. Response prevention has been used as a treatment in many laboratory studies to reduce avoidance responding. Although past research shows that one episode of RP facilitates extinction of avoidance behavior when tested once, complete elimination of the avoidance response has seldom been found. In fact, some studies have demonstrated the existence and even recovery of residual fear after a single RP treatment indicated by an increase in avoidance behavior upon repeated testings. It was hypothesized that additional RP treatments would cause greater and more permanent reduction of avoidance responding.

One hundred and twenty Sprague-Dawley male rats were randomly assigned to one of 12 experimental conditions. There were four treatment levels in each of the following groups; Control, (receiving no avoidance training), Response Prevention, or Nonresponse Prevention. The four levels consisted of the following number and length of treatments: one massed level of 36 min, or distributed levels; two of 18 min, or three of 12 min, or four of 9 min. Fear was tested at 0, 1, and 30 days after treatment for all subjects.

Results consistent with previous studies indicated that RP caused reduction of fear. Unlike past findings with repeated testings, there was no increase in fear over the testing intervals for the RP groups. Relevance to therapy analogues was discussed.

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Introduction

Avoidance learning is a category of learning motivated by aversive stimuli. An aversive stimulus is a stimulus that organisms will seek to escape or avoid. Hence, avoidance behavior is defined as a response which results in the cancellation of a scheduled delivery of an aversive stimulus, (Church, 1971). There are several theories which exist as frameworks to explain avoidance behavior: Mowrer's (1950) two-factor theory; Bolles' (1970) species specific response theory; Seligman & Johnston's (1973) cognitive expectancy theory; Masterson & Crawford's (1982) defense motivation system theory; and Staddon's (1983) adaptive behavior theory. None of these theories are completely adequate to account for the acquisition and persistence of avoidance behavior. Mowrer's (1950) theory, the most frequently used framework for explaining avoidance behavior over the past 30 years, will be presented in depth and applied to the results of this study.

Mowrer (1950) defined the two processes in his theory as 1) a classically learned fear response and 2) an operantly learned and maintained avoidance response. The first component, the classically learned fear response occurs when a conditioned stimulus (CS) defined as a previously neutral stimulus, is paired with an unconditioned aversive stimulus (UCS). An unconditioned stimulus automatically elicits an appetitive or defensive

response. In defensive conditioning the CS presentation is followed by the aversive UCS. The onset of the aversive UCS elicits pain and fear and the organism seeks to get away from the UCS by escaping to a safe place. When the organism learns that the CS is a signal for the UCS, the conditioned response (CR) is elicited by the CS presentation. This CR is referred to as "fear" as defined by past research, (See Mineka, 1979; Neill, 1982 for reviews). In this study a one-way platform avoidance apparatus was utilized with the CS being the opening of the ledge door and the UCS being the presentation of shock to the grid floor. The opening of the shelf door becomes the signal for the onset of the shock. After several trials the opening of the shelf door elicits a fear response in the subject.

Mowrer's second component is the operant learning of the avoidance response. Fear, initially learned through the classical pairing of the CS and UCS, serves as the motivation and its cessation as the reinforcement for the animal to learn and maintain the avoidance response. When an avoidance response is made the CS is terminated thus reducing fear and reinforcing avoidance behavior. The avoidance response is reinforced by the fear reduction hence it reoccurs. In the Mowrer model the avoidance behavior can be used as an indirect index of fear.

Mowrer's two-factor theory has had many critics. One major criticism presented by Rachman (1976) is that the two-factor theory cannot explain the persistence of avoidance responding in an extinction test. Fear should extinguish because successful avoidance trials involve the presentation of the CS without the UCS. This is the respondent model for extinction. Solomon & Wynn (1954) suggest that the fear response does not classically extinguish. Dogs will continue to perform the avoidance response completing hundreds of trials until exhaustion sets in. Another major criticism of Mowrer's two-factor theory presented by Rachman (1976) and Rachman & Hodgson (1974) deals with the lack of synchrony between fear and avoidance behavior. Rachman & Hodgson (1974) review several studies which demonstrate that the three components of fear, cognitive, behavioral, and physiological do not vary together in humans. For example, avoidance behavior is sometimes engaged in without the occurrence of physiological "fear" signs. This evidence seems to indicate that fear appears to be a sufficient motivator for avoidance but not a necessary motivator suggesting problems for Mowrer's theory. The focus of this present study was not with the limitations of the existing theoretical frameworks but rather with the variables involved with decreasing the persistence of avoidance behavior and possible clinical relevance.

The purpose of this thesis was to investigate the effect of repeated treatments on the persistence of avoidance behavior using an animal model. Animal models are frequently used in basic research to study psychopathology, (Bond, 1984). Bond reviews reasons why animal models are important such as providing frameworks, describing systems and discovering new relationships. Animal models can serve to explore specific features of a disorder under highly controlled conditions which can lead us to make hypotheses about the human disorder. The study of avoidance behavior in laboratory rats has often served as an analogue of clinical avoidance behaviors such as the psychopathologies of phobia and anxiety, (Baum, 1971), depression, (Abramson & Seligman, 1977), and anorexia, (Epling & Pierce, in press). Baum (1986a, 1986b) presents animal models for agoraphobia and situational panic attacks. Clinical techniques for treating phobias and anxiety have included implosive therapy, imagining the anxiety producing stimulus in the absence of painful or harmful contingencies, and flooding, (Stampfl & Levis, 1968). In flooding, the subject is exposed to the feared stimulus until there is a decrease in the phobic behavior and anxiety indicated by behavioral and self-report measures. Although there are obvious differences between phobic behavior of people and the decrease of fear of the CS in animals, Baum (1971) contends that studying the variables that lead to

extinction of the avoidance behavior in animals may facilitate our understanding of human phobic behavior. The animal analogue to human flooding, called response prevention (RP) has been used as a treatment in many laboratory studies to reduce avoidance responding, (See Mineka, 1979; Monti & Smith, 1976 for reviews). Response prevention is the process of exposing the animal to the cues which predict shock (the CS) without presenting the previously paired shock (the UCS) while preventing the learned avoidance response from occurring. This technique or treatment has been successful in facilitating the extinction of avoidance responding, (Baum, 1966, 1970).

Many of the variables which can affect the efficacy of response prevention, have been investigated in past studies. The results of these studies suggest the following: the more overall RP time the less avoidance behavior is exhibited in extinction testing, (Baum, 1970, Siegeltuch & Baum, 1971). Baum (1970) found 5 min of RP to be more effective than 0, 1, or 3 min. Siegeltuch et.al. (1971) found that 30 min of RP was more effective than 0, 5 or 15 min. Baum (1972) demonstrated that RP efficacy was enhanced by a delay period of 30 min between acquisition of the avoidance response and the 5 min RP treatment. The groups receiving 5 min of RP treatment immediately following acquisition engaged in significantly more avoidance behavior than those groups

given just a time delay of 30 min between acquisition and testing with no RP or groups receiving 30 min delay with 5 min of RP. Schiff, Smith, & Prochaska (1972) exposed subjects to RP for 1, 5, 10, 50, or 120 sec. Results showed that when total RP time is constant, it is equally effective in reducing avoidance responding for both more trials of shorter duration and a few trials of longer duration.

Another indication of the efficacy of RP is determined by the activity engaged in during the blocked time period, (Lederhendler & Baum, 1970; Spring, Prochaska & Smith, 1974). Lederhendler et.al. (1970) compared a group receiving 5 min of RP with forced movement by a mechanical device with a group receiving 5 min of RP with no forced movement and a group receiving no RP. This study's results indicated significantly less avoidance behavior demonstrated by quicker extinction in the mechanically manipulated RP group. Spring, et.al.(1974) demonstrated similar results. They exposed rats to 25 min of RP and by behavioral observation separated these rats into two groups, those that engaged in exploratory behavior and those that did not. The comparison of latency to approach the previously trained fearful stimulus, (grids in the start box of an alley), was made between these RP groups and the appropriate shocked and non shocked controls. The group engaging in exploratory behavior during RP treatment and nonshocked

controls entered the previously feared/avoided area significantly more quickly than other groups. Both Lederhendler et.al. (1970) and Spring et.al (1974) conclude that if exploratory behavior occurs during RP then RP effects for decreasing the amount of avoidance behavior will be heightened.

Although RP has been shown to facilitate the extinction of the avoidance responding, complete elimination of the avoidance response has seldom been found, (Neill, 1980). In fact a body of research exists which illustrates that short RP exposure can actually have a deleterious effect measured as an enhancement of avoidance responding, (Rohrbaugh & Riccio, 1970; Coulter, Riccio & Page, 1969; Linton, Riccio, Rohrbaugh & Page, 1970; Rohrbaugh, Riccio, & Arthur, 1972). The general finding of these studies is that brief RP exposures, (5 or 15 sec) can result in an enhancement of fear as measured in a conditioned emotional response (CER) paradigm. Subjects were trained to bar press for reinforcement. They were exposed to an aversive CS-UCS pairing followed by brief RP exposures. When replaced into the operant chamber, brief RP exposed subjects demonstrated suppression of responding. Riccio & Silvestri (1973) discuss the concept of residual fear in depth. They review animal studies which demonstrate that RP is effective in diminishing the frequency of the avoidance response but not in removing residual fear

illustrated by CER paradigms. These authors suggest that fear is a multicomponent response. Riccio & Silvestri use Mowrer's (1950) two process theory of avoidance learning as a framework to explain how RP might be working to extinguish the Pavlovian CS-UCS, pairing thus resulting in extinction of the avoidance response. However, when tested in a different paradigm such as CER, residual fear is measured which could be interpreted as the classically conditioned fear response which has not been extinguished by RP. These authors point out the implications and relevance to clinical studies. For example, some clients will show a change in phobic avoidance behavior after behavior therapy but still report feeling "fearful". These results imply that phobic behavior/fearful responses are complex and multidimensional and more than one measure must be taken to test for "fear" to assess if therapy is successful.

Three components of fear are described by Rachman (1976). He presents them as being subjective fear measured by cognitive statements, directly measurable avoidance behavior and physiological disturbance measured by heart rate, respiration, perspiration, etc. Rachman discusses how these responses, cognitive, behavioral and physiological can vary independently, inversely or in synchrony in occurrence. It is futile to attempt to measure rat's cognitions and physiological measures; although the former may exist they cannot be measured and

measurement of the latter would inhibit the animals mobility in the learning task. This study took the most direct and feasible approach and concentrated on the avoidance behavioral component of the fear response. The behavioral measures of approach latency and time on grids were used to demonstrate the effects that response prevention or flooding had on the avoidance response, one subcomponent of the fear response. There are several valid reasons for concentrating on the avoidance behavior subcomponent of the fear response. Behavioral responses are the easiest to observe and therefore measure, enabling manipulation of variables in hopes of predicting and controlling future similar behavior. Response prevention is a behavioral treatment currently being used with some success to treat clinical behaviors such as bulimia and compulsive behaviors, (Ordman & Kirschenbaum, 1985; Rossiter & Wilson, 1985; Stampfl & Levis, 1967). The Ordman et al. (1985) and Rossiter et al. (1985) studies showed the best reduction of bulimic behavior when using a multicomponent treatment of response prevention and cognitive restructuring. However, Ordman & Kirschenbaum, (1985) demonstrated a change in thought structure when using the response prevention alone treatment. Subjects exposed to RP treatment alone reported not having fearful thoughts of eating too much. These studies illustrated that response prevention is a viable treatment for obsessive-compulsive

behavior such as fear of gaining weight the results of which are not confined to the behavioral response alone. Response prevention can alter the cognitive component of fear as well. Although the effects of RP treatment on the cognitive component of the fear response can not be illuminated in basic research using rats, these clinically relevant studies demonstrate that response prevention is a treatment of importance and therefore the variables effecting RP treatment warrant investigation. The results of these studies imply the intricate and complex relationship between the components of fear and that of flooding procedures. Flooding may decrease avoidance behavior but the residual fear, (Rachman suggests possibly the cognitive component), may linger on or in some cases be intensified, (Rachman & Hodgson, 1974).

Further studies have demonstrated the existence and even recovery of residual fear by demonstrating an increase in avoidance behavior upon repeated testing exposures whether using active testing measures, (Benline & Simmel, 1967), or passive testing measures, (Neill, Cottrill, & Smith, 1982). Active avoidance measures entail using continued avoidance responding as a measure of fear. A problem with this measure is that during RP treatment competing responses are sometimes learned. Thus if the animal learns "crouching" instead of running in the presence of the CS, when tested in active

extinction trials the crouching to fear may replace running leading to the erroneous conclusion that the animal is no longer fearful. Therefore a passive avoidance testing such as the approach latency measure becomes a more sensitive measure of fear. In a passive avoidance test measure the animal is placed in the area of the apparatus where there has been no CS - UCS pairings. In this paradigm the ledge is this safe place. If animals learn to freeze or crouch as a fear response during RP then when placed on a ledge they will continue to crouch or freeze as long as they are fearful. When fear has been diminished they will approach the previously fearful stimuli, in this paradigm the grids. See Neill, (1982) and Corriveau & Smith (1978) for reviews on active versus passive avoidance testing techniques.

When Benline & Simmel (1967) used distributed 20 s RP trials of 8, 16, or 32 trials/day over five days, there was an increase in avoidance behavior to the level measured during training. These authors suggest that repeated testing serves as a cue to re-establish the avoidance response which is suppressed during treatment. Neill, Cottrill, & Smith (1982) results showed that on day 0, immediate testing of RP efficacy, the RP group demonstrated behavior equal to a nonshock control group. Upon repeated testing at days 1, 3, 10 and 30 after treatment the avoidance behavior of the RP group was

re-instated at each of these testings to the same level as the shocked group receiving no RP. These empirical findings raise several questions dealing with the efficacy of RP, and the criteria that should be used to assess efficacy of RP or flooding. Under what conditions of RP does repeated exposure lead to continued decrease in avoidance responding. Past research results indicate that one episode of RP does work well at facilitating extinction of avoidance behavior when measured once. Perhaps to facilitate extinction of the avoidance response on more than one occasion repeated RP exposures are necessary. After all, human psychotherapy is always a multi-session enterprise and results would not be expected to be long lasting after only a single treatment.

The present study hypothesized that the number of RP treatments would contribute to the amount of avoidance reduction. It was predicted that there would be a positive relationship between the level of RP treatments and the amount of avoidance behavior reduction. It was predicted that there would be a negative relationship between the level of RP treatments and the return of fear motivated behavior over time. It was also predicted that control subjects would exhibit no avoidance behavior and RP subjects would exhibit less avoidance than NRP (No Response Prevention) subjects and that the NRP group would show the greatest amount of fear.

Method

Subjects

One hundred and twenty experimentally naive Sprague-Dawley male rats with a weight range of 250-365 g were used. They were housed separately and maintained on ad libitum food and water throughout the study. Six subjects were replaced because they did not meet the training criteria.

Apparatus

The equipment used was a one-way platform avoidance apparatus manufactured by the Lafayette Instrument Company (model 85200). The apparatus was housed in a sound attenuated chamber. The grid chamber was 23 cm long, 20.5 cm wide and 20.5 cm high. The platform was 20.5 cm wide and 12 cm deep when the door was fully open. It was located 10 cm above the grid floor and formed a 1 cm x 20 cm opening in an end wall of the grid chamber. Scrambled shock was delivered via a Coulboun Instruments solid state shocker/scrambler (model E13-16) connected to the grid floor. House lights and an air circulating fan were on during all phases of the experiment. A wooden box with dimensions equal to the grid chamber was used as a temporary retaining cage. All procedures except placement in and removal of the subjects from the apparatus were automated with electromechanical programming equipment and took place in the one-way

avoidance platform apparatus or the temporary retaining cage.

Procedure

The study utilized a 3 (Treatment) x 4 (Level) x 3 (Repeated Test) mixed factorial design. The first factor was treatment condition; Control (CON) Response Prevention (RP) or Nonresponse Prevention (NRP). The second factor was level of treatments with the total time of all treatments held constant at 36 min: one massed 36 min treatment interval; or distributed treatments of two 18 min treatment intervals; or three 12 min treatment intervals; or four, 9 min treatment intervals. The third factor was the repeated measure of fear over retention intervals of 0, 1, and 30 days after treatment. Each subject was randomly assigned to one of the 12 experimental conditions. (See Table 1 for an illustration of the design).

Avoidance Training

Eighty randomly assigned subjects were trained to a criterion of 10 consecutive avoidances in the one-way platform avoidance apparatus. A subject met the training criterion by making 10 consecutive avoidances in 60 or less total trials and receiving less than 60 continuous seconds of shock or 80 total seconds of shock, (UCS). Three response prevention and two nonresponse prevention subjects were replaced for not meeting the training criterion. At the start of training the subject was

Table 1

3 x 4 x 3 Factorial Mixed Design for Testing
The Efficacy of Multiple Response Prevention

		Repeated Testing in Days											
		Day 0				Day 1				Day 30			
Level of		1	2	3	4	1	2	3	4	1	2	3	4
Treatments													
	CON												
C													
o													
n													
d	RP												
i													
t													
i													
o													
n	NRP												

Note. n= 10 per cell, N = 120.

placed on the grid floor. After a variable 30 s interval the platform door opened and the subjects had 10 s to climb onto the platform before the onset of a 1.5 mA scrambled shock. The shock remained on until the subject jumped onto the platform. The subjects then remained on the platform for a 15 s platform interval after which they were mechanically returned to the grid floor by the closing of the platform door. A 30 s variable intertrial interval on the grids occurred next. When the door opened it signalled the start of a new trial. When the subject jumped to the platform within the 10 s prior to the onset of shock and remained there during the 15 s platform interval, it was recorded as an avoidance trial. When the subject did not avoid within the 10 s or did not stay on the platform for the entire 15 s it received shock and the consecutive avoidance counter was reset. Shock (UCS) was recorded in .1 s intervals for every trial the subject did not avoid, giving a measure of total UCS for each subject. The total number of trials taken to reach 10 consecutive avoidances was also recorded for each subject.

The 40 subjects randomly assigned to the control condition received no shock but were exposed to the apparatus for 15 min with the door to the ledge open. Pilot research revealed this to be about the average time it took for avoidance training.

Training took place on day 1 of the experiment (subjects were not handled prior to training). Treatment began on day 1 immediately after training and proceeded for the next three days, giving a total of four days of treatment.

Treatment

Response Prevention. All the subjects in the control and response prevention groups were placed on the grids in the shock chamber of the apparatus with the ledge door closed, the house lights and fan on and the shock off for a total of 36 min over the four day treatment period.

Nonresponse Prevention. All nonresponse prevention subjects were placed in the temporary retaining cage located in the colony for a total of 36 min over the four day treatment period.

Level of Treatment Sessions. There were four levels of multiple treatment sessions, one massed level and three distributed levels. Each subject was exposed to either level 1 for 36 min or level 2 for 18 min or level 3 for 12 min or level 4 for 9 min each session. Subjects receiving one, 36 min treatment session were returned to the colony immediately after training and remained there until day four. On day four they were placed either in the shock chamber or the temporary retaining cage depending on their treatment condition, RP or NRP, and tested immediately following treatment. Subjects in the

two, 18 min groups received 18 min of RP or NRP on days three and four and were tested on day 4. The subjects in the three 12 min groups received treatment on days two, three, and four and tested on day four. The groups receiving four 9 min of RP or NRP received treatment on days one, two, three, and four and were tested on day four. (See Table 2 for a flow chart of the procedure.)

Testing

Immediately after the last treatment session all subjects were placed in the temporary retaining cage located beside the one-way avoidance apparatus for one minute while the machine was set for the testing procedure. During testing, 6 cm of the ledge was made available to the animal. All subjects were placed on the exposed ledge, prevented from coming down for 10 s and then left for one hour, (3600 s). Animals were tested on day 0, (last day of treatment), and on days 1 and 30 after treatment.

Two dependent measures were recorded during testing. The first, approach latency, was reported as the time in seconds it took the animal to step completely down from the ledge and stay on the grids for three consecutive seconds. The second dependent measure recorded was the total time on grids which was the total time during the test period that the animal spent on the grids following a complete approach.

Table 2

Flow Chart of Procedure

Day	Level of Treatments			
	4	3	2	1
	Train	Train	Train	Train
1	1 min RC 9 min Treat	1 min RC	1 min RC	1 min RC
2	9 min Treat	12 min Treat	1 min RC	1 min RC
3	9 min Treat	12 min Treat	18 min Treat	1 min RC
4	9 min Treat Test 0	12 min Treat Test 0	18 min Treat Test 0	36 min Treat Test 0
5	Test 1	Test 1	Test 1	Test 1
34	Test 30	Test 30	Test 30	Test 30

Note. RC stands for retaining cage.

Results

Avoidance Training

To verify equivalent avoidance training, two variables, total UCS time and trials to meet the training criterion of 10 consecutive avoidances, were assessed between the RP and NRP groups. Tables 3 and 4 show the means and standard deviations for total shock received and total trials to reach the training criterion. Homogeneity of variance was tested for total UCS and total trials using Hartley's F max test, (Winer, 1971). There was no violation of homogeneity of variance in either variable as indicated by the two F max tests: for total shock received, $F_{max}(8,9) = 3.26$, ns; and for total trials, $F_{max}(8,9) = 3.85$, ns. Separate one-way analyses of variance were performed on the training variables, UCS and total trials and each were found to be nonsignificant indicating no differences between the groups: UCS, $F(7,72) = .590$, ns; Trials, $F(7,72) = .352$, ns. (Appendices A & B contain the summary tables for the analysis of variance for total shock and total trials respectively).

Avoidance Testing

Approach Latency. The means and standard deviations for approach latency, the time to approach the grids and remain on them for 3 s or more, are presented

Table 3

Means and Standard Deviations of Total Shock
Duration in Seconds by Treatment During Training

Treatment Condition	Level of Treatments			
	1	2	3	4
RP				
<u>M</u>	11.5	12.95	17.83	17.54
<u>SD</u>	7.21	8.44	13.02	11.31
NRP				
<u>M</u>	17.64	14.17	13.43	13.18
<u>SD</u>	10.96	8.73	11.99	9.15

Note. n= 10 per cell.

Table 4

Means and Standard Deviations of Total TrialsBy Treatment Group to Training Criterion

Treatment Condition	Level of Treatments			
	1	2	3	4
RP				
<u>M</u>	24.30	23.20	23.10	20.70
<u>SD</u>	7.21	8.52	9.86	5.29
NRP				
<u>M</u>	21.70	21.90	20.10	20.60
<u>SD</u>	10.38	6.24	8.12	5.76

Note. n = 10 per cell.

in Table 5. Overall, the controls took the least amount of time to depart from the ledge, the RP's took longer and the NRP's took the longest time; the overall means being 62.15 s, 628.02 s, and 1126.24 s respectively. The figures for the mean approach latency times are presented in Figures 1, 2, 3 and 4, for all groups, CON, RP, and NRP respectively.

A Cochran's C test was computed to test for homogeneity of variance was found to be significant; $C(12,9) = 0.2180$, $p < .05$. Although the ANOVA is robust with respect to violations of its underlying assumption of homogeneity of variance it is preferable to have homogeneity of variance, (Collyer & Enns, 1986; Winer, 1971). Therefore the data was transformed using the natural log, $LN(\text{score})$ formula, (Collyer & Enns, 1986; Winer, 1971). This transformation has been shown to be effective in restoring homogeneity of variance in temporal data as was the case with the approach latency dependent measure. A Cochran's C test after the natural log transformation, $C(12,9) = 0.1511$, ns, demonstrated the removal of the violation of homogeneity of variance. The means and the standard deviations for the transformed data are shown in Table 6. The figures for the mean transformed approach latency times are presented in Figures 5, 6, 7 and 8, for all groups, CON, RP, and NRP respectively.

Table 5

Means and Standard Deviations for the Approach
Latency Measure in Seconds During All Test Sessions

Treatment		Testing Day			
		0	1	30	
Condition					
CON					
T r e a t m e n t	1	<u>M</u>	50.06	41.12	71.59
		<u>SD</u>	67.46	41.59	145.67
	2	<u>M</u>	22.84	25.82	10.83
		<u>SD</u>	31.22	33.95	1.51
	3	<u>M</u>	166.19	19.92	16.70
		<u>SD</u>	381.99	16.32	17.33
	4	<u>M</u>	222.58	15.69	82.49
		<u>SD</u>	498.83	14.89	158.44
RP					
L e v e l	1	<u>M</u>	415.96	777.83	1088.75
		<u>SD</u>	1122.76	1085.56	1364.85
	2	<u>M</u>	654.55	499.04	403.46
		<u>SD</u>	857.68	520.20	352.89
	3	<u>M</u>	276.94	1140.69	806.61
		<u>SD</u>	318.31	1700.38	1111.03
	4	<u>M</u>	448.35	477.53	546.50
		<u>SD</u>	1118.96	1107.92	724.03

Table 5 cont'd.

Treatment		Testing Day			
		0	1	30	
NRP					
Leve val e l	1	<u>M</u>	473.53	571.59	512.80
		<u>SD</u>	785.74	560.26	413.64
	2	<u>M</u>	826.78	1051.13	1362.51
		<u>SD</u>	1492.42	1391.09	1561.33
	3	<u>M</u>	1845.24	1869.69	1870.00
		<u>SD</u>	1595.10	1657.32	1350.10
	4	<u>M</u>	1038.82	1153.03	939.73
		<u>SD</u>	1590.51	1691.39	1363.77

Note. Total N = 120, n = 10 per cell.

Figure Caption

Figure 1. Mean approach latency scores in seconds for Control, Response Prevention, and Nonresponse Prevention groups.

Figure Caption

Figure 2. Mean approach latency scores in seconds for
Control groups.

Figure Caption

Figure 3. Mean approach latency scores in seconds for
Response Prevention groups.

Figure Caption

Figure 4. Mean approach latency scores in seconds for
Nonresponse Prevention groups.

Table 6

Means and Standard Deviations for Natural Log Transformed
Approach Latency Measure for All Test Sessions

Treatment Condition		Testing Day			
		0	1	30	
CON					
T r e a t m e n t	1	<u>M</u>	3.2628	3.2822	3.2008
		<u>SD</u>	1.1365	0.9789	1.3144
	2	<u>M</u>	2.7396	2.8673	2.3747
		<u>SD</u>	0.7512	0.7670	0.1252
	3	<u>M</u>	3.6560	2.7723	2.5882
		<u>SD</u>	1.5998	0.6464	0.5772
	4	<u>M</u>	3.7676	2.5606	3.2288
		<u>SD</u>	1.7611	0.5324	1.4492
RP					
L e v e l	1	<u>M</u>	3.7295	5.3431	6.1181
		<u>SD</u>	1.9965	2.2178	1.6933
	2	<u>M</u>	5.3656	5.3787	5.1370
		<u>SD</u>	1.9102	1.7570	1.8561
	3	<u>M</u>	4.7181	4.8050	5.0925
		<u>SD</u>	1.6993	2.6547	2.4603
	4	<u>M</u>	4.0958	4.3902	4.6498
		SD	1.9324	1.9504	2.2977

Table 6 cont'd.

Treatment		Testing Day			
		0	1	30	
NRP					
Lev	1	<u>M</u>	4.2643	5.5489	5.5539
		<u>SD</u>	2.2165	1.7006	1.6599
	2	<u>M</u>	4.0850	5.7700	6.3007
		<u>SD</u>	2.5623	2.0335	1.7603
	3	<u>M</u>	6.1626	6.4501	6.9203
		<u>SD</u>	2.2518	2.2516	1.7496
	4	<u>M</u>	4.5602	5.0074	5.0595
		<u>SD</u>	2.6538	2.5855	2.4555

Note. Total N = 120, n = 10 per cell.

Figure Caption

Figure 5. Natural Log transformed mean approach latency scores in seconds for Control, Response Prevention, and Nonresponse Prevention groups.

Figure Caption

Figure 6. Natural Log transformed mean approach latency scores in seconds for Control groups.

Figure Caption

Figure 7. Natural Log transformed mean approach latency scores in seconds for Response Prevention groups.

Figure Caption

Figure 8. Natural Log transformed mean approach latency scores in seconds for Nonresponse Prevention groups.

A 3 (Treatment) x 4 (Level) x 3 (Repeated Test) mixed design analysis of variance on the transformed data showed significant Treatment, $F(2,108) = 28.07$, $p < .001$; Test, $F(2,216) = 4.45$, $p < .01$; and Test x Treatment, $F(4,216) = 5.47$, $p < .001$ effects. (See Appendix C for the ANOVA summary table). Follow-up tests were computed to determine where the differences occurred.

The main effects for Treatment Group across all test times was analyzed with a one way ANOVA simple effects test, $F(2,108) = 3.1682$, $p < .05$. An Omega-squared showed that Group effects accounted for 3% of the variance ($\omega^2 = .0376$). (See Appendix D for the ANOVA summary table and Appendix E for the collapsed means).

A Newman-Kuels test determined that the CON group was significantly different from the NRP group at the .05 level with CON's having the faster approach latency time. The CON and RP groups did not differ from each other significantly and neither did the RP and NRP groups.

The main effects for Test across all treatment groups was analyzed with a one-way ANOVA simple effects test, $F(2,216) = 4.4547$, $p < .05$. An Omega-squared showed that Test effects accounted for 3% of the variance, ($\omega^2 = .03059$). (See Appendix F for the analysis of variance summary table and Appendix G for collapsed means). A Newman-Kuels test determined that test 0 and test 30 were significantly different at the .05 level with test 30 having the significantly longer approach latencies. Test

0 and Test 1 did not differ significantly from each other, nor did Test 1 and Test 30.

The interaction Test x Treatment was analyzed as follows. At Test 0 interval, immediately after the last treatment session, a one-way ANOVA simple effects tests showed the treatment groups to differ significantly, $F(2,216) = 13.6419$, $p < .001$. An Omega-squared showed that Test 0 accounted for 10% of the variance, ($\omega^2 = .1035$). (See Appendix H for the ANOVA summary table). A Newman-Kuels test determined that the CON groups were significantly different from both the RP and NRP groups at the .01 level with CON groups having the faster approach time. RP and NRP groups were not significantly different. At the Test 1 interval, 24 hrs after treatment, simple effects tests showed the treatment groups to differ, $F(2,216) = 52.9198$, $p < .001$. An Omega-squared showed that Test 1 accounted for 32% of the variance, ($\omega^2 = .32164$). (See Appendix I for the ANOVA summary table). A Newman-Keuls determined that the CON groups differed from the RP and NRP groups at the .01 level and that RP and NRP groups differed at the .05 level. CON's continued to have the fastest approach time the RP's the next fastest and NRP's the slowest approach time. At the Test 30 interval, 30 days after treatment, simple effects tests showed the treatment groups to differ, $F(2,216) = 65.2599$, $p < .001$. An Omega-squared showed that Test 30 accounted for 37% of the variance,

($\eta^2 = .3750$). (See Appendix J for the ANOVA summary table and Appendix K for the collapsed means). A Newman-Kuels test determined that the CON groups differed from both the RP and NRP groups at the .01 level and that the RP and NRP groups differed at the .05 level. The pattern of behavior demonstrated at the Test 1 interval was maintained with CON group having the fastest approach latency times followed by RP group and NRP group being the slowest.

To assess if groups were behaving differently across repeated testings, another series of follow-up tests were computed. Simple effects tests for CON groups across repeated testings were nonsignificant, $F(2,324) = 0.9639$ ns. (See Appendix L for the ANOVA summary table and Appendix K for the collapsed means). Simple effects tests for RP groups across repeated testings also were nonsignificant, $F(2,324) = 1.7994$, ns. (See Appendix M for the ANOVA summary table). Simple effects tests for NRP groups across repeated testings were significant, $F(2,324) = 4.5665$, $p < .05$. An Omega-squared showed that NRP accounted for 2% of the variance, ($\eta^2 = .02135$). (See Appendix N for the ANOVA summary table). Newman-Kuels test determined that Test 0 and Test 1 did not differ, Test 1 and Test 30 did not differ but Test 0 and Test 30 did differ at the .05 level with Test 30 having the longest approach latency.

Time on Grids. The means and standard deviations for time on grids, the total amount of time in a 3600 s period that the animal spent on the grids are presented in Table 7. The figures for the mean time on grid scores are presented in Figures 9, 10, 11 and 12 for all groups, Con, RP and NRP groups respectively. A Cochran's C test was computed to test for homogeneity of variance and found to be nonsignificant; $C(12,9) = 0.1138$, ns.

The 3 x 4 x 3 mixed design ANOVA yielded only significant Treatment Group effects; $F(2,108) = 8.007$, $p < .001$. (See Appendix O for the summary table). The main effects for Treatment were analyzed with a one-way ANOVA simple effects test, $F(2,108) = 2.1262$, ns. (See Appendix P for the ANOVA summary table and Appendix Q for the collapsed means). It is apparent in Table 7 that all of the treatment groups showed great variability perhaps making this an insensitive measure for observing treatment group differences in avoidant behavior in this study.

A pearson product moment correlation was computed between the two dependent measures to assess the relationship. The results were as follows; $r(358) = -.7366$, $p < .001$.

Table 7

Means and Standard Deviations for Time on GridsMeasure in Seconds During Testing Sessions

Treatment			Testing Day		
			0	1	30
CON					
Treatment	1	<u>M</u>	3198.80	3213.28	3223.39
		<u>SD</u>	942.96	873.18	506.18
	2	<u>M</u>	2331.97	2584.80	2928.92
		<u>SD</u>	1106.68	1099.55	764.80
	3	<u>M</u>	2586.38	2969.57	3168.87
		<u>SD</u>	1513.30	1220.80	785.69
	4	<u>M</u>	3123.70	3174.14	3244.26
		<u>SD</u>	1038.69	683.99	453.84
RP					
Lever	1	<u>M</u>	2481.41	2734.49	2363.78
		<u>SD</u>	1654.74	1049.28	1290.38
	2	<u>M</u>	2232.96	2974.08	2856.18
		<u>SD</u>	1509.20	543.42	578.30
	3	<u>M</u>	1975.27	1996.03	1836.61
		<u>SD</u>	1643.94	1686.26	1588.51
	4	<u>M</u>	2394.39	2484.35	2403.39
		<u>SD</u>	1470.53	1325.91	695.19

Table 7 cont'd.

		Testing Day			
Treatment					
Condition		0	1	30	
NRP					
Leve l	1	<u>M</u>	2149.34	2243.76	2479.24
		<u>SD</u>	1635.24	1026.69	653.00
	2	<u>M</u>	1768.37	2070.39	1951.71
		<u>SD</u>	1726.47	1444.94	1591.19
	3	<u>M</u>	1496.22	1666.80	1469.12
		<u>SD</u>	1602.74	1601.63	1257.14
	4	<u>M</u>	2310.69	2355.36	1934.92
		<u>SD</u>	1614.02	1629.29	1611.37

Note. Total N = 120, n = 10 per cell.

Figure Caption

Figure 9. Mean time on grid scores in seconds for Control, Response Prevention and Nonresponse groups.

Figure Caption

Figure 10. Mean time on grid scores in seconds for
Control groups.

Figure Caption

Figure 11. Mean time on grid scores in seconds for
Response Prevention groups.

Figure Caption

Figure 12. Mean time on grid scores in seconds for
Nonresponse Prevention groups.

Discussion

The nonsignificant differences between the RP and NRP conditions for training criterion measures indicates equivalent levels of trained avoidance behavior for these groups. Therefore any subsequent differences in avoidance behavior between these groups should be attributable to the different treatments. Interpretation of the results will center on the transformed approach latency dependent measure only. Approach latency defined as the time a subject takes to approach a previously avoided stimulus, the grids, is used as an index of fear in this paradigm. The time on grid dependent measure was not a sensitive measure in this study. The lack of sensitivity of time on grid measure has been reported in the past, (Neill, 1980).

The hypotheses that there would be a positive relationship between the number of RP treatments and the amount of reduction in avoidance behavior and that there would be a negative relationship between the number of RP treatments and the return of the behavior over time were not readily supported by the results. Possible explanations for this will be discussed in detail further on in this section. The prediction that Control subjects would exhibit no avoidance behavior and RP subjects would exhibit less avoidance behavior than NRP subjects, with NRPs showing the greatest amount of avoidance behavior was partially supported. The following sections will

describe in detail interpretations of the main effects and interactions in relation to the original hypotheses and predictions.

The significant main effect of group differences was because the Controls had faster approach latency times than the NRPs. The RP scores were in between the Controls and NRPs. However they were not significantly different from either of these groups. (See Figures 5-8). The analysis of the interaction effects illuminates the differences between these treatment groups more clearly. The significant main effect for test interval was attributable to greater avoidance behavior exhibited on Test 30 than at the other two test intervals, Test 0 and Test 1. (See Figures 5-8). The reason for this pattern of behavior also becomes clearer when interpreting the interaction effects.

In analyzing the significant AL interaction of Test x Treatment, the following findings emerged. Controls were significantly faster in their approach to the grids than RP or NRP groups on all test days as predicted. The interaction of treatment groups RP and NRP with Testing intervals was as follows. At Test 0, RP and NRP groups were not significantly different from each other; however at Tests 1 and 30, RPs and NRPs were significantly different with the RPs having the faster approach times. This pattern of behavior generally supports the original prediction that control subjects

would exhibit the shortest approach latencies and the RPs would have shorter latencies than the NRP subjects. The NRP group showed the greatest delay to approach the grids, indicating the most fear.

The lack of difference between the RP and NRP groups on Test 0 is different from past studies which all found significant differences between RP and NRP on the first testing of avoidance behavior, (Baum, 1966, 1970; Corriveau & Smith, 1978; Neill, 1980). This lack of difference between the RP and NRP groups on Test 0 may be attributed to faster approach latency times for the NRP groups than previously reported. Past studies with repeated testing, (Neill, 1982) showed stable avoidance behavior across the tests with the NRP group. In contrast the present study found NRPs increasing in avoidance behavior across the tests, culminating in a level of avoidance behavior similar to past studies. (See Figure 8). One possible explanation for the initially low avoidance behavior of the NRP groups could be the effect of repeated handlings inherent in the design of this study. All subjects were placed in, and immediately removed, from the retaining cage on days they were not receiving treatment to equate for handling of the groups receiving four treatments. Pilot research indicated that handling alone can have some initial avoidance behavior reduction effects. Perhaps future

research should define handling as part of the treatment and not equate for handling for the nontreated groups.

Repeated testings of avoidance behavior in past research, (Benline & Simmel, 1967; Neill, Cottrill, & Smith, 1982), demonstrated a tendency for increases in avoidance behavior over a 30 day interval. This increase of avoidance behavior was perhaps an activation of residual fear. The present study attempted to further investigate the finding of residual fear being reactivated by repeated testings by having four levels of repeated treatment exposures as well as repeated testing. In previous studies, (Neill, et al, 1982; Benline & Simmel, 1967) the subjects received one RP exposure and were tested repeatedly. These studies reported an increase of fear measured by an increase in avoidance behavior after the first test. Perhaps the repeated exposure to the "fear" cues in the testing situation "reactivated" the fear because the effect of a single treatment was soon forgotten or easily overridden. Repeated RP exposures might serve to first reactivate the fear and then classically extinguish it. The effect of the number of treatments variable did not reach statistical significance, although the data showed a different pattern over repeated testings than the past research. Analyzing approach behavior within groups across repeated testings show Controls demonstrating stable behavior as expected. However, the RP's also

demonstrated stable behavior, showing no increase in approach latency over the 30 days. No increase on avoidance in the RP groups could indicate good retention of the treatment effects which may have resulted from the effect of the subject receiving multiple treatments. Graphically, as depicted in Figure 7, it appears that the RP1 group had a similar pattern of increase in avoidance behavior as past studies (which all used only 1 RP treatment), whereas the other groups, RP2, RP3, and RP4 show a smaller increase. Perhaps the number of treatments chosen were too restricted in range to produce the predicted behavior pattern of decreased avoidance as a function of increasing the number of treatments. Increasing the number of treatment sessions to 6, 12, and 24 might produce a significant effect for the variable. It is of interest that the RP groups receiving two, three or four treatments seem to show less enhancement of avoidance behavior with repeated testings than the group receiving a single treatment.

The NRP group showed a significant increase in avoidance behavior over the repeated testings. The approach times were slower on the 30 day test than on the 0 day test. This implies that without treatment, repeated exposures to the avoided stimuli results in enhancement of fear. Therefore it is not merely repeated exposures to fearful stimuli that reduces the avoidant behavior but the RP treatment of blocking a previously learned

instrumental response which facilitates the reduction of avoidance behavior and therefore one aspect of the fear response.

Although the results of this study are not conclusive they lead to further research questions. Does the lack of difference in treatment efficacy for the numbers of treatment variable indicate that massed and distributed flooding procedures can be equally effective in diminishing fear responses? Results from the Schiff, Smith & Prochaska, (1972), study supports the lack of differences in efficacy of massed vs distributed RP treatment sessions. Using a straight-alley runway they manipulated number of blocked trials; 1, 4, or 12 and RP blocking length of 0, 5, 10, 50 or 120 s. The overall results indicated that the variable of importance in RP efficacy was overall RP time. Although the procedure includes RP times of minimal length and all RP sessions were completed on one day these findings are consistent with those of the present study. However, Berman & Katzev, (1972), manipulated massed vs distributed presentations of response prevention treatment in a shuttle box avoidance trained response. Their results showed that distributed RP treatments were significantly more effective in eliminating avoidance behavior. All of their treatment was administered on one day consisting of a massed group of one trial for 200 s and a distributed group of 40 trials for 5 sec each. Perhaps the massed

and the distributed treatment sessions of the present study should have been confined to one day rather than being spread over a four day period. It is possible that having 24 hrs between each trial weakened the potential effect of short discrete treatment sessions in the distributed groups.

In conclusion, the lack of fear enhancement measured by an increase in avoidance behavior in the RP groups upon repeated testings is a new finding in this area of research. To better investigate the relationship of the efficacy of repeated RP treatment sessions on residual fear enhancement demonstrated upon repeated testings several parameter changes are suggested. The levels of distributed RP treatment sessions should be expanded to include a larger range: perhaps 6, 12 and 24 sessions. Other variables of possible interest would be the effect of treatment completed on one day as compared to treatment involving several days and the effect of more treatments of equal length.

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Appendix A

Analysis of Variance Summary for Training Total UCS

Source	SS	df	MS	F
Group	436.358	7	62.337	.590
Error	7600.857	72	105.567	
Total	8037.215	79		

Appendix B

Analysis of Variance Summary for Training Total Trials

Source	SS	df	MS	F
Group	152.800	7	21.829	.352
Error	4461.000	72	61.958	
Total	4613.800	79		

Appendix C

Natural Log Transformed Analysis of Variance Summary
for Approach Latency

Source	SS	df	MS	F
Group	393.7784	2	196.8892	28.07 ***
Level	19.0330	3	6.3443	0.90
G x L	47.8140	6	7.9690	1.14
Error	757.4450	108	7.0134	
Test	14.5119	2	7.2559	4.45 **
T x G	35.6389	4	8.9097	5.47 ***
T x L	18.9541	6	3.1590	1.94
T x G x L	20.6872	12	1.7239	1.06
Error	351.8168	216	1.6288	
Total	1659.6793	359		

*** p < .001

** p < .01

Appendix D

Analysis of Variance Summary Table for

Natural Log Transformation on Approach Latency

For Group Main Effects

Source	SS	df	MS	F
Test	44.4393	2	22.2197	3.1682 *
Error	757.4450	108	7.0134	
Total	801.8843	110		

* $p < .05$

Appendix E
Collapsed Natural Log Transformed
Approach Latency Scores for
Group Main Effects

Condition	Overall Approach Latency
Con	
<u>M</u>	3.35651
<u>SD</u>	1.37870
RP	
<u>M</u>	4.47724
<u>SD</u>	1.91802
NRP	
<u>M</u>	4.76801
<u>SD</u>	2.53623

Note. n = 40 per cell; N = 120.

Appendix F

Analysis of Variance Summary Table for

Natural Log Transformation on Approach Latency

For Test Main Effects

Source	SS	df	MS	F
Test	14.5119	2	7.2559	4.4547 *
Error	351.8168	216	1.6288	
Total	366.32872	218		

* $p < .05$

Appendix G
Collapsed Natural Log Transformed
Approach Latency Scores for
Test Main Effects

Test Day	Overall Approach Latency
----------	--------------------------

Test 0	
<u>M</u>	4.20059
<u>SD</u>	2.07610
Test 1	
<u>M</u>	4.51466
<u>SD</u>	2.15281
Test 30	
<u>M</u>	4.68537
<u>SD</u>	2.20911

Note. N = 120 per test.

Appendix H

Analysis of Variance Summary Table for
Natural Log Transformation on Approach Latency
For Test 0 Interval by Groups

Source	SS	df	MS	F
Group	44.4392	2	22.2196	13.64187 ***
Error	351.8168	216	1.6288	
Total	396.2560	218		

*** $p < .001$

Appendix I

Analysis of Variance Summary Table for
Natural Log Transformation on Approach Latency
For Test 1 Interval by Groups

Source	SS	df	MS	F
Group	172.3896	2	86.1948	52.9198 ***
Error	351.8168	216	1.6288	
Total	524.2064	218		

*** $p < .001$

Appendix J

Analysis of Variance Summary Table for
Natural Log Transformation on Approach Latency
For Test 30 Interval by Groups

Source	SS	df	MS	F
Group	212.5879	2	106.2940	65.2599 ***
Error	351.8168	216	1.6288	
Total	564.4047	218		

*** $p < .001$

Appendix K

Collapsed Natural Log TransformedApproach Latency Scores for Follow-up Tests forCon, RP, and NRP Across Test Intervals

Condition	Test Day		
	0	1	30
Con			
<u>M</u>	3.35651	2.87063	2.84813
<u>SD</u>	1.37870	0.76765	1.05247
RP			
<u>M</u>	4.47724	4.97925	5.24937
<u>SD</u>	1.91802	2.12680	2.08976
NRP			
<u>M</u>	4.76801	5.69410	5.95861
<u>SD</u>	2.53623	2.14677	1.99124

Note. n = 40 per cell; N = 120.

Appendix L

Analysis of Variance Summary Table for
Natural Log Transformation on Approach Latency
For Con at Test Intervals

Source	SS	df	MS	F
Test	6.6004	2	3.3002	0.96399 ns
Error	1109.2618	324	3.4236	
Total	1115.8622	326		

Appendix M

Analysis of Variance Summary Table for
Natural Log Transformation on Approach Latency
For RP at Test Intervals

Source	SS	df	MS	F
Test	12.2821	2	6.1410	01.7937 ns
Error	1109.2618	324	3.4236	
Total	1121.5439	326		

Appendix N

Analysis of Variance Summary Table for
Natural Log Transformation on Approach Latency
For NRP at Test Intervals

Source	SS	df	MS	F
Test	31.2684	2	15.6342	4.5665 *
Error	1109.2618	324	3.4236	
Total	1140.5302	326		

* $p < .05$

Appendix O
Analysis of Variance Summary
For Time on Grids

Source	SS	df	MS	F
Group	59189619.375	2	29594809.695	8.007 ***
Level	16090686.875	3	5363562.293	1.451
G x L	10433323.750	6	1738887.292	.470
Error	399158540.000	108	3695912.409	
Test	2636634.375	2	1318317.188	2.270
T x G	1668416.875	4	417104.219	.718
T x L	2555868.750	6	425978.125	.734
T x G x L	3189481.875	12	265790.156	.458
Error	125425446.250	216	580673.363	
Total	620348018.250	359		

*** $p < .001$

Appendix P

Analysis of Variance Summary Table for
Time on Grids for Group Main Effects

Source	SS	df	MS	F
Group	15716452.38452	2	7858226.1922	2.12619
Error	399158540.00000	108	3695912.4090	
Total	414874992.400	110	*	

Appendix Q
Collapsed Time on Grid Means
For Follow-up Tests

Condition	Overall Time on Grid
Con	
<u>M</u>	2810.2124
<u>SD</u>	1183.5043
RP	
<u>M</u>	2271.0074
<u>SD</u>	1522.5789
NRP	
<u>M</u>	1931.2574
<u>SD</u>	1613.3584

Note. n = 40 per cell; N = 120.

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